



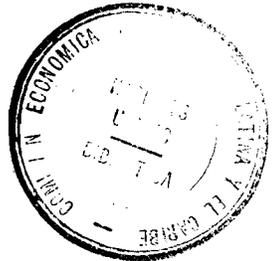
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**CARIBBEAN COUNCIL FOR  
SCIENCE AND TECHNOLOGY**

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**REPORT OF THE REGIONAL SEMINAR/WORKSHOP TO DEVELOP A  
PLAN OF ACTION FOR SCIENCE AND TECHNOLOGY FOR THE CARIBBEAN**

4 - MAY 1993





## **REPORT OF THE REGIONAL SEMINAR/WORKSHOP TO DEVELOP A PLAN OF ACTION FOR SCIENCE AND TECHNOLOGY FOR THE CARIBBEAN**

A regional seminar/workshop to develop a Plan of Action for Science and Technology for the Caribbean was organized by the Caribbean Council for Science and Technology (CCST) in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Industrial Development Organization (UNIDO) and the Caribbean Community Secretariat (CARICOM) and hosted by the Government of Saint Lucia from 8-11 September 1992. The United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC) Subregional Headquarters for the Caribbean served as the secretariat for the seminar/workshop. The Caribbean Conservation Association (CCA) graciously contributed towards the publication of this report.

The workshop was addressed and opened by the Honourable Michael Pilgrim, Minister in the Prime Minister's Office. The Honourable Minister's statement appears as Annex I.

The objectives of the workshop were:

1. To examine the recommendations of the CCST initiated and supported national consultations on science and technology, held in Antigua and Barbuda, Belize, Dominica, Grenada, St. Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines.
2. To develop a systematic long term Plan of Action for scientific and technological aspects of development in the region.
3. To identify areas of co-operation and collaboration among regional organizations and countries.
4. To examine mechanisms for establishing or strengthening linkages between organizations and institutions conducting research and development and the industrial and commercial sectors.
5. To examine the experiences of Latin America in establishing science and technology structures e.g. CONICYT, COLCIENCIAS, as major staging points for directing science and technology activities in the state.
6. To provide the framework and impetus for private sector participation in the development of technology in the region.
7. To assist in the diversification efforts of the Organization of Eastern Caribbean States (OECS) and CARICOM states.
8. To assist the countries particularly the smaller ones in identifying priorities for action with their own national development plans.

The workshop was attended by representatives of the following countries: Antigua and Barbuda, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Puerto Rico, Netherlands Antilles, St. Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and the United States Virgin Islands.

The following organizations were also represented: Caribbean Agricultural Research and Development Institute (CARDI), CARICOM, Caribbean Development Bank (CDB), Commonwealth Science Council (CSC), Caribbean Environmental Health Institute (CEHI), CONICIT of Costa Rica, Organization of American States (OAS), Saint Lucia Chamber of Commerce, Saint Lucia National Commission for UNESCO, UNESCO, UNIDO, United Nations Environment Programme (UNEP), and the University of the West Indies/Caribbean Agricultural Extension Programme (UWI/CAEP).

A number of observers and consultants also attended. The list of participants is given as Annex II.

The action plan will provide member countries of CCST with the basis for developing national plans in science and technology development, technical assistance, collaboration and popularization and provide the direction for the future work programme of the Council within a long-term perspective.

After two days of presentations and general discussions five working groups were established to formulate action plans in specific areas of expertise from which both regional and national plans would be drawn.

The recommendations of these working groups follow.

## **GROUP I: SCIENCE AND TECHNOLOGY POLICY**

### Members:

Eslie Alleyne	-	Barbados
Arnold K Ventura	-	Jamaica
Jeffrey Dellimore	-	CDB, Barbados
Alejandro Cruz	-	CONICIT, Costa Rica
Serigo William Calderon	-	INDOTEC, Dominican Republic
Thomas de Gregori	-	University of Houston
Winthrop W Wiltshire	-	UNESCO, Trinidad and Tobago

### Introduction

Science and Technology are integral and essential core components of successful national development in the Caribbean. The evidence is overwhelming and incontestable that countries that have experienced rapid economic development have integrated science and technology into every aspect of the development process. It is a truism in agricultural economics for example that the green revolution technologies have transformed agriculture in those countries that had indigenous operating research and technology structures. Effective technology transfer in the Caribbean requires local science and technology capabilities for adaption and development. It is equally true, that failure to utilize local scientific and technological knowledge in technological choices have often been costly, inhibiting development and increasing external dependency. Science and technology policy involves a process by which questions are raised concerning the scientific and technological implications of choices and actions and answers are in terms of local capability to contribute to solving the problems inherent in development activities. Science and technology are fundamentally universal and global but the ability to utilize the full range of human knowledge requires local scientific and technological capability at the point of application.

Science and technology must be understood as a coherent organized body of problem solving knowledge that should be nurtured, structured and focused to allow it to serve the government and people in the process of national economic development.

Though science and technology should be involved in all decisions, its role is not to make policy decisions but to help the decisions of policy makers be more effective.

### Goals

To assist countries of the region to devise strategies for the acquisition of technology and to develop national science and technology policies and action programmes which address the following major problems/issues:

- (a) The science and technology requirements for national, social and economic development;
- (b) The integration and coordination of national science and technology efforts;
- (c) The need for national science and technology activities to address the technology development needs of both the formal and informal sector;
- (d) The need for an active process to indigenize imported technology in order to effectively use technology to satisfy the needs of society in a competitive global environment;
- (e) The need for a scientific and technological approach to goal setting, policy formulation and problem solving by involving scientists and technologists at all stages in the development/formulation and implementation of national plans for social and economic development;
- (f) Creation of mechanisms/indigenous capacity to incorporate the results of indigenous research and development into the social and economic development process;
- (g) The need to ensure the sustainable development of indigenous science and technology capabilities by devising programmes for the development of science and technology manpower, by reducing the 'brain drain' of scientists and technologies from the region and by reversing the trend of declining student enrolment in science and technology disciplines.
- (i) The need to monitor and evaluate the impact of science and technology policies at the micro and macro-economic levels, in order to continuously refine/improve upon existing strategies and policy instruments; and
- (j) The need to increase the level of financing allocated by the public and private sector to science and technology activities on the basis of agreed priorities and criteria of cost-effectiveness.

## Action programme

### Science and technology requirements analysis

International and Regional organisations, such as UNESCO/UNIDO/CCST, should support development and application of methods for assessing the science and technology needs of key economic and social sectors of Caribbean Countries.

### Integration and Coordination of Science and Technology

International and regional organisations, such as UNESCO/CCST/CARICOM, should assist countries in conducting institutional analysis to determine the most efficient organisation and means of implementation of National Science and Technology functions and activities.

National Governments should be encouraged to create a senior-level post of Science and Technology Advisor and a Science and Technology Council, attached to the Office of the Prime Minister or other relevant office, to assist and advise all public and private sector agencies on Science and Technology needs and the Science and Technology implications of government policies and actions.

The main functions of the Advisor and Council should be to:

- (a) Advise government on specific Science and Technology programmes and policy instruments to effectively operationalise government policies;
  - (b) liaise with international organisations and funding agencies, in collaboration with the relevant national planning agencies, to secure financial support for Science and Technology development;
  - (c) recommend to government priorities in the allocation of budgetary and programme resources to Science and Technology activities;
  - (d) promote and facilitate collaboration between national Science and Technology institutions;
- and
- (e) monitor and evaluate the implementation of Science and Technology programmes and policies and progress in developing Science and Technology capabilities (including manpower development) and reporting annually on the status of Science and Technology at the national level.

### Technology Development Needs of Formal and Informal Sector

International and regional institutions should assist governments in developing national extension services which facilitate contact and two-way transfer of knowledge between enterprises in the formal and informal sectors and Science and Technology institutions.

### Sustainable Development of Science and Technology Capabilities

At the national and regional level programmes should be developed to:

- (a) recognise outstanding contributions by Scientists and Technologists to social and economic progress through national and regional awards and fellowships;
- (b) improve working conditions of Scientists and Technologists, which facilitate personal as well as national development, and create career paths that adequately reward and recognise their efforts/contributions to economic and social development;
- (c) facilitate contact and interaction between indigenous Scientists and Technologists and their regional and international peers (through secondments, participation in conferences and seminars, etc.);
- (d) facilitate development of professional scientific and technological organisations; and
- (e) continue to utilize competent and experience Scientists and Technologists who have completed their terms of service.

### Increased Support for Useful Science and Technology Activities

Private enterprises and Government Departments should be assisted in:

- (a) explicitly identifying expenditure on Science and Technology activities;
- (b) regularly assessing the impact of such activities on national/enterprise output and competitiveness;
- (c) allocating increased resources to such activities on the basis of demonstrable cost-effectiveness or importance in solving problems related to the long-term viability of productive and social sectors; and
- (d) establishing a special national fund to finance risky but potentially highly beneficial project to commercialise indigenous innovations.

**GROUP II:(A) MARINE SCIENCE AND TECHNOLOGY  
(B) NATURAL RESOURCE UTILIZATION  
(C) ENVIRONMENTAL ISSUES**

**Members**

John W Ashe	-	Antigua & Barbuda
Naresh Singh	-	CEHI, Saint Lucia
Vicente Santiago-Fandino	-	UNEP, Jamaica
Peter Anderson	-	Saint Lucia
Rosa Marie Oliveras	-	Puerto Rico

**Background**

The environment constitutes a major resource in many countries of the region; in others, it is the only resource on which they depend for all their economic activities. Hence, the management of the environment requires the development of appropriate technology and scientific research based on national and regional capabilities.

The development of marine science and technology and natural resources development has become one of the most important issues in the region, particularly due to economic constraints of the national economies. Although government officials are aware of the need to encourage the appropriate management of natural resources, their intentions could not be fulfilled due to the lack of funding, expertise and the nonexistence of national programmes to address the needs of the subject.

The over-dependence on the natural resources for economic activity and the countries' unique ecological and environmental characteristics make them particularly susceptible to a number environmental problems, which has underscored the need for the utilization of S&T in the development of national and regional programmes, policies and plans.

Different key issues are of vital importance for the preservation and utilization of the natural resources, i.e. implementation of integrated management plans, development of adequate technology, science development, co-operation among institutions, information exchange, local participation and funding, etc.

The coastal and marine resources of the Wider Caribbean are under pressure due to the development of inadequate tourism development, pollution, waste disposal, land and water use practices and the perspective of sea level and temperature rise, urban development and agricultural expansion, among others. Thus, a Plan of Action should consider the above-mentioned issues in order to seek their solutions through the development of marine science and technologies.

In an attempt to address the most important environmental aspect to be considered within the plan of Action for Marine Science and Technology and Natural Resource Utilization to be incorporated into the national and regional agendas for the management of marine and coastal resources, the following issues have been identified:

- (a) Tourism development in ecologically sensitive areas;
- (b) Trans-boundary movement of and/or the safe disposal of locally generated solid, liquid and hazardous wastes;
- (c) Land and offshore based sources of pollution;
- (d) Protected areas;
- (e) Collection and dissemination of information;
- (f) Land and water use practices;
- (f) Education and public awareness;
- (g) Sea level and temperature rise;
- (h) Water supply;
- (i) Biotechnology;
- (j) Energy.

(a) Tourism development in ecologically sensitive areas

This type of tourism development and activities may cause coastal erosion, beach pollution, alteration of sea currents, reduction in biodiversity, negative impact on fisheries and degradation of the environment in general.

Science and technology requirements

Development of equipment and knowledge for obtaining inventories of land and marine living and non-living resources, control and monitoring of pollution, oceanographic surveys and integrating planning.

Human resources/expertise needs

Marine biologists, marine geologists, oceanographers, natural resources managers, ecologists, planners and environmental engineers.

Activities

Training of human resources in techniques related to the obtaining and management of inventories, database analysis, drafting and enforcement of environmental policies and regulations, eco-tourism activities and environmental impact assessments.

(b) Trans-boundary movement of and/or the safe disposal of locally generated solid, liquid and hazardous wastes

The movement of hazardous waste without appropriate control and safety measures poses a major risk for the environment and human health which could apply to the inadequate treatment and disposal of waste products.

Science and technology requirements

Equipment for transport, technology for treatment and disposal of wastes, development of safety containers, landfill techniques, waste water treatment plants, sea outfalls, appropriate technology and pollution control.

Human resources/expertise needs

Environmental and sanitary engineers, chemists, oceanographers, geologists, economists.

Activities

Training of human resources in waste management disposal, treatment and transport, ocean dynamics, modelling, local construction materials (appropriate technology), international shipping regulations and transport and pollution control.

(c) Land and offshore based sources of pollution

As a result of the industrial and agricultural development as well as urban expansion, there has been an incremental of pollution affecting hydrological basins, wetlands, seashores, marine and coastal ecosystems and human health.

Science and technology requirements

Development of techniques to identify, measure and monitor pollutants and contaminants affecting the coastal and marine ecosystems and resources and model development to understand the dissemination of contaminants in coastal waters and the biota in general.

Human resources/expertise needs

Biologists, marine biologists, oceanographers, ecologists, chemists, toxicologists, environmental engineers, hydrologists, mathematicians, microbiologists and sanitary engineers.

Activities

Training human resources on pollution control, reduction and abatement, pollutants dynamics and bioaccumulation, toxicity tests, production of industrial, agricultural and oil industry related pollutants, sewerage treatment and disaster preparedness and response.

(d) Protected areas

The protection of critical areas or vulnerable ecosystems is vital for their preservation. The development of tourism, industry in general and urban settlements, as well as the expansion of the agricultural frontier, coastal development and exploitation of natural resources has become a major threat to these ecosystems.

Science and technology requirements

Development of scientific knowledge and techniques for the management of the existing resources, for the understanding of the interactions between the species themselves and their physical environment.

Human resources/expertise needs

Marine biologists, ecologists, biologists and geologists.

Activities

Training of human resources in park management, environmental impact assessments, data collection and database set-up, photo interpretation, remote sensing analysis and geographical information systems (GIS).

(e) Collection and dissemination of information

The collection of information and its dissemination within the national institutions and governments allows for the appropriate management of natural resources and preservation of ecosystems. It also encourages the development of new technologies by making the results of research activities available to institutions in the region.

Science and technology requirements

Development and establishment of an electronic network based on PC computer systems and communication modems.

Human resources/expertise needs

Biologists, ecologists, engineers, chemists, geologists, computer scientists.

Activities

Training personnel in information systems, database set-up and management, electronic mail systems, soft- and hardware network and communication management.

(f) Land and water use practices

The established land and water use practices as well as their change may provoke erosion, pollution, soil depletion and salination, siltation, flooding, ecosystem degradation and biodiversity reduction.

Science and technology requirements

Facilities for remote sensing, computer system for satellite image analysis and Geographical Information System (GIS) and photointerpretation equipment.

Human resources/expertise needs

Geologists, agricultural engineers, hydrologists, chemists, ecologists, biologists, marine biologists, environmental engineers and hydrologists.

Activities

Training human resources in remote sensing analysis and geographical information systems (GIS) processes as well as in photointerpretation.

(g) Education and public awareness

Insufficient or nonexistent education at all levels in technical and scientific matters as well as in public awareness has resulted in the lack of interest in the development of local or appropriate technology and protection of the environment.

Science and technology requirements

Development of appropriate and innovative technologies.

Human resources/expertise needs

Specialists in education and communication in science and technology and environmental matters.

Activities

Training of human resources on different aspects regarding teaching and communicating with the public in general, the importance of science and technology for the development of the nation and the protection of the environment in the region.

(h) Sea level and temperature rise

As a result of climate change, it is expected that there will be a temperature and sea level rise which will impact the shore lines, coastal resources and the intensity and the periodicity of tropical storms and hurricanes in the region.

Science and technology requirements

Upgrading and establishment of a network of sensors for sea level and temperature rise recording, development of coastal protection measures and devices.

Human resources/expertise needs

Oceanographers, marine biologists, geologists, meteorologists, computer experts, naval officers, coastal engineers.

Activities

Training of human resources on reading and maintenance of the equipment, aspects of modelling, weather forecasting, ocean and coastal water and beach dynamics, geological processes of subsidence and coastal retreat and coastal protection.

(i) Water supply

In many countries of the region the problem of water supply has become critical, particularly in some of the small island countries.

Science and technology requirements

Development of appropriate or innovative technologies for waste water recycling and desalination.

Human resources/expertise needs

Chemists, environmental and chemical engineers, geologists, biologists and microbiologists.

Activities

Training of human resources in waste water treatment and desalination technology, analysis of the physical and chemical characteristics of natural local materials and technology adaptation.

(j) Biotechnology

Many countries to help cover their national demands for medicines (vaccines, anticancer medicines, etc.), proteins, (fish and alga flour), food in general (aquaculture and fisheries), agriculture (resistant crops), elimination of waste (waste recycling and biodegradation), etc. depend on biotechnology programmes and projects to which on some occasions they incorporate local natural resources and materials.

Science and technology requirements

Development of innovative specific techniques, equipment and materials based on the particular needs, programmes and projects.

Human resources/expertise needs

A large variety of scientists and technologists but mainly chemists, engineers (agriculture, chemical, electronic, environmental, etc.), biochemists, microbiologists, biologists, medical doctors.

Activities

Training of human resources for the specific characteristics and objectives of the programmes and projects to be undertaken on biotechnologies.

**(k) Energy**

The need to obtain cheap energy or produce alternative energy is a major concern for many countries in the region, particularly for those which depend on foreign supply, which is expensive and depletes foreign exchange savings.

Science and technology requirements

Development of equipment and techniques for the production and consumption of alternative sources of energy i.e. solar, eolic, tidal, waves, density, temperature/salinity, etc.

Human resources/expertise needs

Chemical engineers, physicists, mathematicians, biologists, oceanographers, environmental and mechanical engineers and economists.

Activities

Training of human resources in available and alternative energy production technologies and future trends.

Goals

(a) The collection of comprehensive marine data and the development of computer modelling systems to provide national and regional governments and institutions with the predictive capability for sustainable exploration of marine resources, environmental management and natural disaster mitigation.

(b) The development of training programmes to increase the national and regional human resources capacities and capabilities to conduct basic and applied research on coastal and marine resources and environmental management.

(c) The development and implementation of an integrated coastal zone management plans at the national level.

(d) Identification of potential areas to be consider under specific management regimes as well as identification of species of fauna and flora under the CITIES Agreement for their protection; the development of scientific knowledge for the drafting of adequate legislation and regulation for the management of protected areas and wildlife, and the development of techniques to study the protected ecosystems and species habitats as well as the flora and fauna.

(e) The strengthening of the regional sciences network (COSNET) with particular reference to the use of data gathering and dissemination of information.

(f) Developing the Institute of Marine Affairs (IMA) into a regional specialised entity for conducting research and acting as an information centre for the marine environment of the region.

(g) Expanding the role of the Caribbean Environmental Health Institute (CEHI) to include that of a centre for networking the technical services and cooperation with other national, regional and extra-regional entities required to guide and support the regional programme in environmental monitoring.

(h) The acquisition and/or adaptation of local, regional and extra-regional environmentally sound technologies and materials in the development and construction of facilities and environmental protection; the development and use of appropriate technologies for the treatment of wastes originated from man made activities and for the study of the interactions of the pollutants in the ecosystem; and to alleviate the stresses on fragile ecosystems cause by sea-level rise and other manifestations of potential global climate change.

(i) Develop Science and Technology capability:

(i) To undertake environmental impact assessment/statements for all development projects in order to assess their potential negative/positive impacts and propose alternative measures as necessary;

(ii) To develop policies and legislation to ensure the requirement of environmental impact assessment/statements at the national level;

(j) The development of national and regional data-banks on marine and coastal ecosystems, science and technology discoveries, facilities and research, institutions, experts and programmes/projects ongoing in the region; and the dissemination of information to all interested governments, institutions, NGO's and public in general through means of newsletters and electronic mail etc.

**SCIENCE AND TECHNOLOGY IN THE SERVICE OF  
NATURAL RESOURCES MANAGEMENT**

<b>SUBJECT</b>	<b>ACTIVITY/CAPACITY</b>	<b>OUTPUT</b>
General Resource Management	Computer Development assisted models for total small island system	Computer models
Forestry	Sustainable utilisation technologies (TFAP)	
Soil	Soil conservation capacity	Manual trained persons
Fisheries	Sustainable utilisation methodologies (FAO)	Manual
Land	Orderly land use planning	Physical planning guidelines, maps etc
Marine resources	CEP/UNEP Science and technology issues to be identified	Science & technology interventions for marine resources
Fresh water - Rivers - Wells - Springs	Monitoring and pollution control techniques	Data and control methods
Biological diversity	Scientific description of the state and value of the regions flora and fauna	Data

**SCIENCE AND TECHNOLOGY IN THE SERVICE OF  
ENVIRONMENTAL QUALITY PROTECTION**

SUBJECT	ACTIVITY	OUTPUT
Air quality protection	Enhance CCST member states capacity to monitor and protect air quality	<ul style="list-style-type: none"> <li>- Air quality data</li> <li>- Standards &amp; guidelines</li> <li>- Legislation</li> <li>- Control methodologies</li> <li>- Human health</li> <li>- Protection</li> </ul>
Drinking water	As above for water	As above for water
Costal waters	as above	as above
Waste Management - solid waste	design & introduce -engineered sanitary land fills - consider appropriate alternative technologies	<ul style="list-style-type: none"> <li>- demonstration model</li> <li>- trained personnel</li> <li>- landfills</li> <li>- manual of technology selected</li> </ul>
Pesticide residues contamination	Monitoring & control capability	Residue data certification of commodities Human health protection
Pollution control	Computer assisted modelling capacity	Predictor models for planning and assessments for approvals etc.
EIA	Science and Technology capacity development	EIA tool

**GROUP III: (A) HUMAN RESOURCE DEVELOPMENT  
(B) SCIENCE EDUCATION  
(C) POPULARIZATION OF SCIENCE**

**Members:**

Cecil Ford	-	Belize
A M B Sankies	-	Guyana
Barbara Carby	-	Jamaica
Milton Whittaker	-	Saint Kitts and Nevis
Dunstan Campbell	-	Saint Lucia
Marie-Grace Auguste	-	Saint Lucia
Cyrus Reynolds	-	Saint Lucia
Claudia Jean Baptiste	-	Saint Lucia
Iain Andrew Smith	-	Saint Lucia
LaVerne Ragster	-	United States Virgin Islands
Naresh Singh	-	CEHI
M P Laurent	-	UNESCO, Saint Lucia

**Background**

The basis of science and technology (S&T) policies research and activities in general, are ultimately dependant on natural resources and effectively oriented human resources. The human component's level of participation in S&T is dependent on an appropriate knowledge base and on approaches developed through formal and informal training. The Caribbean continues to produce rhetoric indicating the importance of training and education related to S&T in an environment of relatively uncoordinated initiatives and low investments in the maintenance of its S&T human resource base. The proposed actions are areas of basic needs for human resource development in the Caribbean.

Each of the areas discussed was analyzed based on the following format:

1. Priority
2. Action
3. Output
4. Target Group
5. Responsibility for implementation

Action programmes were designed for the following:

- (a) Human Resource Development;
- (b) Science Education;
- (c) Popularization of Science.

(a) Human resource development

Human resource development for the science and technology sector cannot be addressed in isolation of HRD in other sectors. Indeed HRD problems in individual sectors such as health, environment agriculture etc seem impossible to address in the absence of national HRD policies. It would soon be recognised that even national HRD policies would be severely handicapped in the absence of a regional HRD policy. It is therefore incumbent on each sector including science and technology to make concerted demands and appeals to regional governments to address the question of national policies and regional policies on HRD, if we are to emerge from decades of rhetorical regurgitations of HRD problems in the region and give a chance to any of the myriad action plans the region has developed.

Priority 1

Appropriate Human Resource Needs Assessment that can relate to National Plans/Policies.

Action

Extract S&T needs from National Plans/Policies.

Output

Development of HRD needs in specific areas.

Target

Governments; Regional Organizations and/or National Science Councils.

Organizations responsible for implementation

CDCC (Source UNESCO).

Priority 2

To retain S&T resource personnel in the Caribbean.

Action

Professional development awards in S&T. (Categories: National awards; Regional awards. Mechanism through Science Research Council or Science Associations; through the Caribbean Academy of Sciences or Appropriate Body).

Output

Increased retention of S&T personnel.

Target

Public and private sector S&T personnel.

Organizations responsible for implementation

Private and public sector collaboration

Priority 3

Improving communication/information flows between S&T organizations and personnel in the region.

Action

- a. Strengthening of the CCST Secretariat to facilitate information flows;
- b. Training of communicators (e.g use of electronic mail, scientific journalism).

TARGET

S&T organizations and personnel.

Outputs

- a. Improved communication and networking among S&T resource persons;
- b. Better understanding of S&T issues in the region.

Organizations responsible for implementation

CCST, UNICA and CAIC.

Priority 4

Improvement of technical and vocational skills in the Caribbean.

Action

- a. Establish Industrial Training Acts or appropriate legislation;
- b. Industrial levy to be introduced through the region;
- c. Production of directory of occupational skills;
- d. Sensitise the public/private sector re: (a) and (b);
- e. Establishment of National Training Boards.

Output

Production of trained personnel at craft, technical and professional levels with practical skills.

Target

Entry level personnel into TVET schemes.

Organizations responsible for implementation

- a. Regional office of the ILO/CATVET/CARICOM/CINTERFOR;
- b. Ministries of Education and Labour.

Priority 5

Strengthening of the research and development capability of researchers in the Caribbean.

Action

- a. Provision of scholarships for graduate work to improve R&D capability
- b. Attachment of staff members from private sector to tertiary Institutions to improve research capability with an emphasis on methodology.
- c. Collaboration between industry and research institution to address research problem to both the public and private sector.

Output

Improved capability of R&D institutions in the region to address S&T issues nationally and regionally.

Target

Graduates from UNICA institutions.

Organizations responsible for implementation

Tertiary Institutions /UNICA/CAIC.

- (b) Popularization of science and technology

Priority 1

Improvement of image of science and technology in the region.

Action

- a. To institutionalize S&T fairs and exhibitions.
- b. To create S&T museum exhibits on a National level.
- c. To establish a regional award in S&T for the informal sector.

Target

General public.

Output

- a. Increased popularization of S&T.
- b. Enhanced recognition of the importance of S&T.

Organizations responsible for implementation

- a. CCST secretariat
- b. National science and associations in conjunction with UNESCO
- c. National science associations & private sector (CAIC)

Priority 2

Increasing the S&T knowledge base of the region.

Action

- a. Public service spots on the role of S&T using the mass media;
- b. Documentary programmes on Caribbean S&T activities;
- c. Identify, develop and exploit appropriate symbols for S&T in the region.

Target

General public.

Output

Better understanding of S&T by the public.

Organizations responsible for implementation

- a. Ministries of education and communication;
- b. Private sector, NGO's;
- c. Universities and other tertiary education system.

(c) Science education

Priority 1

Integration of Science and Technology in the general curriculum - from primary education upwards.

Action

To introduce S&T concepts and approaches into the curriculum from primary school upwards.

Output

Integrated hands-on curriculum. Students with strong enough base in S&T so that s/he can come out with flexibility in career and educational options

Target

Ministries of Education.

Organizations responsible for implementation

- a. Ministries of Education; Tertiary Education Leaders; Coordinators for Science: Private Sector; Regional Educational Bodies: ACTI, CATVET, OECS, U.W.I. (This group will be further referred to as the consortium).
- b. The consortium should be responsible for the design of the evaluation and provide some input in implementation.
- c. The consortium should provide recommendations to Ministries of Education on the type of concepts and approaches of S&T that should be included into the curriculum.

Priority 2

Revision of the training curriculum to reflect a hands-on approach to S&T for primary and secondary school teachers.

Action

To put in place training programmes for the teaching of hands-on approaches in S&T for all teachers.

Target

Universities and Community Colleges, S&T and Education Faculties, and Ministries of Education.

Output

Teachers capable of transferring the development of critical thinking skills and guiding the hands-on approaches associated with S&T concepts.

Organizations responsible for implementation

- a. Ministries of Education; Tertiary and Training Institutions; Association of Caribbean Universities and Research Institutions; ACTI.
- b. Regional/sub regional committees based on the educational system (to accommodate the differences in the different educational systems existing in the region re: the U.S. SAT and the British Caribbean CXC).

Recommendation

Graduates from these training programmes should be rewarded financially.

Priority 3

Improvement and development of materials for teaching S&T in the schools in the Caribbean.

Action

- a. Produce video teaching tapes.
- b. Production of user friendly S&T software.
- c. Production and purchase of audio-visual material.
- d. Strengthening the region's capability to produce audio visual material.
- e. Establish a list of S&T resource materials in the region, distribute the list and place in appropriate repositories in the region.

Target

Primary through tertiary level education.

Output

- a. Literate school population in S&T and ultimately the larger population.
- b. Software and resource materials demonstrating S&T as it relates to the Caribbean Region.

Organizations responsible for implementation

- a. Coordination through CCST.
- b. UNICA/ACTI.
- c. UNESCO.
- d. Coordination through CCST.

**GROUP IV: TECHNOLOGY TRANSFER, ADAPTATION AND INNOVATION**Members:

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Problem Statement

Small and medium enterprises in the Caribbean do not have ready access to technological information to inform choice of technology options when entering into technology transfer arrangements. As a result there are many examples of less than appropriate choices.

A review of the situation led one consultant to state that " The Caribbean is a junkyard of abandoned plant and equipment." This lack of capability to choose has led to wastage of scarce investment capital as well as loss of life and plant where the plant chosen was so totally unacceptable that its malfunction resulted in the total destruction of the plant and individual loss of life.

In today's world where emphasis is being placed on entry into export markets in most of the countries in the Caribbean it is urgent that the level of technological choice be capable of supporting competition in the International market place.

### Definition of Technology Transfer

Technology Transfer is primarily the transfer or acquisition of the necessary knowledge and skills for production of a product or a service by the receiving organization. {it is to be noted that the purchase of plant and equipment by itself should not be considered technology transfer}

### Objectives

#### Long-term

1. To create a technology information and extension network to assist the small and medium sized firms in the region to source and acquire technology suitable to their needs.

#### Short term programmes, projects and recommendations

(a) To create a programme of awareness of the need to carefully evaluate technology choices based on guidelines and checklists working in close cooperation with private sector agencies such as manufactures associations and Chambers of commerce. This programme should include project activity utilizing the media as well as training seminars for specific audiences.

(b) In recognition of the need for awareness of the role of standardization of process, service and product in international competitiveness the creation of a project in conjunction with regional standards bureaux to increase awareness at the level of the industrialist and the staff of the organizations responsible for providing assistance. Training seminars will be mounted for specific audiences. CCST should establish links with bodies responsible for standardization in the region as soon as possible to ensure that any initiatives are complementary in view of the initiatives currently taking place in relation to compliance with International Standards such as ISO 9000.

(c) The development of a project to create a data base and Directory of individuals and firms with experience in technology transfer and negotiation services available in the region to inform would be purchasers of technology of available services. The Directory should be published and distributed for regional use.

(d) Information support for technology acquisition should be provided at the regional level, utilizing local Technology Windows as a point of contact for users. The basis for selection of such centers should draw on an assessment of the current CARSTIN Caribbean Science and Technology Information Service for technology acquisition project in order to identify appropriate choices for staffing or selecting such Windows. national focal points for such activity. Immediate linkage of the existing centers done utilizing currently available e mail systems.

#### (e) Innovation and Adaptation

Ideally technology transfer should be part of the local technology innovation and adaptation process. Case studies and Consultancies should be undertaken to identify and describe innovations with wider application which have occurred in small firms in the region. Chambers of Commerce and Manufactures associations should be encouraged to participate in such activity as well as in the provision of Awards for Innovation and sponsorship of Innovation Competitions.

Recommendation - Individual countries should review and assess their mechanical workshop capability to support technology transfer and capital goods creation. The assessment should recognize strengths and weaknesses in manpower and infrastructure.

### Medium Term

1. Information exchange between regional centers for technology information should be improved and integrated with provision of information support services for National Windows. This network should seek to collect information on regional innovations and disseminate same.

2. The creation of a regional technology extension service building on the existing regional and international technology information services and the regional technology consultancy service by creating " One Stop Windows" at the national level in order to provide the technology purchaser with the best available information and technical advice to choose and negotiate purchase. The provision of training in technology sourcing and technology negotiation for staff of these centers as well as interested private sector organizations and individual investors will be organized as part of the programme of activities.

## **GROUP 5:SECTORAL COLLABORATION**

### Members:

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### Problem

The need for sectoral collaboration arises from an apparent inefficient use of available national and regional resources in advancing national and regional goals. Overall national programmes are not often fully integrated, vertical and horizontally, at the operation levels. As a consequence there is a tendency towards over capitalization in terms of facilities and equipment, inefficient utilization of personnel and materials and often the inappropriate use of available skills. Many of the associated manifestations may have arisen as a result of:

1. Poor definition of problems/issues at some operational level;
2. Inexperience of sectoral and divisional heads coupled with inadequate familiarity with national plans, goals objectives and national capabilities;

3. **Personality conflicts: the human factor and often territorial imperatives that stem from insecurity and or ignorance and arrogance; and or over zealousness.**
4. **Cultural ethic which may be related to a static educational system and principles that failed to evolve rapidly enough to meet the changing development environment; and**
5. **Inadequate involvement of relevant actors at appropriate stages in the planning process.**

These appear to be rooted in deficiencies in the systems that provide national and regional planners and managers and succession plans that ensure continuity of effort and familiarity with the total development process.

It may be concluded that a paucity of management skills and of integrated planning skills have resulted in isolated sectoral plans.

### Goals

To maximize use of available national and regional sectoral capacity and capability for national and regional development.

### Objectives

1. **To enhance collaboration among and between various sectors at the national and regional levels;**
2. **To enhance management and planning skills and efficiency of national planners and sectoral managers.**

### Strategies and issues

1. **Issue: Changing attitudes and perceptions of senior administrative staff, managers and planners to holistic national development and resource management.**  
**Strategy: Conducting frequent awareness, sensitization workshops/seminars aimed at exposing, analyzing issues (positive and negative), basic and refined methodologies of collaborative planning programmes (CCST).**
2. **Issue: Providing or developing adequate information-flow systems among and between sector (vertical and horizontal).**  
**Strategy: Developing and maintaining relevant information systems and training in the organization, use and management of information systems. Accessing and dissemination of relevant information will facilitate collaboration and better utilization of national resources. A multi-sectorial network becomes an efficient tool in managing information.**

3. **Issue:** Insecurity of managers: Creating a cadre of confident, competent managers will promote a higher level of sectoral collaboration. It is perceived that an integral part of management of sectors are on a one manager rather than on a team basis. Such techniques create a fragmented approach to management with the total strategy resting only with the manager and second level support exposed only to smaller section of the strategy.
- Strategy:** Create a cadre or team of managers fully knowledgeable of the whole sectoral strategy and operations. This would shatter the misconceptions of indispensability cocoons and encourage a team approach to management.

### Outputs

- (a) A cadre of well trained, confident and competent managers and planners reoriented to maximizing use of national resources in all sectors developed;
  - (b) An improved organization, utilization and management of relevant information system established;
  - (c) Induced changes in development perspectives achieved through revamping and upgrading education concepts and philosophic;
  - (d) National and regional planners capable of developing multi-sectoral programmes;
5. Interdepartmental, interagency, multi-sectoral collaboration fostered.

**THE LAST POSITION  
BY  
SERGIO W. CALDERON C., (INDOTEC)**

### Introduction

In the beginning of the "Seminar to Develop a Plan of Action of Science and Technology for the Caribbean", we listened to presentations about the importance of making a difference between "A Plan of Action" and "A Plan for Action". From this we thought that the main aspects to be taken into account would be those related with productive actions instead of the known speech, the beautiful speech of Science and Technology philosophy. The expressions, the phrases, and the different positions have been very interesting and therefore will be enough to create an additional document. I am sure of this, but I am not so sure if it will be able to take us to action. I, in the representation of INDOTEC, will underline some ideas which, if you find that can be part of the conclusions of this seminar, may be included in the last report and if you don't consider it so, they can be discarded. Anyway, the intention is not to simply add a few words to this discussion, but to present a few points of reference for future debates.

I define the following points which I suppose must be taken into account at some future date in the preparation of a plan for real action:

- (a) Define clearly the difference between a plan of action from a plan for action because this will determine the amount of time spent in philosophical aspects or in defining real projects for development.
- (b) The need to incorporate the people who work with technology with the people who speak of technology, and the people who work with science and make science with the people who speak about it.
- (c) The need to listen to the voices of the people who work with Science and Technology and make Science and Technology to prepare plans for action.
- (d) The definition of the needs related to defined and real projects in order to avoid the possibility of repeating the same words in every event. For example what human resources for what projects.
- (e) The need to include real Scientists and Technicians in the high level of management of science and technology in the place of or sharing positions with the people who have nothing to do with this but have experience in management activities.
- (f) The need to speak not only of environmental cleaning, but also of recycling of wastes to produce useful products which could be used as animal and human feedstock, as chemicals and pharmaceuticals and as fuels.
- (g) The need to prepare specialized technical and scientific magazines, directories and catalogues which reflect in a continuous way what's happening in our countries, and more important our capability of solving problems in the different areas.
- (h) The need to develop motivation programmes to enable lay people to contribute their unique experiences to Science and Technology and Research and Development.
- (i) The need to speak about patents and standards instead of technical information only as a general concept.
- (j) The need to identify and use the people in our countries who know about Science and Technology, but who are not being used in this capacity nor in any other.

#### Proposed Regional Projects in Science and Technology

Taking into account that this is the first time that INDOTEC has taken part in an event like this for the Caribbean region, it is clear that we do not know the specific actions that take place in your different countries, though, I suggest:

1. A Project to create a database about the Research and Development projects in progress in the region, which first step should be the preparation of a Research and Development in progress directory with data provided by the Research and Development Centers and Universities of the region.
2. The preparation of specialised Scientific and Technological magazines for the region which allows the dissemination of technical and scientific productions in the different countries of the region and to the world if needed.

3. The creation of an "Ideas buying, capturing and analysing Centre" able to take and to convert into actions the projects proposed in universities, on the newspapers, on the Television and so on.

4. The preparation of a Directory of Technical and Scientific thesis prepared in the different universities in the region with abstracts from each of them to analyse their contents and define which of them can be turned into practical actions.

5. A project to identify the human resources and equipment for Science and Technology and Research and Development in the region from which it might be possible to define real needs in human and physical resources.

#### Research and Development Projects Proposed

With the same observations presented before, we suggest:

1. A project to recycle industrial and municipal wastes to produce fuels, chemicals, food for animals and human beings, examples:

(a) The use of bananas pseudostomas to produce chemicals, feedstuff and food for humans and textile fibres.

(b) The use of animal blood in the production of proteins, chemicals, pharmaceuticals and food for animals and human.

(c) The use of scrap automobile tyres to produce fuels and chemicals.

(d) Identify and study similar projects.

2. A project to identify the main projects developed in the regions on Science and Technology and Research and Development which can be of interest in the Caribbean and the ways to obtain this technology. This project could be focused on:

(a) Use of solar energy for rural communities.

(b) Processing of fruits and vegetables.

(c) Mixed and single Aquaculture.

(d) The production of non-traditional foods.

(e) Health projects.

(f) Others.

3. Projects in which INDOTEC is working and can offer cooperative actions.

- (a) Identification of Ciguatoxins.
- (b) Identification of Vibrio Cholera virus.
- (c) Mixed culture of shrimps and scallops.
- (d) Projects on solar energy for rural communities.
- (e) Tropical Mushroom culture.
- (f) Medical plants for the formulation of high cost medicines.
- (g) Offering "INDOTECNICA", our Technical and Scientific magazine, for you to publish any scientific production until you have one for the region.
- (h) To assist in the production of thesis directories and Research and Development in progress directories if needed.

Conclusion

In this print out we want to make it clear that the objective of our proposal or presentation is to present a contribution to this event responding in this way to the kindness you had in inviting us to this session.

**Speech by the Honourable Michael Pilgrim, Minister in the Office of the Prime Minister  
at the Opening Ceremony of the Regional Workshop/Seminar to Develop a Plan of Action  
for Science and Technology for the Caribbean.**

**8-12 September 1992**

I am pleased to welcome you, particularly our overseas guests to this workshop. Let me immediately congratulate the Caribbean Council for Science and Technology (CCST), the United Nations Educational Scientific and Cultural Organisation (UNESCO) and the Caribbean Community (CARICOM) for the vision reflected in organising a gathering such as this. Your meeting is of particular significance to the Caribbean at this time because of the sweeping changes engulfing our world today. The collapse of Communism and the creation of mega trading blocks are some of the obvious changes with which small developing nations must come to grips. There is, however, a more subtle and unobtrusive global revolution taking place which, if not addressed will threaten to erode the meager gains we have made and destroy the very fabric of our societies.

The days when economic prosperity was a function of the control exercised over natural resources now engage the attention of historians and the machine revolution which served the world's richer nations well in not a departing era. But these changes are not creating any voids in the economic prosperity of nations. On the contrary, they are being displaced by human intellectual capabilities to converge the forces of Science, Technology, Management, Organization and Production to the satisfaction of human needs. It is these forces, rooted in knowledge and entrepreneurship, that are emerging as the basis for economic prosperity in today's world. In this context, the lessons of the ASEAN countries are clear:

The comparative economic advantage of nations is becoming less dependent on naturally provided factor endowments and more dependent on the quality and richness of human intellectual resources. These are expressed through capabilities in Science, Technology, Organization, Management and the will and capability to harness the creativity and the energies of all classes and sectors of society to achieve excellence in meeting national objectives. To remain, or in the case of the Caribbean, to become competitive each state, however small, must therefore find a niche in which its own peculiar comparative advantages can best be exploited to national advantage.

But this must be done in a world in which change is the only constant. The rapid development of new technologies, as in Informatics, Biotechnology and materials Science to name a few, is characterized by high research intensity, rapid changes in products and processes, the marginalisation of cheap labour as a factor

advantage and the increased privatisation of knowledge. Small states like ours are individually unable to keep pace with the changes taking place and are therefore unable to use them to advantage. But they cannot be ignored, for to do so would be to court peril! We must therefore find ways to collectively harness the forces of these changes.

The debate therefore is not whether Science and Technology are investments in the future prosperity of our region. Rather, it is about how we can use Science and Technology to satisfy the hopes and aspirations of our people.

Theoretically the Scientific and Technological revolution sweeping the world presents an enormous opportunity for the betterment of the lives of all mankind and the preservation of our environment. However, we live in reality. And the reality of the situation is that nations with strong Science and Technology traditions, strong infrastructure and rich human resource endowments are engaged in a fierce and intensifying struggle to gain supremacy in Research and Development, product superiority, market share and economic and political dominance. The reality is also that we in the Caribbean, with weak Science and Technology traditions, weak infrastructure and poor human resource endowments must compete with those better endowed nations.

Where do we go from here? Do we throw our hands up in despair and let the chips fall where they may? If we do, history will be unkind to us, as will future generations. I do not profess to know the answers. What I do know, however, is that we in the Caribbean must, as a matter of urgency, make better use of the vast opportunities presented to us by Science and Technology if we are to meet the economic, social, political and cultural expectations of our increasingly enlightened peoples.

In this task, the Caribbean Council for Science and Technology is well placed to play a leading role. After all, the Council was created to promote Scientific and Technological development in the region. It has within its membership the collective experiences of the majority of our nations and, as is evident today, can reach beyond our regional borders to draw on the experiences of others.

This must be its central role to draw on the experiences of the global community to create a Science and Technology identity unique to the Caribbean in the same way that the region has drawn upon global experiences to create our unique Caribbean identity. I therefore call on the leaders of the region to provide the support necessary for the Council to carry out its mandate.

I have already mentioned some of the difficulties countries like ours face in our attempts to take advantage of the opportunities presented to us by the Scientific and Technological changes around us. There are others, and it is for you to identify and elaborate on them. This, in fact, should be your first step, for as Scientists you are aware that no problem can be solved until and unless it is well defined and clearly isolated. As Scientists, you also know the other steps in the problem solving cycle. As a non-scientist, what I know is that the solutions

we seek will require a departure from current and conventional approaches and will challenge your individual and collective imagination, ingenuity and perceptions to find new ways to focus our meager resources to meet our growing expectations in this increasingly competitive world. This is a daunting task. But you have accepted an invitation to participate as a workshop To Develop a Plan of Action. From this I understand that you have accepted the challenge, and I have no doubt that you are equal to it. Let me remind you however, that a Plan of Action must also be a plan for action and must, of necessity, be based in reality. Therefore, the plan you develop, must use the realities of the Caribbean, its human and natural endowments, its infrastructure and its institutions as the basis for future endeavours.

In short, do not tell us that we could build a bridge to cross our river, but the engineers are not available. Rather, tell us how to cross our river given the resources to which we have access.

In closing let me remind you that over the next five days you have the opportunity to recommend courses of action which can change the way our people exploit the opportunities presented to them by the current Scientific and Technological revolution. In doing so however, you must never lose sight of the fact that if the environment should fall casualty to development, then so will the birth-rights of generations yet unborn.

I wish you success in the task ahead and hope that you will find the time to enjoy the beauty of our island and the hospitality of our people.

Thank you.



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