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A Green Step Forward:

- **creating a strategic, sustainable, knowledge-driven and technology-based agriculture industry in the Caribbean.**

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Report on the workshop held at the “Tropical Agricultural Congress”,
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A Green Step Forward: creating a strategic, sustainable, knowledge-driven and technology-based agriculture industry in the Caribbean.

Background

As part of the 60th Anniversary celebrations held to commemorate its 60 years of service to the Caribbean, The University of the West Indies organised an International Congress on Tropical Agriculture entitled “Overcoming Challenges to Developing Sustainable Agri-food systems in the Caribbean” from November 30 to December 3, 2008. Immediately following the Conference a two-day Caribbean workshop was held with the objective of arriving at a consensus on the way forward for Caribbean Agriculture vis-à-vis rising food prices and concerns regarding food security. The name of this document is coined to reflect the name of the white paper that will emerge from it. The workshop provided a forum where experiences from different countries could be shared, discussed and consolidated. The workshop included representatives from CARICOM institutions, technocrats representing the various Ministries of Agriculture from CARICOM countries, farmer organizations, Research and Development institutions, agri-business associations and other private sector organizations.

The Caribbean contains the Caribbean Sea, its islands and the surrounding coasts, organised into 27 territories. The Caribbean archipelago—4020 km in length and up to 257 km wide—contains a number of island territories surrounded by the Caribbean Sea. The CARICOM consists of 15 nations, varying from continental states (3) to island states (12) of various sizes and formations (volcanic to sedimentary), largely situated in a hurricane belt spanning between the tropics to the subtropics. Agriculture within the region varies depending on the latitude of the country, terrain, scale of production, agroclimatic conditions, socioeconomic status of the people, availability of labour and the level of organisation of agriculture; the extent to which diversification from plantation sector has been successful and the level of development of physical infrastructure necessary for agriculture. It is difficult to articulate a common view to solve the peculiar problems of each country. Many past studies and reports have nevertheless identified the major constraints to agriculture, the magnitude of which may vary depending on the country.

The **William Dumas Report** (1988) identified poor and inconsistent agricultural policies, weak diversification efforts out of the plantation-based sugarcane sector, poor rural physical infrastructure, poor marketing systems for farmer produce, limited or non-existent agriculture credit or insurance, poor research, development and outreach systems, lack of adequately trained human resources, and natural resources as the limiting factors. In 2005, the [Bharrat] **Jagdeo Initiative** identified the lack of value-added products as well as education, in addition to the above eight, as the key binding issues affecting agriculture in the Caribbean. FAO National Medium Term Priority Frameworks (2008) has attempted to prioritize these constraints for each of the CARICOM territories.

The President of the Caribbean Development Bank, Prof Compton Bourne, (CFCS, 2008) highlighted some of the immediate actions required by member countries to address the key binding constraints, stated under the Jagdeo Initiative. He identified land tenure as the most important policy issue that should be tackled by governments. He also pointed out that agricultural diversification should take into account the increasing divergence between what is supplied and what the consumer wants, while ensuring that the chosen agricultural enterprises are competitive.

Marketing systems in the region should rise to meet the quality and convenience demanded by the consumer, to remain relevant. Similarly, the research, development and outreach systems should ensure high levels of productivity of Caribbean agriculture, to ensure that it remains competitive. Agriculture credit and insurance should be based on capital renewal models to be sustainable. He suggested that agriculture be made attractive to lure investors and labour into the sector and thereby reverse the trend of an aging farming population throughout the region. He also pointed out that frequent hurricanes were a cause for concern and contributed to food insecurity, which requires better planning.

Analyses of past reports show general agreement regarding major constraints. The absence of an overarching agricultural policy that is consistent, strategic, forward-looking and capable of steering Caribbean agriculture into a globally competitive industry (while nurturing sustainable agricultural livelihoods), was a common thread in all reports. Clear policy direction and appropriate governance systems are imperative to achieve the right enabling environment to achieve the above. Further, there is general agreement that research,

development and outreach systems under this environment have not been supported and/or have not been focused on achieving competitiveness. This has resulted in the agricultural credit and insurance systems failing and agriculture becoming a sector that has increasingly been unable to attract newcomers, both farmers and investors. Most trained human resource in these areas has hence migrated to other attractive sectors, leaving the agriculture sector depleted of capable talent to lead, and farmer population aging. Lack of innovative enterprises has resulted in limited value-adding to products emerging from agriculture production, lack of development of innovative agro-based industries or agro-biotechnology industries around the primary production sector.

The objective of the workshop was therefore to go beyond the peculiar limitations experienced by a country and recognize the major constraints that should be addressed in a holistic way towards modernizing Caribbean agriculture and positioning it on a sustainable developmental path. The workshop also addressed the role The University of the West Indies should play in bringing about the transformation of agriculture.

The workshop format

The workshop was organised based on group discussion along six questions, listed below, followed by plenary presentations and general discussion of issues emerging from individual group presentations. The consensus was captured by rapporteurs. The general discussion and recommendations to be adapted by CARICOM were developed around these consensus points.

1. What are the key issues/constraints in Caribbean agriculture? List and prioritize the top ten.
2. For the top five issues identified in (1), what approaches have been used in the past, how successful have they been? How could these be improved or what alternative approaches can be used to overcome the constraints?
3. What is the role of governance in agriculture development in the context of policy, institutional support, sectoral linkages, stakeholder organizations and the provision of public goods?
4. How could we involve the private sector in the governance to agro-industries?

5. Given the importance of innovation in developing a competitive and profitable agricultural sector, how could the innovation system support to the region be made more effective? What institutional models could be proposed?
6. What is the assessment of The University of the West Indies' contribution to regional agriculture? How could The UWI improve its support to regional agriculture?

Question 1

Key issues/constraints affecting Caribbean agriculture

As expected, the key issues differed from group to group and varied from farm-level constraints (infrastructure, praedial larceny, finance, hurricanes and crop insurance, extension etc); constraints with respect to the organization of agriculture (lack of or poor governance of marketing systems, cooperatives, commodity groups, community groups); issues relating to the low levels of innovation, technology development/procurement and transfer along the agri-food chain (resulting in lower productivity, higher cost of production, lack of value-added products, low farmer income, etc), poorly trained and declining human resource in agriculture and finally, issues emanating from poor policy and governance (lack of a focused or consistent agricultural policy or diversification policy (priorities), lack of a consistent land tenure policy, inadequate support for farm and marketing infrastructure and innovation/technology transfer; inadequate financing systems/subsidies to support new agriculture ventures, and inadequate incentives for private sector investment).

To further ventilate and tease the major issues, these constraints were summarized into five categories *viz.*

- (a) Research, technology development and transfer
- (b) Agricultural infrastructure
- (c) Agricultural finance and insurance
- (d) Policy and governance models, and
- (e) Human resources development.

It was agreed that further discussion should focus on key issues related to the above five challenges that can lead to a regional policy, which can then be tailored to each individual country within the CARICOM.

Question2

(a) For the first three issues identified in (1), What approaches have been used in the past, how successful have they been? How could these be improved or what alternative approaches can be used to overcome the constraints?

a) Research, technology development and transfer

Past scenarios

1. Agriculture, in the past, has been based on a limited number of traditional export crops, principally sugarcane, banana, and cocoa depending on the territory. Traditional export agriculture was based on early research (1928-1960) carried out by the Imperial College of Tropical Agriculture (ICTA). Following this period, R&D support for these plantation crops has been inadequate, inconsistent and often not holistic. As a result, productivity has increasingly lagged behind that in the rest of the world. This, along with the higher cost of production due to high labour cost, low labour productivity or smaller scales of production, results in an uncompetitive state. These plantation crops have either been pushed out of the mainstream markets to supply niche markets e.g. fair-trade banana and organic cocoa, or have been entirely abandoned.
2. Diversification efforts—from plantation crops to other food crops—have not been prioritized based on SWOT analysis, or supported through sustained, focused support for research and development. Furthermore, research has not been supported along the entire agri-food chain towards making the sector profitable, with particularly limited attention placed on value-added production. The commodity approach that had helped to place the plantation crops on the international scene was abandoned for the other crops.
3. Agriculture development in the region has been and is based on outdated green revolution technologies, which have been replaced by gene revolution technologies in many countries. The region is lagging behind in this arena and this adds to its uncompetitiveness.
4. There has been a growing disconnection between farmer needs, agro-industry needs, government policy and research.

5. Research and development in the Caribbean used to be supported by global funding systems (USAID, CIDA, OAS, EU, and Rockefeller Foundation). With much of the funding redirected to sub-saharan Africa and other LDCs, funding has considerably dried up for most CARICOM countries.
6. Due to the lack of a critical mass of scientists in regional agricultural research and development institutions in the Caribbean, the region has relied on technologies developed by the CGIAR (Consultative Group on International Agricultural Research) system. With financing for these centres declining (being replaced by global private sector research and development companies) support for appropriate technologies has declined. This has resulted in declines in agricultural productivity and innovation.
7. Research and development initiatives have largely remained in the public sector and publicly-funded R&D institutions in the Caribbean, and have not been taken up by the private sector. The private sector has been investment-shy towards agriculture and agriculture research.
8. Consequently, research and development has been based on food security, ignoring the potential of research and development for building innovative global agro-industries and bio-businesses.
9. Local R&D has largely ignored adaptive research, where the numerous technologies developed elsewhere are not routinely tested and validated locally for local crops and conditions and adapted, where, necessary.
10. The University of the West Indies (UWI), which has the highest concentration of researchers in the region, was divorced from its research and development arm: 'the regional research centre' to establish CARDI in 1975. With CARICOM identifying CARDI as its agriculture research organ and recognizing UWI as responsible for only human resource capacity development, the research capacity of the region was severely hurt.
11. Limited collaboration between regional and national institutions—The University of the West Indies (UWI), other national universities,

National Agricultural Research Institutions (NARI), Caribbean Agriculture Research and Development and Institute (CARDI) and Scientific Research Council, Jamaica (SRC)—has resulted in limited efficiency in utilizing scarce financial and human resources, disjointed research, poor research capacity, poor scope of research findings and ultimately, limited impact. Similarly, limited or lack of collaboration between CARICOM institutions and other R&D institutions in the Caribbean (French, US and Spanish territories e.g. University of Puerto Rico, CIRAD, INRA, Cuban and Dominican Republic based institutions), or operating in the Caribbean (Florida, USA, China and Taiwan in OECS) have had the same impact. Furthermore, the CARICOM institutions have not built collaborations with lead organizations working on Tropical Agriculture in Latin America.

12. The lack of coordination between research institutions in the region has resulted in duplication of efforts, unfocused research and consequently, considerable wastage of resources. The research networks established to coordinate R&D activities in the region have largely failed (e.g. PROCICARIBE). This was based on a Latin American model, and the Caribbean culture and geography didn't lend itself for cooperation. Further, the system was not adequately financed or the financing system was not sustainable.
13. Limited human capacity to support research and development initiatives. In the absence of opportunities for UWI agriculture graduates in the Agriculture sector in general, and the R&D sector in particular, in the past, most have drifted into other sectors or migrated to greener pastures abroad. Hence, the number of agriculture graduates produced by The UWI per annum has continuously declined. Further, because of the mixed signals given by the policy makers in the region the Agriculture curriculum has remained rather unfocussed.
14. R&D did not take into account social collective components.
15. Governmental commitments have been transitory. There has been a lack of continuity in policies both at the national and regional level. The record with respect to policy implementation has been worse. Policies on land use, land tenure, development of physical infrastructure, setting up a regulatory environment, setting priorities based on national

consensus, support for focused research and development in the priority areas, development of agricultural credit and insurance, supporting commodity groups and community groups, incentives for farmers, private sector involvement in research and development and support for a system to foster innovation and competitiveness.

In summary, although the region inherited an excellent research and development capacity from the Imperial College of Tropical Agriculture, recognized internationally as a leader in tropical agriculture, the momentum has been lost over the years through the approaches to agriculture, in general, and research and development in particular. The lack of policy direction, diffused, un-coordinated research efforts, slow adjustment in response to the changes in global environment, inadequate financial support for research and development and lack of private sector involvement have resulted in research and development effort failing to make an impact in keeping agriculture ventures successful.

Alternative approaches to research and development

1. Research and development should be (a) strategic and focused, (b) based on a commodity approach, and (c) involving the entire agri-food chain.

Strategic and focused research require some level of prioritization at the national level based on a national consensus, and on global realities (not inward-looking). It should be directed at achieving global competitiveness in selected areas of strength, viz. products based on indigenous genetic diversity, indigenous knowledge, established quality premiums, established lucrative mainstream, ethnic or specialized markets in North America. Secondly, the commodity approach ensures that it is stakeholder-driven or, more desirably, stakeholder-involved, so that the results accrued from R&D will immediately benefit the industry. Thirdly, research along the entire agri-food chain will allow the industry as whole to become sustainable and create a number of livelihoods along the agri-food chain. There are many global success stories for small nations using this approach.

2. Institutional capacity for research and development should be modernized.

Institutional capacity for agricultural research throughout the region should be modernized and staffed with a high calibre of staff, under a system where the staff is motivated through a scheme of incentives and sanctions. Institutional research capacity should be maintained through in-service training programmes, short-term research internships and win-win collaborations with universities. Institutions should be expected to apply for both developmental and research grants from global, regional and national sources to support their work programmes.

3. Balance between innovative and adaptive research; research oriented to food security vs innovative bio-businesses.

Given the small human capacity it is important to carefully identify and adapt already available technologies to support agricultural competitiveness. Only where these are not available, the research capacity should be used to develop new research to solve problems. This will allow the research capacity in the region to be better used to develop innovative bio-businesses.

4. Technology development, adaptation and transfer should be an integral part of R&D.

Innovative research findings should naturally lead to technology development, possibly under an incubator system and testing of technologies, in collaboration with potential private sector partners. The private sector partners could be industrialists, agricultural input companies, agricultural marketing organizations, food and beverage manufacturers, farmer cooperatives, commodity groups, farmer associations or even individual farmers.

Where technologies already exist, local validation using local crops/animals and under local conditions should be pursued, and where necessary, technology should be adapted as a matter of priority.

5. Cross-institutional collaborations should be fostered to achieve an integrated R&D system to serve the Caribbean.

Given the limited institutional capacity within each nation, the approach to Caribbean Agricultural Research Capacity Development should be based on cross institutional collaboration between a range of institutions involved in research and development in the Caribbean, CARICOM institutions or otherwise. A mechanism may be based on collaboration through cooperative arrangements between the entities, while operationalising these cooperative arrangements through developing regional project proposals for funding, and developing mechanisms for benefit sharing. Strategic partnership between extra regional institutions that can greatly benefit Caribbean agricultural development should be pursued along an expressed strategic course.

6. Information technology should be used to develop a research coordination system.

Information technology should be used to develop a system to coordinate the development of a relevant, competent, responsive and engaging R&D system, where all players feel part of the process. This system should be able to have IT-based symposia on “critical issues” within the research community and support policy decision in a timely manner. This should form a Caribbean think tank on Agriculture, and can serve to prioritize problems, develop research proposals to develop solutions to problems, adopt the research findings to regional locations and transfer knowledge to the stakeholders.

7. Outreach should not be divorced from research and development.

Outreach cannot be divorced from research and development, since without outreach the cost of research and development will not be justified, and the fruits of research will not benefit the region. Given the dispersed nature of the Caribbean, innovative outreach systems should be developed. Possible approaches may include:

- (a) public-private sector participatory approach, where the private sector is engaged at the technology development stage or marketing stage (through licensing of IP) to ensure that technologies developed would be satisfactorily marketed
- (b) IT-based information portal to provide up-to-date information on relevant technologies

- (c) in-service training to members of organisations and short-term training to farmers and farmer organisations
- (d) participation in exhibitions, and
- (e) other innovative approaches such as to disseminate information through agricultural input supply companies, which traditionally have played an important role in supplying information to farmers.

8. Public funding for research and development should be strategic:

Public funding for innovation (at regional or national level) should be:

- (a) competitive, based on transparent guidelines, and properly monitored, so that the value for each dollar spent is obtained. Such funding should give preferences for institutional collaboration based on institutional synergies, which would ensure that the scarce human resource distributed among institutions is better utilized;
- (b) to support (venture capital) pre-investment or agri-business development should be based on research institution-private sector collaboration towards achieving technology adaptation and enterprise development
- (c) for problem solving along the agri-food chain. It should be provided to agri-business and farmer organisations to overcome specific problems through engaging research institutions in contract research. This will also ensure that the research institutions are accountable to the commodity organisations or agricultural associations.

9. Private sector involvement in research will bring greater private funding for agriculture research.

Greater private sector involvement in research, particularly pre-investment type research or incubator research. This could be achieved through:

- (a) developing an industry relevant research agenda
- (b) active engagement of private sector in the development and monitoring of work programmes in research institutions;
- (c) engaging the private sector in participatory research where research can be conducted on the premises of the private sector entities to overcome problems

(d) setting up incubators in a bio-park setting where new product development occurs, among many others. Additionally, the private sector should be provided incentives possibly in the form of tax breaks to engage in agriculture research and development activities along the agri-food chain but particularly in the area of post-harvest research and product development.

10. Agricultural innovation and the development of bio-businesses should be stimulated in small island Caribbean states.

Given the limited land area available for agriculture in small island developing states, development should be based on innovation and generation of bio-businesses.

These may include

- (a) developing a tropical seed industry to supply the rest of the tropical world of selected neotropical species or
- (b) developing novel agricultural products from indigenous genetic resources or
- (c) developing nutraceuticals and medicinals from natural products utilizing the indigenous biodiversity
- (d) developing diagnostics for tropical diseases or
- (e) biosensors for monitoring product quality, or
- (f) developing niche, high-value industries based on geographical advantage or established market premiums.

11. A consistent and focused, pro-agriculture policy along with an efficient system for policy implementation is essential to foster R&D for enterprise development.

Public policy on developing an innovation system that would nurture a variety of innovative bio-businesses utilizing biotechnology, nanotechnology and other innovative scale independent technologies. The smaller islands within the CARICOM, with limited scale of agriculture production will greatly benefit from investments in such enterprises. The fundamentals of such a policy would include support for innovative research, establishment of innovation centres in key areas, incentives for public private sector collaboration, incentive for foreign direct investments in agro-industries within a bio-park, support for establishing incubator type activities, regionally harmonized IP

legislation, regulatory environment, administration of competitive research grants and venture capital, and support for technology acquisition, adaptation and transfer activities.

The policy should include a clear land-use policy, including squatter regularization, land tenure, sustainable use of agricultural land towards preserving the most arable lands for agriculture. These while not directly affect R&D but will provide the enabling environment for agriculture development in general and hence greater private sector investment.

12. Research should support cross-sectoral linkages such as agro-tourism, food tourism, nature tourism, sports tourism and research tourism.

Each of these linkages generates numerous research possibilities. How could developing new tropical products or cuisines support the tourism industry? How can the tropical soil conditions and tropical turf grasses be developed to foster sports tourism? How can ornamental farms and orchards be developed into an agro-tourism landscape? How can the natural flora and fauna be conserved in a landscape to provide nature tourism opportunities? Setting up an advanced research facility in an attractive tropical setting will encourage global researchers to participate in solving global challenges.

There is tremendous benefit for the small island developing states in the Caribbean to use these opportunities to develop additional streams of incomes through exploiting tourism opportunities along with agriculture opportunities.

Question 2 (b)

Agricultural infrastructure development

What approaches have been used in the past, how successful have they been? How could these be improved or what alternative approaches can be used to overcome the constraints?

The major agricultural areas are in rural districts, where agricultural infrastructure is an important limiting factor to agriculture development. Agriculture infrastructure includes development and maintenance of farm access roads, rural electrification, irrigation and drainage infrastructure, propagation of planting material and distribution infrastructure, watershed management, storage facilities for agricultural produce, marketing and product development facilities, market information systems, regulatory systems, intra-regional transportation, and general farmer support services such as inputs, agricultural credit, agricultural insurance and agricultural extension facilities.

Past approaches, limitations and successes.

1. Much of the physical infrastructure (access roads, irrigation infrastructure, and electrification) in the rural sectors in the CARICOM was developed by private companies that managed the traditional export crops during the colonial era. These have been largely neglected both by the post-colonial companies and the public sector, and are essentially dilapidated.
2. With the decline of traditional agricultural crop production, precipitated by globalization, much of the land has been earmarked for agricultural diversification, but there has not been a concomitant development of physical infrastructure to support those activities.
3. The governments of the CARICOM have commandeered existing agricultural infrastructure for non-agricultural uses (urban development). Arable land has dwindled significantly, particularly the Class 1 agricultural land, pushing agriculture steadily into marginal lands. This has implications for productivity (reduction), cost of production (increased management cost) and consequently, the sustainability of agricultural systems.
4. Without policing of land use policies, squatter agriculture has resulted in destruction (soil erosion) of the water sheds and sloping lands. This is continuing rapidly, and if unchecked, will inevitably destroy the future of agriculture. It has already caused flooding during the wet season, with the watershed being unable to intercept rainfall, and a lack of water to service agriculture during the dry season since most of the surface runoff results in loss of water.

5. Ad hoc agricultural developmental agendas by governments which change every five years, lead to infrastructure being improved only in response to crisis, and hence much of the existing production infrastructure is in a dilapidated stage.
6. Agriculture in the past has been stuck in the production mode, with post-production infrastructure (post-harvest storage, marketing, product development and manufacturing infrastructure) largely ignored. Although there is recognition of the importance, these are still lacking in most countries.
7. Access to market intelligence and information in the Caribbean is lacking in many parts of the Caribbean. This has made agricultural decision-making (what to plant? when to plant? how much to plant? where to sell?) difficult.
8. Underdeveloped regulatory infrastructure to facilitate trade, and hence unable to meet the sanitary and phyto-sanitary requirements for export.
9. Intra-regional and extra-regional transportation has also been a limiting factor for export agricultural development. Without sea transportation, many exporters use air transportation, which is costly and unreliable. In the absence of a coordinated agricultural system in the Caribbean there is inadequate capacity to hire a commercial service.
10. Although agricultural extension divisions have been set up in various areas by regional governments, the agricultural extension systems are inadequate in several aspects. Philosophy, facilities and systems are insufficient, outdated or unfocused. This, combined with the small number of poorly trained extension workers, with limited knowledge of current technology and poor communication skills, poses a serious handicap to technology transfer. As a consequence, agricultural extension support is provided through private sector input companies, agricultural credit organisations, marketing organisations, agricultural export companies or commodity-based extension arms. The information provided is often biased, partial (re. part of the agri-food chain), commodity based (banana only), or incomplete. Lack of information regarding good agricultural practices, HACCAAP has led to difficulties in intra-regional and extra-regional trade.

11. Agricultural credit, insurance and agricultural input facilities should also be available in the rural setting to foster agriculture. Agriculture credit is inadequate, expensive or unavailable in different parts of the Caribbean. Agriculture insurance is almost non-existent in the CARICOM. In many agricultural countries, these along with the extension facilities are located under a single roof in rural agricultural areas.

The establishment of NAMDEVCO in Trinidad and Tobago has resulted in significant infrastructural improvement in post-production, and marketing infrastructure, and in the provision of real-time market information to farmers. NAMDEVCO also provides support in production planning, export assistance and good agricultural practices support. This can be regarded as a success story.

Similarly the farmer cooperatives of banana growers in the OECS have been successfully providing comprehensive support to their farmers.

Alternative approaches.

1. Long-term non-partisan commitment to agriculture development is necessary for a consistent policy environment.

It is imperative that CARICOM and constituent governments recognize that ensuring the sustainability of agricultural systems is important for the long-term survival of the Caribbean people. A non-partisan approach to the development of an agricultural policy would therefore have a better chance of achieving infrastructure development as part of a medium to long-term strategic plan for agriculture development.

2. Public sector investment in agriculture has to be improved, so that agriculture infrastructure would be developed and maintained.

Innovative approaches have to be found to support infrastructure development, which is necessary to provide the right enabling environment for private sector investment. One possible mechanism may be to assign a portion of taxes and tariffs on food imports towards improving the agriculture sector. Another approach may be to partner with

commodity groups in maintaining the infrastructure. Alternatively, the government could earn revenue from services rendered (storage services, market facilities, market information, agricultural credit, etc), which could be ploughed back into supporting the modernizing and maintaining infrastructure.

3. Land use policy development and implementation.

If existing arable lands are to be preserved from further deterioration the land use policy should be restructured and implemented. Land use policy should entail among other things (a) strict land zoning for agriculture purposes; (b) distribution of government land for agriculture and land tenure (b) soil erosion management measures for sloping terrains (c) the inclusion of water management (irrigation and drainage) into agricultural infrastructure planning, (d) a mechanism for integration of forestry, watershed management, works and environment towards achieving flood control, forest fires, drought, etc. It is important that the policy is implemented through appropriate legislation and policing.

4. Emphasis extended to include post-production infrastructure.

The infrastructure for post-harvest storage of produce, for marketing and market information, and for manufacturing/processing produce into valued-added products or convenient foods is inadequate. Development of post-production infrastructure would serve as a backward linkage to drive investments in agriculture, and hence agricultural production for both local consumption and export.

Post-harvest storage facilities will minimize losses, store produce during periods of glut or keep produce intransit to processing facilities or export. This will help the farmer avoid risk and improve profitability.

In addition to providing traditional market facilities (farmer markets), where the producer and consumer can trade products, infrastructure development should take into account the development of an e-market place where the producers, exporters and importers can trade produce, make payments, organise shipments and receive other services on-line. This allows not only buyer to seller interactions but also buyer to buyer and seller to seller interactions. For small island states where production

volumes are small, it affords the opportunity for regional commodity groups to collaborate towards gaining access to larger markets. Such interactions can also reduce the cost of produce to the consumer through minimizing the intermediary costs, while improving profits for the producer. It has been estimated that direct marketing of anthurium blooms will fetch the grower a minimum of 4-6 times the wholesale price.

Modern market information systems provide historical trends as well as real-time market information to the producers, exporters and importers. This is essential in assisting the producers in decision making. By producing the right produce at the right time in the right amounts for the appropriate markets the producer can maximize income.

In a global food market, marketing should minimize the gap between what the consumer wants and what the farmer produces. This could be achieved through produce development, manufacturing of value-added and convenient foods. This will not only expand the local and export market for the producer, but also will improve the value of the produce along the agri-food chain, allowing the development of other sustainable livelihoods within the agriculture sector.

5. Emphasis extended to intra-regional and extra-regional transportation infrastructure

Being largely island states, the Caribbean region faces serious problems in marketing which serves as a competitive disadvantage to the region in exporting produce. Present systems of transportation by air freight is fraught with problems including limited trans-shipment volume, inconsistency in available volume, cost of trans-shipment, conditions of trans-shipment not appropriate for all commodities etc.

While sea freight or dedicated air freight utilizing cargo planes can reduce cost, they need the volumes to be cost effective. Regional coordination of commodity groups can provide the necessary volumes to make this feasible. A regional trans-shipment strategy should be developed to reduce the cost of trans-shipment therefore making regional farmers more competitive.

6. Regulatory framework and infrastructure to facilitate international trade

International trade environment has become increasingly competitive. With the removal of barriers to trade there are a number of technical barriers to trade being erected by countries, including sanitary and phytosanitary requirements for products which include levels of pesticide residue, adherence to good agricultural practices/HACCP, under the IPPC and OIE; bio-safety regulations and requirements for trade under the Cartagena protocol for bio-safety; food safety standards under CODEX ALIMENTARIUS, fair trade etc. It is important therefore that countries have updated legislation, regulatory frameworks, training and an oversight infrastructure to ensure that the markets can be protected.

In most countries praedial larceny has been identified as one of the most important deterrents to agricultural development. An enabling environment for agriculture would therefore require legislation, severe punitive measures and policing to curb this menace.

7. Extension infrastructure should be modernized to meet 'New' Agriculture.

In the age of information explosion, and globalization, the philosophy of traditional agricultural extension is becoming irrelevant. There are many multinational companies and research institutions, operating in a global environment, producing new products, technologies and services which are available in the market place – rapid systems for the diagnosis of pests, nutrient deficiencies, water status and soil defects are available; a choice of planting material from clones, purelines, hybrids, synthetics, OPVs and GMOs; numerous pest control options, cultural control, chemical pesticides with different modes of action, bio-pesticides, biological control and integrated pest management; precision agriculture techniques using automated watering systems, fertigation systems, soil-less culture systems, use of growth regulators; and protected agriculture systems, all capable of pushing productivity levels higher. In addition, to production technologies, there is a whole host of post production technologies, and regulatory information is available, which need to be disseminated in a timely fashion to the farmer to allow appropriate decision making. Inability of the extension worker to provide current information has led to the loss of

confidence of the extension worker in the eyes of the farmer. Hence, the reliance of farmers on input suppliers who provide current proprietary information on products and technologies, which are however neither validated locally or unbiased.

Modern agricultural information has to be delivered through an internet-based agricultural portal providing up-to-date information on various products, technologies and services, validated or developed by regional experts in various disciplines. This system will empower the extension worker and the technology savvy farmer. A modern extension worker should be continuously trained to test technologies under farmer field conditions under different agro-ecological zones and provide feedback to researchers, who will then adapt the technology to suit the specific conditions. The extension workers should be able to provide on-site diagnostic services using modern kits and keep yearly surveillance of pest and disease problems. This makes the extension worker a researcher in his own right but working with farmers in their farm environments. The farmer field school setting illustrates such a teaching and research environment in which the modern extension worker must exist.

Given the history of the agricultural input supply shops serving as points of information, extension information (hard copy) in the form of pamphlets should be distributed through these facilities. Alternatively agriculture extension offices can be set up within the same building as other agriculture services (credit, insurance, inputs), as obtained in some countries. There is also the necessity to modernize the extension offices with ICT equipment and train extension staff to be client-driven. Like any efficient service, there should be a mechanism for continuous monitoring and assessment of its efficiency.

8. Agriculture credit and insurance infrastructure

This is dealt with in the next section.

Question-2 (c) – Agricultural finance. What approaches have been used in the past, how successful have they been? How could these be improved or what alternative approaches can be used to overcome the constraints?

Past approaches to inject funding into agriculture involved national development plans and projects with state funding, direct subsidies or support by the government (e.g. after hurricanes), agricultural credit through agricultural development banks, Ad hoc approaches to funding, regional projects (e.g. Common front for commodities), loans from the Caribbean Development Bank, International donor funding (e.g. European Union, OAS, USAID etc), technical assistance with respect to specific projects or programmes by the FAO, private sector investment (e.g. commodity cooperatives, oil companies etc).

Past approaches, limitations and successes.

1. Public sector funding has been inadequate for agriculture development, and hence agricultural infrastructure has been neglected. Even when available it is often not timely resulting in cost over-runs (poor administration of funding).
2. Public sector funding often lacked a long-term vision, and was subject to abrupt changes in policy.
3. Public sector funding has not been based on an agribusiness approach involving all stakeholders and impact oriented.
4. Public sector funding has particularly been inadequately directed to developing a local or regional R&D capacity or for developing post-production infrastructure.
5. Public sector funding has in general not been used to provide incentives for innovations in agriculture. Generalized subsidies breed inefficiencies in agriculture production, have verification issues, and are unsustainable.
6. No venture capital funds for innovative industry development.
7. Public sector funding has often not been transparent, or adequately monitored to ensure results.

8. Donor funding is uncertain in quantity and timeliness; and often channeled through the public sector.
9. The success of international funding for agricultural projects in general has been successful, but success has varied with institutions based on the administration and monitoring systems put in place.
10. Delivery of agriculture credit through agricultural development banks has been inadequate, if available. The default rates associated with loans are too high to make them sustainable due to improper screening of projects or adequate monitoring of projects. Lack of agricultural insurance systems has further contributed to the high default rates.

Farmers have had difficulty in obtaining loans from commercial banks due to the risk involved in agriculture, and even if they are successful, the interest rates of loans are too high.

11. Technical assistance programmes have been generally successful. They can be programmed and address a specific weakness in the agriculture system.

Alternative approaches.

- 1. Public sector funding for agriculture should be increased within the context of creating an enabling policy environment for agriculture development.**

This should be based on long-term policy towards developing sustainable agro-industries that are globally competitive and capable of providing sustainable employment for the people of the CARICOM. This may include public sector investment in agriculture infrastructure, Agribusiness support, R&D support, establishing a venture capital fund, establishing agricultural credit and insurance facilities, not on an ad hoc basis but on a holistic programmed basis.

Funding mechanisms should be used effectively to achieve the short-term and long-term goals, since finance is the single most effective

mechanism through which the governments can provide direction to the agriculture sector.

Donor funding or favorable loans should be accessed to support the public sector investment programme, where necessary (EU, USAID, IDB, CDB, OAS, World Bank).

2. Public funding to agriculture should be transparent

All stakeholders should be sensitized as to what level of funding is available and how it is being spent and how agriculture stakeholders can benefit from the funding. A critical question that must be asked when disbursing funds is to what extent is the available finance effectively reaching the target groups/stakeholders?

3. Administration of public finance should be efficiently managed.

Funding should be prioritized according to the long-term policy vision, disbursed in a timely and transparent fashion and monitored during and after the project period for impact. Project or programme prioritization should be based on identified policy priorities.

For efficient management, the government should privatize agriculture research and services and take the role of providing oversight.

4. Government incentives for agriculture research, development or service agencies/institutions for 'international fund-raising' to support their work programme.

It is in the best interest of the governments to strengthen institutional support since this is essential for the success of financial investments.

Governments should provide incentives, perhaps in the form of matching funds, to institutions and agencies which successfully generate funds in support of agriculture development activities. This would require that the institutions configure themselves into an efficient, client-oriented delivery system to attract significant donor funding on a consistent basis. This incentive programme will result in considerable injection of funds into agriculture through tapping the

ingenuity of people, while at the same time creating a client-oriented institution supporting local investment in agriculture.

5. Public sector funding for Research and Development should be administered as a competitive fund that is transparently managed, to allow institutional synergies to be harnessed.

Priority should be given to (a) R&D aimed at targeted food security crops/animals (b) R&D capable of creating innovative enterprises that can provide new value agricultural opportunities for the people, and should involve support for both production and post-production research. Collaboration between regional institutions with synergies should be given greater priority—this will allow better utilization of scientists throughout the region. This has been also discussed in detail under ‘Research and Development’.

6. Public sector assistance to stakeholders should be based on an ‘agribusiness approach’ or a ‘community approach.’

An alternative approach would be based on the traditional export crop model where all stakeholders involved in a particular prioritized commodity identify and prioritize the limiting factors for improving the industry and either explore funding (loans, grants) on their own or seek state funding. This approach empowers the stakeholders but may require greater oversight by the government to ensure funding is well managed, and is utilized in a results oriented manner. The agri-business organizations provide an excellent mechanism to provide management of fund and oversight to constituent commodity groups that receive funding.

Often agricultural developmental constraints may be community based and assistance could be provided to communities of farmers facing similar difficulties, also under the umbrella of a national agribusiness association. .

7. Agriculture credit should be based on a capital renewal model.

Governments should ensure that adequate finance is allocated for agriculture credit for farmers and other agricultural stakeholders.

Agriculture credit should be based on a capital renewal model, but for this to happen, the credit default should be minimized. The agricultural credit should be based on careful scrutiny of several considerations *viz.* project proposals, R&D support to projects (institutional support), relevant training (entrepreneurship training; project management skills) for the project, agricultural insurance and access to markets, so that agricultural risk would be minimized. Further, approved agricultural projects should be monitored closely by the agriculture development banks to ensure targets are met based on proposed timelines. This will allow capital renewal and at the same time benefit stakeholders in the form of lower interest rate. Appropriate punitive measures for default may also be part of the policy.

In developing agriculture credit facilities, farmer's needs (what, when, how, why, where and if) must be considered.

8. Agricultural insurance.

Governments should strongly consider the establishment of Agricultural insurance schemes. Without such schemes, agriculture risks will become a deterrent to private sector investment, particularly in large projects. For these schemes to be pragmatic, generalized risk (which is risk beyond the control of an individual or an institution) should be minimized or mitigation measures developed. Generalized risks such as flooding and drought could be minimized through appropriate public sector investment programmes. For risks such as hurricanes, mitigation measures should be adapted in hurricane prone areas. These could be built into proposed projects. Specific risks can be minimized or mitigated through research and development. This will also provide a very practical role for R&D institutions through the provision of technical assistance to large investment projects or to the insurance companies themselves.

9. Venture capital funds

Agricultural innovation will drive the next generation technologies that would be able to create sustainable livelihoods in agriculture in a globalised world. For agricultural innovations to be developed into technology based industries, capital is required for pre-investment

research or incubator research. Venture capital stimulates the emergence of for small and medium enterprises, which have been the drivers of development in the developed world.

10. For financial investments to be effective entrepreneurship training is required.

Successful project implementation would require entrepreneurship training and information literacy for stakeholders. This would entail financial literacy, business management, investment training, training on project implementation and other relevant skills training..

Question 3

What is the role of governance in agricultural development in the context of policy, institutional support, sectoral linkages, support for stakeholder organizations and the provision of public goods e.g. drainage, irrigation, roads?

Policy

1. Long-term consistent regional and national policy direction aimed at creating an enabling environment for agricultural investment towards food security and innovation. Creating the appropriate legislative and regulatory environment to implement policies. Allocating the necessary resources to implement the policy on a consistent basis
 - Food security policy (priority crops/livestock, land policy, labour policy, infrastructure & regulatory environment, institutional support, capital injection; incentives, taxation, managing praedial larceny; risk alleviation)
 - Innovation policy (S&T policy, IPR environment, R& D institutional capacity, foreign direct investment, venture capital, bio-parks, incentives, taxation.).
2. Creating a mechanism through which stakeholder inputs are incorporated into the policy, thus ensuring stakeholder buy-in.

3. Ensuring a well organised (components work in harmony), highly motivated, sustainable (economically, environmental and socially) agriculture system that will create sustainable livelihoods along the agri-food chain and will lead to the long-term development and prosperity of the Caribbean.

Institutional support

1. Developing institutions or building capacity within institutions in agriculture to ensure that they are capable of supporting ‘New Agriculture.’

This includes developing capacity both infrastructural and human capacity of R&D institutions, outreach institutions and other institutions, providing credit, insurance, marketing and other agricultural services..

2. Funding projects and programmes in keeping with national agricultural policy, within the institutions. Ensure that all projects and programmes funded by public funding have clear objectives, timelines, continuous evaluation and reporting.
3. Provide necessary incentives to ensure that the institutional capacity built is functioning efficiently.
4. Capacity building of tertiary level institutions that can produce the human capacity needs to support agriculture or engage in ‘new agriculture’ in the region.

Provide oversight to ensure that the study and training programmes are relevant to the long-term policy vision for agricultural development in the region.

5. Ensure that the publicly funded institutions are managed efficiently and transparently by setting up oversight mechanisms. Setting up mechanisms for benchmarking institutions.

Sectoral linkages

Agriculture development should be linked to other leading sectors in the economy, mutually supporting each other, e.g. tourism sector, including sports tourism, food and beverage manufacturing sector; the petrochemical sector. Such a push-pull strategy is required for the leading sector to pull other sectors along with it, while all sectors gain quantitative or qualitative improvements.

Agriculture working with the manufacturing sector for instance will allow agriculture to function in a private sector goal-oriented mind set, providing a consistent year-round supply of raw materials to the processing industry.

1. Facilitate the development of intersectoral boards of management to oversee intersectoral development.
2. Provide funding to develop intersectoral R&D and development programmes that add value to both sectors.
3. Facilitate venture capital availability, so that innovative projects and programmes would eventually be commercialized.
4. Engage in the marketing and advertising of successful project and programmes, so that they will gain the necessary momentum.
5. Institutionalize linkages, where necessary, under private sector management, to ensure the long-term continuity of the momentum gained.

Stakeholder organization support.

Stakeholders are the producers, input suppliers, manufacturers, service providers, commodity groups and the final consumers, who should in the final analysis benefit from developing an organised sustainable agricultural system.

1. The stakeholders, being the drivers of agriculture (demand and supply end), should be engaged in policy formulation and implementation, at all levels. This will ensure that there are no critical errors in the policy

and that all views of the stakeholders are taken into account. In addition, will ensure stakeholder buy-in, resulting in a motivated sector.

2. The government should therefore support the formation of stakeholder organizations, and strengthen existing organizations. A funding mechanism should be instituted, where necessary, for the long-term continuation of these organizations.
3. Ensure that the stakeholder organizations function in a transparent, democratic, accountable and efficient manner, particularly when public funding is utilized, and the decisions are transparent.
4. All governmental, quasi-governmental and non-governmental organizations who are responsible for implementing governmental policy should engage the stakeholders in their work programmes/projects.
5. The implementing agencies should take into account recommendations from various stakeholder organizations or engage them in dialogue to reach compromises, where appropriate.
6. Each of these engagement steps should be carefully documented, so that future decisions may be guided by previous one and not in isolation.

Provision of public goods.

This is the most important function of the governments of the region. Without appropriate infrastructure, agriculture development would not be possible. Agriculture infrastructure involves general infrastructure such as electrification, watershed management, roads, drainage, extension, credit and insurance, etc. and production infrastructure such as access roads irrigation and postproduction infrastructure such as storage facilities, marketing infrastructure and a market information system.

These should be developed and maintained in the most efficient manner.

Question 4

How could we involve the private sector in governance to improve agricultural industries?

Large industrialized countries vs small developing countries

In the developed countries, many of the agriculture activities have been privatized—research and development, seed production, agricultural services including agricultural extension, agricultural credit and insurance, input development and distribution, postharvest storage, manufacturing, transportation, as well as marketing services including market information, wholesaling and retailing. The larger scale of production within the countries and a more globalised world has provided the economies of scale for these to be highly profitable. Public sector involvement is restricted to overall policy and provision of public goods such as road and drainage, ensure that the private sector companies. Private sector governance ensures profitability of each component, but not necessarily sustainability (environmental and social aspects, in particular). This is particularly becoming apparent now.

The scenario is different in small developing states such as the CARICOM states, where the scale of agricultural activities are limited, inward looking and often not highly profitable, and hence the role of the government and private sector should be carefully balanced. While it is desirable to have a private sector-led governance model, the process has to be phased in, and managed through appropriate policy. The CARICOM should develop its strengths into globally competitive industries.

1. Creating a new image for agriculture – “New Agriculture”

Agriculture is considered to be a backward, backbreaking, unprofitable and degrading livelihood in the Caribbean. Agriculture should be marketed as strategic, forward looking, knowledge driven, technology based industry that is highly profitable. To do this existing agricultural farms should be transformed into modern, intensive, technology based, profitable outfits.

2. Private sector is involved in decision making

Private sector should be part of boards of institutions/organisations and boards so that they become part of the decision making process. This would result in publicly funded institutions and organizations adopting a private sector culture.

3. Assistance for technology transfer:

Governmental assistance to local universities to set up technology transfer systems. This will allow R&D institutions to convert innovations into business models that can be marketed to the private sector.

Where local technologies are not available, incentives for technology procurement, transfer, or partnership with foreign organizations should be fostered. This could include incentives for foreign direct investment, support for adaptive research, support for organizing local or regional technology transfer workshops or training programmes, etc.

4. A Regional Investment Forum.

An investment forum should be organised on a biannual basis for the research organizations involved in agriculture to showcase the investment portfolios and business models. This could be coupled with trade shows.

In addition, the private sector such as the food and beverage sector, agro-chemical sector and other input sectors, should be encouraged to participate in agriculture conferences, workshops and boards of institutions and organizations, to create an awareness of investment opportunities.

5. An innovation system to be developed, to include an intellectual property system.

An intellectual property (IP) policy, legislation, regulations and an implementation mechanism need to be set up so that these IPs can be the basis of negotiations and partnership.

The research and development institution may license a product or technology to a private sector company/service provider or enter into a partnership arrangement or sell the technology to a private sector company.

6. Incubators and accelerators to develop into SMEs.

Universities and research institutions should be encouraged to develop public private sector collaborations in the form of

incubators/accelerators towards providing research support and services to the agro-industry, using venture capital. An innovation policy, regulatory framework and implementation system is imperative to achieve this.

The incubators should lead to the development of SMEs which should slowly move from a national focus to a regional and global agenda, so that they can become viable entities in their own right.

Governments should provide incentives to support such development, particularly in the beginning, and also ensure that some of the risk involved in operating in a small economy is mitigated.

7. Fiscal and other incentives to the private sector.

Government to provide fiscal incentives to promote private companies to engage in innovative agricultural initiatives and adaptive research.

Reduce agricultural risk by provision of better infrastructure, agricultural insurance, protection against praedial larceny etc.

8. Weaning R&D and service institutions.

Overtime research institutions should be weaned from government funding and expected to generate revenues through IPs, incubator companies, consultancies and international competitive grants.

9. Nurture the natural evolution of strong regional private sector institutions.

Encourage national level institutions to merge or transform into larger regional level institutions that are capable of competing at the international level.

10. Government, in the longer term, confines its activities to policy, oversight and provision of public goods.

Government in the longer-term completely out-sources services (research, extension, support services), from the private sector, as necessary, to support its substantive functions. Further, the government should ensure that the business models proposed for development should be evaluated not only for economic sustainability but also for environmental and social sustainability.

Question 5

Given the importance of innovation in developing a competitive and profitable agricultural sector, how could the innovation-system-support be made more effective in the region? What institutional models could be proposed?

Innovation system support

1. Innovation policy

Any innovation system support cannot be effective without an innovation policy that provides an enabling environment. This policy should elucidate a clear vision with priorities, a conducive regulatory environment, which is less bureaucratic and efficient, a regionally harmonized IP system, a mechanism for institutional and human capacity building, support for research, technology development and transfer, incentives for private sector investment, a mechanism to attract foreign direct investment in selected areas, support for public-private sector collaboration, a financial mechanism for supporting the development of incubators and SMEs and a mechanism of stakeholder involvement in the developmental process.

2. IP environment

A regionally (CARICOM) harmonized IP environment is essential for emerging SMEs to target the CARICOM market. Harmonization should result in mutually agreed upon IP philosophy, common application forms, similar criteria for evaluation procedures, and possibly in the longer-term, one point of application. Such a system would allow intellectual properties or products derived from such intellectual properties to be marketed or licensed throughout the Caribbean without fear of infringements on the rights of the IP holder. This allows the developers to have an economically viable market place to test the products before venturing into global markets.

3. A regionally harmonized regulatory environment

The regulatory environment should be simple, less bureaucratic and current. It should be developed using a participatory approach in the most transparent manner, based on globally agreed protocols. An oversight mechanism should be put in place to ensure that the

regulations are strictly followed. This will ensure that the products adhere to global standards, and therefore will facilitate trade within and outside the region.

4. Education system that nurtures critical thinking, creativity, entrepreneurship and continuous learning

A fundamental feature of an innovative environment is the nurturing of an innovative people. Innovative people can only be developed through an educational system that places emphasis on critical thinking and creativity. Children from a very young age should be allowed to learn through a process of exploration, research and critical evaluation.

Researchers should be trained in entrepreneurship so that they can convert innovative ideas into successful enterprises. Further, a system of continuous training of researchers on the latest technologies should be facilitated through staff exchange or in-service training.

5. Innovation centres

Innovation centres should be established for the priority areas of development identified. This involves concentration of resources and human capacity into those critical areas, with the expectation that the innovations produced will result in spin-off companies that would have a regional or global impact; and create sustainable livelihoods for the country or region.

7. Effective funding of innovative research

Although innovation centres may be established, it should be recognized that innovative ideas can emanate from any institution or person. A funding system should be established to provide seed funding for a number of promising projects, with the expressed aim to establish the innovative potential of those research projects. If this has been successfully shown, then this could be the basis for supporting a larger grant proposal.

Funding should be prioritized based on the expressed goals of the innovation policy for a country. In other words it should be relevant and should address the national and regional priorities.

Given the small number of researchers in the Caribbean (lack of critical mass of scientists), conditions for funding should encourage inter-institutional research and multidisciplinary research. Multidisciplinary research has consistently resulted in the most innovative research findings.

8. Incentives for innovative research

An incentive system for innovative research should be established, based on the potential for such research being developed into incubators. This would provide a direct incentive for developing innovative people.

9. Incentives for technology transfer: incubators.

Research innovations by themselves will not lead to agricultural development. Research innovations have to be first converted into technologies, within incubators, established through university-industry collaboration. Incentives for technology transfer could include fiscal incentives for the private sector, support for technology transfer offices within institutions, and bio-park facilities. Technology transfer offices document important innovations within the institution and develop agreements with private sector companies for incubator development.

10. Facilitate incubator: SME migration.

Following technology development within an incubator setting it is important that there is pre-investment testing to validate the results in a semi-commercial scale, before full scale commercialization as a SME. The government has a role in assisting with the pre-investment of technologies developed, possibly through providing venture capital and insurance systems as a risk mitigation mechanism.

11. Venture Capital

Establishment of venture capital allows resources for establishing SMEs based on innovative research.

12. Agro industry insurance

Agricultural insurance schemes are important to provide an enabling environment for innovative investments. Innovative research always comes with some risk, and averting the risk will provide an incentive for private sector investment into innovative technologies. Lack of an

insurance scheme is likely to result in the private sector being largely investment shy.

Institutional models

There are three possible models.

- (a) Vertical integration: All aspect of the innovation, technology development, commercialization and outreach are vertically integrated within an institution. This is what occurs in the land grant university system. The Caribbean academic institutions do not have the business skills necessary to benefit from this system. Further, this system has been superseded by other systems in the developed world.
- (b) The various aspects of the innovation system are institutionalized, where research is done in research institutions, technology development in technology institutions, and commercialization in private sector institutions. The systems require strong inter-institutional collaboration. In the Caribbean the institutional cultures often makes this model a difficult proposition to implement.
- (c) The research institutions collaborate with different private sector institutions for technology development in an incubator setting. The participatory technology development approach in collaboration with the private sector facilitates immediate commercialization. This system exploits the strengths of the research institution and private sector in bringing the commercial benefits of innovation.

An enabling policy environment is required to make the institutional models to work properly.

For model (c) to function properly:

- (a) National research fund
Bring the various researchers from different institutions in the right configuration to solve a critical problem using a multi-disciplinary approach.

- (b) Incentives for private sector to establish incubators along with research institutions – mitigate risk of investment, provide venture capital, provide fiscal incentives to private sector, provide bio-park facilities.
- (c) Incentives for private sector to establish SMEs
Providing the right fiscal policy, venture capital, agricultural insurance,
- (d) Innovation centres in priority areas
Focus on priority areas of research through providing excellent facilities and excellent human resources and funding. Innovation centres can license technology or enter into an incubator setting to develop technologies or derive revenue from partnership in the SME or licensing of IP.
- (e) Regulatory agencies should oversight to R&D.
- (f) A number of spin-off companies (SME) from a particular priority area are expected form a cluster, towards branding and market penetration.

Question 6

What is your assessment of The University of the West Indies' contribution to regional agriculture? How could The University of the West Indies improve its support to regional agriculture?

Contribution of UWI

The UWI had contributed to agriculture development in a number of ways, principally in human capacity development, but also in research, innovation and outreach as well as policy support.

A. Human capacity development

Undergraduate

1. The UWI has produced the majority of the agricultural personnel in the Ministries of Agriculture, agricultural institutions, agencies and private sector industries, in the past, and has in this respect been very successful.
2. UWI training was good but its application in the work environment limited. UWI students have good theoretical knowledge but often lack the knowledge to function in a practical environment.
3. The number of students being trained at The UWI in Agriculture has declined over the years, with most students, at present, originating from Trinidad. This trend may be due to, among other things, the decline in agriculture in general in the region, rising costs of training at The UWI for regional students (inability to afford travel lodging and fees), an increase in other degree awarding institutions in the region, increases in student scholarships to Cuba to pursue agriculture, and a perception that the UWI graduate does not have the necessary practical competencies to function in an agricultural environment.
4. The graduates have not seen themselves as agricultural entrepreneurs, which in part has led to the decline in agriculture in the region.
5. The graduates may not have had an opportunity to be nurtured in an innovative environment, and hence are incapable of functioning in an innovation-based society: creating innovation, technology development and having the necessary entrepreneurial skills, support and confidence to establish successful SMEs to add value along the agri-food chain.
6. The degree programmes have not adequately changed to reflect the changing global environment, changing regional agricultural realities or the changing science and technology environment. In a recent survey, the CARICOM Ministries of Agriculture rated the experiences gained at Guyana School of Agriculture, Zamarano, ECIAF and EARTH as superior to that at UWI. The UWI agricultural programmes have not set themselves philosophically apart from those offered by the other technical institutions.
7. The rapid change in the global environment requires an agriculture worker that can critically think, adapt and change. The curriculum may not be sufficiently reflecting the changing ground realities. The system at The UWI should change to adopt more case-based or problem-based learning

methods, so that it produces a thinking worker, who can function in a rapidly changing knowledge environment.

8. UWI graduates do not have strong leadership and communication skills, and lack the self motivation and self confidence to become change agents.
9. The educational programmes provide limited opportunities for students to learn from real life problem situations, which can be experienced through inter-institutional collaborative research programmes, internships, and other means of engagements so that they can gain real-life knowledge.
10. The UWI programme is not attracting the brighter students from the region, capable of effectively transforming agriculture.
11. The UWI graduates are not being trained in the new and emerging technologies such as gene technology, biotechnology and nanotechnology.
12. The UWI students seem not to be familiar with the great historical heritage of the Imperial College of Tropical Agriculture and its impact on global agriculture.

Postgraduate programmes

1. Inadequate MSc programmes to meet the needs of a modern regional agricultural sector.
2. MSc programmes are not stakeholder driven and are not seen as based on stakeholder needs. MSc programmes are not seen as providing the necessary skills and competencies required to seek value opportunities in the agri-food chain.
3. The MSc research projects should be ideally conducted in a real-life settings where the student works along with the enterprise to solve problems, or works in an incubator setting, or participatory research settings.
4. More MSc programmes or diploma programmes or short-courses delivered through the distance mode.
5. There is an important need to train extension personnel which seems to have been abandoned by The UWI.
6. Research degrees leading to M.Phils and PhDs should be based on practical problems or incubator models

7. Graduate research students are not functioning in an innovation based environment, and lack the entrepreneurial training, leadership training to establish SMEs or incubators.
8. Graduate research students do not perform well in multidisciplinary teams, or in team situations.

Short courses (in-service training)

1. The UWI does not support the continuous education and training of agricultural officers or farmers, who should function in an increasingly competitive global environment. Personnel should be continuously updated on recent technologies, market information systems, and changing regulatory environment. The UWI has inadequate distance programmes for further education and training.
2. The UWI does not have an information management or an outreach system, through which new knowledge can be transmitted rapidly in paper form or electronically or through a web portal to end users.
3. The UWI doesn't host regional workshops, bringing experts from various fields to address problems faced in the region.

B. Research, innovation and outreach.

1. The UWI mandate by CARICOM is only for human capacity development. Although, UWI has the largest critical mass of scientists in the Caribbean distributed over many disciplines, the CARICOM does not recognize The UWI as a research and development organization. This contradicts with global realities, where successful agri-enterprises are developed through multidisciplinary research and university-private sector collaboration.
2. Over the years, The UWI has not established a strong link with other CARICOM states to solve problems affecting the industries. Hence UWI's influence is mainly in Trinidad and Tobago.

3. UWI research has not had an impact on regional agriculture in a large way, either because relevant research was not carried out or has not been transmitted.
4. UWI research has largely not been participatory, involving the various stakeholders and hence has not been immediately adoptable. There is a disconnection between researchers and users.
5. The UWI has not been or has not been sufficiently involved in adaptive research on technologies emanating from other parts of the world. This would greatly enhance the sector.
6. UWI research does not seem to be prioritized. Further, it should be along the entire agri-food chain so that the industry as a whole is set on a good footing.
7. There are many research and development functionaries within the region, the UWI has not sufficiently coordinated with them to provide a streamlined research and development environment using the various strengths of stakeholder organizations.
8. The UWI has withdrawn the outreach personnel from the various CARICOM territories but has not replaced it with a suitable alternative system.
9. UWI research has not adequately incorporated futuristic technologies such as gene technologies, biotechnology and nanotechnologies into their research and development agenda.
10. UWI research does not seem to fit into an innovation based model, capable of technology transfer through incubators and ultimately generation of SMEs along the agri-food chain.
11. The UWI research system should keep up-to-date with global advances and employ a more multidisciplinary approach to solving problems.
12. Plant and animal breeding is essential to develop varieties and breeds adapted to tropical conditions, for agriculture to be competitive. This seems to be lacking.

C. Policy support, industry support, institutional linkages.

1. The UWI has played an important role in supporting agriculture policy throughout the region. However, this has been passively based on demand by governments. The UWI should actively be involved in analysis of global and regional food and technology issues, innovations policy, local land policy or sustainability issues, etc and provide policy support to CARICOM governments.
2. The UWI has met industry needs through largely consultancies. This should be marketed vigorously and pursued actively so that industries are aware of technology, policy or regulatory issues that may affect their competitiveness.
3. The UWI has not provided many agricultural services in the past such as disease diagnostic services, certification services, oversight of regulatory systems, etc. This is a possible area where The UWI can make an impact because of its critical mass of scientists in a wide range of disciplines.
4. The UWI has, to some extent, become a successful partner with agri-business groups or other community groups but should become actively involved in the activities of commodity, community groups and agricultural associations so that it can provide technical support and research support where necessary. This will also ensure that the work of the University will be relevant to the agricultural sector.
5. The UWI doesn't seem to have the institutional linkages to have an impact in other CARICOM countries and hence only Trinidad and Tobago has benefited from its research activities. This has to be rectified.
6. The UWI has to improve its coordination with other policy support institutions that operate in the region such as CTA, IICA, CARDI, etc. so that the stakeholders can benefit.

How could The University of the West Indies improve its support to regional agriculture?

General

1. The UWI should be recognized by the CARICOM not only as an institution involved in building human capacity but also a research, innovation and outreach institution.
2. The UWI should develop the institutional linkages with other institutions to carry out its mandate more effectively, particularly in non-campus territories.
3. The UWI should transform itself into an excellent research and innovation institution that can spawn innovative products, enterprises and livelihoods along the agri-food chain.
4. The UWI should develop a mechanism through which it can improve its interactions with agribusiness organizations, agricultural agencies, organizations institutions and associations.

Human capacity building

1. The UWI should raise the image of agriculture through instilling into its students the great tradition in tropical agriculture (from the days of the Imperial College of Tropical Agriculture) so that they can attract better and brighter students from throughout the region.
2. The UWI should develop innovative mechanisms to attract students from outside of Trinidad and Tobago, so that its mandate to the region is better served.
3. The UWI should improve the learning experience of students pursuing a degree in agriculture through
 - motivating students based on the region's early heritage, and creative delivery methods, so that they become active partners in the learning process.
 - developing a curriculum that is current, stakeholder-driven, balanced (theoretical and practical components) and capable of developing a creative thinking, innovative and an entrepreneurial graduate who can function in a knowledge-based society.
 - equipping students with the tools of emerging modern technologies and skills towards problem solving.

- preparing students should function in multidisciplinary real-life situations through internships..
 - providing opportunities to work in innovation centres, incubators, and SMEs, to be able to function in a knowledge-based economy.
 - Providing students the opportunity to be part of a UWI think-tank on current issues, so that they become aware of the issues facing agriculture in the real world scenario.
 - instilling leadership, confidence and communication skills into graduates.
4. While the M.Phils and the PhD programmes provide the necessary research capacity to solve problems facing agriculture in a variety of disciplinary areas, the MSc programmes should reflect the needs of the industry, and hence stakeholder driven.
 5. The number of MSc and postgraduate diploma programmes offered should be augmented and as much as possible delivered through the distance mode so that persons from different islands can take the course without taking leave from their jobs or relocating themselves. This would also allow cooperative teaching using the dispersed staff within the CARICOM.
 6. Research students should be allowed to develop their research findings into incubator projects, or work in incubators or SMEs solving problems. Creative ability should be nurtured through journal club discussions.
 7. Research students should be provided opportunities to work in a multidisciplinary environment, in teams, so that their ability to work in teams would be enhanced.

Research, innovation and outreach.

1. If The UWI is to fulfill its mandate as a regional institution, it should develop mechanisms to address the needs of not only Trinidad and Tobago but the rest of the Caribbean: i.e. the developmental priorities of the government, commodity groups or institutions in the various territories. They broadly fall into innovative research support that is essential to the development of new agri-enterprises, problem solving research to overcome bottlenecks faced by agro-industries (at various stages of the agri-food chain) in their attempts at becoming

competitive, and finally outreach support, which involves management and transmission of existing information to address specific needs of the stakeholders.

2. The UWI should develop strong project development and management capacity administered through a single faculty office. This office should have the necessary memoranda of understanding with other research institutions in the Caribbean or outside, so that where capacity is lacking within the institution it can engage other institutions towards delivering timely services.
3. The project development and management unit should be responsible for developing projects, executing projects and raising funds and should be subjected to in-house and external oversight to ensure that it is functioning in the most efficient way. Furthermore each project should be closely monitored so that the deliverables are given to the stakeholder interest in a timely manner, so that confidence in the institution is augmented over time.
4. A mechanism for consensus building on priority issues facing different countries or different commodity groups in the region should be developed. The agri-business associations being established in the various territories or existing agro-manufacturer groups could be used as one of these mechanisms. There should be regional and national funding mechanisms established which are informed by these priorities, so that these are reflected in the advertising and administering of these competitive funds. Such a system would not only ensure that there is no disconnect between the needs of the region or sector and the research output of The UWI and other research institutions but will also ensure that the funding utilized in the most efficient way by exploiting the synergies of the regional research capacity..
5. Alternatively, The UWI could engage various commodity groups in the region, and establish a memorandum of understanding to deliver research services. The UWI can convert the problems faced by a commodity group into projects, develop proposals, and execute the projects in a participatory manner with the stakeholders. The UWI should find a mechanism possibly through developing regional projects to engage other research organizations/institutions in other countries.

This approach would have two advantages. It would bring together synergies of the various regional research institutions, while at the same time ensuring that the outputs of the findings are implemented in the individual countries. Funding for such projects would be raised from the governments, the commodity groups or independently raised from external sources.

6. Another approach is for The UWI to provide contract research services to various stakeholders in the agriculture sector.
7. While most of the above approaches are focused on solving various short-term constraints facing the industry and are important towards becoming relevant to stakeholders; building the necessary innovative research capacity is even more important to a University. Focused multidisciplinary research efforts in 'innovation centres' can result in the development of SMEs along the agri-food chain, leading to the development of sustainable new livelihoods. The University should have an innovation policy, technology transfer office, incubator facilities and a strong marketing arm to attract private sector investment.
8. Involving the graduate research training function of the university to build inter-institutional collaboration, participatory (stakeholder) problem solving exercises, innovative centre research, incubator-based research activities would allow The UWI to extend its arm to the various territories, institutions and incubator facilities. The University should use this capacity effectively. The students functioning in such a research environment would also have an opportunity to immediately gain employment in the area they function in. The graduate students will also have the necessary competence to establish SMEs based on their background training.
9. The marketing and outreach arm should be developed through an internet-based information portal. This should seek to provide information to stakeholders on research activities, research findings, and should be also involved in managing and disseminating information on new technologies, validated technologies from throughout the region. It should be a one-stop information portal for the region, and The UWI, being involved in knowledge generation,

management and dissemination would be the institution of choice to carry out this function.

10. This doesn't mean that UWI should not be involved in other means of outreach. The UWI has traditionally provided outreach and in-service training through short courses. This should be expanded not only in terms of the breadth of the courses delivered, but also the locations at which they are delivered. The system should be self-supporting, and sustainable. The UWI should be able to move a small cadre of personnel based on the needs of a country, utilizing existing facilities used by distance education for hands-on training. Where a hands-on practical component is not necessary, in-service courses could be best delivered through the internet. Whatever way is chosen, The UWI has a responsibility to keep the agricultural sector technologically relevant in the global society.
11. Other outreach opportunities include exhibitions that take place in several parts of the region. The UWI should have transportable exhibition modules built that can be taken to any location. The material should be kept current. Further, The UWI should continually develop short TV clips on new technologies, new research findings, and current issues facing agriculture and supply them to television stations throughout the Caribbean. This will go a long way in transforming Caribbean agriculture farm units into modern, technology driven, intensive units capable of competing in the international arena.
12. It is important that the University develops a benchmarking system so that it can be evaluated against other universities with respect to its research, innovation and outreach capacity and thereby reset targets .and continuously refining its delivery mechanism so that The UWI can continuously grow as an R&D institution relevant to the development of the region.

Policy support, industry support and institutional linkages

1. The UWI should configure itself into a think-tank to address current issues in agriculture and provide pro-active policy directions to agricultural ministries in the region in a number of areas. For this it should link with

other international and regional policy institutions for greater impact (CTA, IICA).

2. The UWI should establish memoranda of understanding with R&D institutions in the region, so that it can play a more active role in assisting the industries outside the region through technical support to agencies and institutions within countries.
3. The UWI should configure itself into a second-line agricultural service institution to provide support to existing frontline agricultural services institutions in individual territories. In this capacity it can provide technical assistance towards developing capacity or provide oversight & certification for its services or provide higher level services, which may not be economically feasible for a front-line service institution. Agricultural services could be diagnostic services, vaccination, soil testing, food safety, GMO testing, macro and micro-propagation, DNA fingerprinting, an e-marketplace facility, etc.
4. The UWI should develop a feedback mechanism through which it can interact with stakeholder institutions and groups. Given the nature of Caribbean territories, an internet based system should be established.

Concluding Remarks:

The workshop provided an interactive setting in which key stakeholders were able to discuss issues facing agriculture in the region and develop possible models that can be used to develop a regional policy for Agricultural development. This document will form the basis for the formation of a white paper towards developing a regional policy for agricultural development.

The workshop advocated a triple-helix model in which government (regional and national), R&D institutions and private sector play a role towards developing a strategic forward looking, knowledge driven and technology based agricultural sector. The governments have to develop an enabling environment for agriculture development with the twin objectives of achieving food security and developing innovative agricultural opportunities that can create value livelihoods to the peoples of the region. The workshop contends that the governance models should increasingly be private sector led, but with collaborations with R&D institutions or innovation centres that

can provide the necessary science and technology input to make the industries successful. The governments have an important role in providing an enabling environment for private sector investment.

The report also discusses the role The UWI and other universities have to play in transforming agriculture.