GENERAL
LC/CAR/G.696
28 June 2002
ORIGINAL: ENGLISH

THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY INDICATORS IN THE CARIBBEAN

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Introduction

Developed countries have for a long time collected statistics on science and technology (S&T) activities and their contribution to development and have also focused on how interpretation of these statistics could inform policy. In addition, these indicators, as they are called, have been used to determine and compare the relative positions of the various countries in the global economy. For such comparisons to be meaningful, however, it was necessary to standardize the units and methodologies. That process led to the development and adoption of a number of manuals, namely, Frascati, Oslo and Canberra, for use in the collection and analysis of S&T indicators and these have since been adapted as standard texts. The developing countries of Latin America, conscious of the usefulness of these indicators, have been collaborating with some developed countries in the use and interpretation of these manuals. These manuals are largely oriented towards developed countries. They can, however, provide useful guides for smaller economies, but they have limited value in a meaningful analysis of very small economies.

Over the years, the small Caribbean States have been collecting data on economic statistics, in keeping with their tradition of accountability. However, these data have not been sufficiently disaggregated or analyzed on a sectoral basis in order to inform policy. With respect to science and technology, data collection and the interpretation of the data have not been done in a systematic manner, since S&T activities in these countries are considered to be nominal, and the importance of S&T to the development process is not properly understood and appreciated.

Since 1997, however, following discussions on science and technology and its role in development and the adoption of the Programme of Action for the sustainable development of Small Island Developing States (SIDS POA) in 1994, Caribbean countries have begun to appreciate the need to collect meaningful data on science and technology. The need to dissaggregate the data on science and technology from the rest of the trade statistics that are usually collected, to show the role of S&T in development strategies, has also been recognised. This need for data and analysis follows also from the concern for sustainable development and the critical role of science and technology in that process, which involves the integration of social, economic and environmental components of action. A programme for the determination of sustainable development indicators was launched in the region, with S&T indicators identified as a subset of this programme.

In addition to the foregoing, there are other compelling reasons for collecting and analyzing science and technology data. Given the pervasive nature of science and technology and its impact on all facets of society, it is necessary that the scientific and technological needs of the various public and private sectors be properly addressed in order to achieve maximum benefits and efficiency of inputs. Moreover, the need to inform policy implies a need for sound and

relevant data in societies that are increasingly calling into question decisions made and the needs of the public and private sectors. Lastly, a harmonization of methodologies and comparisons with other countries could be valid only if valuable data sets are used. These elements can be achieved only by careful planning, for which data and analytical inputs are indispensable.

The measurement of indicators of science and technology that could inform policy decisions and measure or promote innovation is relatively new in the English-speaking Caribbean. Although some S&T data collection programmes exist in Jamaica, Trinidad and Tobago and, to a lesser extent, Barbados and Guyana, the other countries have not yet developed a systematic approach to the collection of the data on S&T. Facing growing competition in a globalized market, issues such as innovation and competitiveness, too, recently have become discussion topics in the region. Approaches to these issues are still not fully defined and the need for a systematic approach to decision-making to address these problems is urgent. However, any policy decision ought to be based on sound and reliable data that will permit verification and analysis of choices and programmes.

Early Caribbean economy and the place of science and technology

Why is S&T in general, and the impact of S&T in the development process not recognised in a region that is noted for agricultural production? Historically, the region has been a source of primary products for a protected market in Europe. As such, the "the plantation economy", as the production patterns have been described by a number of Caribbean writers, has not promoted technological development whether indigenously or through technology transfer mechanisms. Thus, from the production of sugar cane in the 1700s, to the production of coffee and bananas at present, there has been very little value-added or transformation of products. Research and development work in product development was undertaken primarily in the metropole and, where some research was done in the region, it was centered on cultivation of the crops rather than on value-added dimension.

Lloyd Best, a noted Caribbean political economist, explains this phenomena. He made the following points in 1965, about the Caribbean economy: "*The technological path followed by the economies is an imitative one. Indeed, the typical enterprise being a metropolitan subsidiary, affiliate or branch plant, the techniques of production are actually programmed abroad. Imitative technology and branch plant organization also provide the second reason for not controlling incomes. The pattern of supply and the character of the goods available are, in an important sense, beyond local regulation. Therefore, for the programme of "industrialization by invitation" to proceed at all, not only has there to be demand, but taste has first to be shaped by the importation of commodities from the source of the technology."*

On data and statistics he noted that *"In the West Indies for example, we have elegant national accounts and on one assessment, some of the best statistical services on this side of the Atlantic. But we cannot easily find estimates of the effective price of sugar though so much of the politics turns on it".*

Development planning was not the concern of local authorities when they were colonies of the United Kingdom. This was the case even with the various facets of devolution that took place between 1950 and 1960. The development model pursued in the region that came to be known as "industrialization by invitation" taken from the work of Sir Arthur Lewis in his book *"Industrialization in the British West Indies"* emphasized that the way to develop a manufacturing sector in a small country was to attract metropolitan business which brought not only capital, but also technology, organization and market connections. This model did not foster or nurture indigenous technological growth.

By the time of the adoption of United Nations Vienna Programme for Science and Technology for Development in 1979, six of the 12 English-speaking Caribbean countries had attained political independence. The Programme created and promoted the awareness, especially in developing countries, of the role of S&T in the development process and highlighted the need for increased spending at the national levels in order to put systems and institutions of research and development in place for the productive sectors. The Programme also set a minimal target of 5% of Gross Domestic Product (GDP) to be directed to science and technology. The Caribbean countries, strapped for finances, never achieved that benchmark, especially when there was much to do in putting administrative structures in place to govern the newly independent States. In addition, the Programme proposed increased avenues for technology transfer in the expectation that such transfers would assist the developing countries in building capacity in research and development. Experience has shown that, in order to benefit from technology transfer, the receiving State must have some minimal indigenous technological capacity. The lack of this prerequisite has been mainly responsible for the poor results in technology transfer efforts, regionally.

Immediate post-Independence scenario

The preoccupation with governance; a limited resource base; the lack of financing and mono-crop practices for protected markets all combined to further frustrate the development of a strong technological culture in the region. Thus, in the absence of analysis, the line of least resistance was taken by the governments after independence and business continued as usual with the protected market arrangements. The primary interest was to produce raw materials for the overseas market and industries, with even the marketing arrangements out of the control of the local government or local elite. With such arrangements the only data sets perceived to be necessary were trade data and statistics for revenue projection purposes.

The establishment of a Caribbean Free Trade Association (CARIFTA) in 1968, later to become the Caribbean Community (CARICOM) in 1973, coupled with the transformation of the University College of the West Indies to a full-fledged independent university and the establishment of the University of Guyana provided the major avenues and forums for discussion on the production patterns and trading regimes in the region. At the same time, increases in the prices of such commodities as bauxite and eventually hydrocarbons provided the impetus to the two larger Caribbean producers of these respective commodities to critically examine marketing arrangements and to begin to recognize the benefits of added value through technology applications and processing. Thus, in 1960 Jamaica established the Scientific Research Council (SRC). Trinidad and Tobago established the National Scientific Advisory Council in 1968 to be

followed by the National Institute for Higher Education, Research, Science and Technology (NIHERST) and the Caribbean Industrial Research Institute (CARIRI). Guyana established the National Science Research Council (NSRC) in 1975 followed by the Institute for Applied Science and Technology (IAST). These institutions were mandated to undertake research and development work for industrial development at the national level.

While certain critical elements such as the collection of data, analysis of trends and priority setting were included in the mandates of these institutions, they were not the primary areas of focus, so that work programmes were developed without serious critical and scientific approach to resource allocation and returns. Instead, projects that could show immediate results were favoured over data collection in an effort to continuously justify the existence of these institutions. Further, these institutions developed within a policy vacuum. There were no long-term national development plans in which the technological requirements were clearly enunciated. There was also the lack of a regional science and technology policy to guide research in the region, given the relative small size of these States and the obvious benefits to be derived from cooperation and the pooling of resources as agreed under the CARICOM Treaty. A science and technology policy was not developed for Jamaica until 1987 and for Trinidad and Tobago in 1997. Grenada had an active science and technology council during 1979-1983 but the collection of data or development of indicators was not part of its mandate. The Council also lacked financing on sustained basis and at a level sufficient to carry out its mandate.

Continued agitation by such agencies as the United Nations Conference on Trade and Development (UNCTAD) increased the awareness of the need to invest in science and technology. However, with the private sector predominantly foreign owned and operating as branch plants, the task of convincing the political directorate to provide funding through the public sector for science and technology was never successful. Ministers of Finance would argue that funding was already being provided through such ministries as agriculture, communications and works and education. However, such funding was primarily for salaries and administrative costs of these ministries and not for research and development. The call for research and development and investment in science and technology was also taken up by academia. However, because of their strong emphasis on teaching, the universities established were not seen as making a significant contribution to the solution of problems of the State, by the political directorate. Regional and international agencies also agitated for science and technology and research and development policies and held a number of seminars on the topics of science and technology and research and development. These seminars focused on the writing of a policy rather than on the justification of the policy since there were no indicators available to support the kind of analysis necessary to make the case for a change in direction.

As a result of increased agitation, Caribbean governments established the Caribbean Council for Science and Technology (CCST) in 1981. One of the first activities of the CCST was to produce a regional science and technology policy. Although the Council was established by governments, the driving force for its establishment was not the governments, but regional bureaucrats in international organizations. The exercise was therefore not driven by the political directorate's recognition of the need for such a policy. A policy document was produced, but never circulated and discussed for possible implementation. The cause was also not helped by

the multiplicity of institutions, both regional and international, operating in the subregion, each calling for separate policies for their areas of activity.

Faced with falling commodity prices and increased competition by the late 1980s, the political directorate began to be interested in the idea of the development of a regional policy for science and technology, mindful of limited national resources as well as limited influence at a global level. The policy document that was produced in 1981 was revived and presented at ministerial level for consideration. In 1987, the policy document was adopted by the Conference of Heads of Government of CARICOM. The policy outlined the various areas in which research programmes and projects could be undertaken. However, it was fundamentally flawed since it did not attempt to establish the bases for these proposed actions from sound scientific data. It also did not begin by promoting systematic studies in the sector. Such studies would have pointed to the need for data and indicators to be collected for proper analysis and evaluation. Justification of the policy, rather, was based more on instinctive propositions. Another fundamental problem related to responsibility for implementation, especially in a situation of a dearth of national institutions and the absence of a regional funding mechanism. The document, as justification for the policy, in its introduction made note of this issue. Attempts were made to compare the situation that existed in the Caribbean with that of Singapore, noting that in the 1960s, Singapore and Jamaica were almost level in terms of economic activity. However, by the 1980s, Singapore had made a quantum leap forward while Jamaica experienced a period of economic decline. The document, however, failed to analyze how Singapore attained its level of economic development and the steps or programmes that were implemented to maintain the momentum.

Systems of data and statistics

Notwithstanding the above, data and statistics were available for the region. As noted by Best, Caribbean countries had been collecting data on trade, demography and finance, primarily through statistical divisions of ministries of trade or planning. Given their limited resources, the data were not always timely or sufficiently uniform to facilitate comparison. However, in recognition of these problems, a number of seminars and workshops were held, especially through the work of the Economic Commission for Latin America and the Caribbean (ECLAC) Subregional Headquarters of for the Caribbean, to help strengthen the statistical databases and human resource development in this area. One such meeting, on Statistics and the New Technologies, was held in 1989. The main stated objective of the colloquium was to develop a system of shared databases to increase the usefulness of statistics to the planning apparatus and the streamlining of statistical activity within national boundaries to contribute to the development of a national data set of greater reliability. However, with only a few short presentations on the role of statistics, the seminar focused more on the use of the new technologies rather than on the analysis of data and its effectiveness in the planning process utilizing the new technologies.

The present scenario

With the approach of the 1990s, there was increased liberalization of trade and competition, but with no realistic mechanism established to deal with the science and technology agenda for development. When, therefore, scientific and technological requirements related to

product testing, quality control, labels and packaging were mandated by the various international bodies, Caribbean States were not equipped to deal with the increasing pressures of a globalized market. Very little had changed since the 1960s. With the exception of Trinidad and Tobago, with its oil-based industries, and Jamaica, with bauxite and agro-processing, manufacturing and industrial output were at very low levels. Activities in the garment, alcohol (rum, beer) and furniture industries were among the major productive sectors in the region. The tourism industry was also beginning to surpass the agricultural sector as the major earner of foreign exchange in these countries.

The small size and limited resource base of these countries did not allow them many options for development. Therefore, once an activity was successful and generated income, as fresh bananas had done for the Eastern Caribbean countries over the last 25-30 years, there began to develop, a level of complacency and satisfaction that prevented taking risks. Yet, it was precisely because of the existence of limited options that very small countries must properly develop their economies, in order to achieve sustainability. Using the banana industry as an example, no effort was made to diversify within the industry, to promote agro-industrial development using the primary product as raw material as is done in Costa Rica or the Philippines. It should be noted that the development of new products for export requires substantial investment in plant and equipment that would be beyond the reach of small producers. However, the more likely problem is the lack of information to market access conditions and to make predictions. The indicators on which the relevant studies would be based are unavailable.

The SIDS POA, adopted in 1994, called for the provision by the international community of assistance to help those States overcome their sustainable developmental problems. Since the twenty-second Special Session of the United Nations General Assembly in 1999, the implementation of the Programme of Action addressed all the sectoral issues from trade and other economic and social issues to the environment and agreed on the steps to be taken at the national, regional and international levels to promote sustainable development. However, much of the work leading to the adoption of the Programme of Action was descriptive rather than analytical and the document is silent on the need for data and indicators for policy choice, for measurement and for evaluation. The implementation of the SIDS/POA remains problematic because of limited financing and the lack of a proper implementation strategy based on sound analysis of capacity.

Issues of innovation and competitiveness

What then have been the efforts to correct these problems given the acceptance by the countries of the need to be innovative, to compete and to develop policies that are sound and sustainable? Early efforts at dealing with competitiveness have been reflected in the provision of incentives such a tax free concessions and other fiscal policies. While these are necessary, they need to be complemented with innovations at the plant or industry level. Education and training must also be tailored to meet the skills and manpower needs of any innovation and competitiveness programme. This holistic approach to an innovation and competitiveness programme remains elusive. A survey conducted in Jamaica in 1990 concluded that "*critical shortages of specially trained personnel, equipment and funds; need for coordination:*

organizational and institutional defects; lack of adequate engineering resources, consultancy and money; no effective and coordinated mechanisms to stimulate, encourage and support creativity and innovativeness have led to the continued dependence on imported technology and low local innovative capacity". In the list of recommendations proposed by the writers to correct these problems, no mention was made of the need for indicators or proper analysis and use of existing indicators. A similar paper was written in 1997 at the University of the West Indies, St. Augustine, Trinidad campus as part of a report to the Campus Council. The focus also was on research, without emphasis on proper analytical procedures for the determination of the research agenda. The arguments put forward were based more on perceptions rather than on analytical findings. It would seem, therefore, that the need for indicators to strengthen these arguments and proposals and to convince policy makers and the decision makers in the private sector seems not to be appreciated even by the academic elite.

The first effort at the design of a more comprehensive innovation programme was taken by CARICOM in 1996 with the development of a two-year project entitled "Regional Enterprise Competitiveness Programme" funded under the Lomé Financial Protocol. Like the first science and technology policy document, the project was not analytical in approach but descriptive and lacked targets and evaluation methods as well as an integrated funding mechanism. In addition, as a regional initiative, its success depended on national institutions and efforts that are still relatively weak.

The apparent imminent demise of the banana industry and the decreasing demand for traditional primary products prompted the Caribbean governments to re-examine a position and proposal put forward by the CCST with respect to the promotion of ancillary industries around the banana crop. This position was presented at a meeting of Heads of Government of the Organization of Eastern Caribbean States (OECS) in Dominica in 1997. The proposal called for the establishment of incubators at the national level. The incubators would be used to train young entrepreneurs in all aspects of industrial development. The establishment of an industrial extension service, similar to the agricultural extension service, to promote small- and medium-sized enterprises, especially in the rural areas where banana is grown, was also recommended.

The regional science and technology indicators programme

The foregoing is intended to serve as a summary of the relevant issues to provide the basis for an understanding of the scenario within which a programme for the measurement of science and technology in the Caribbean should operate and the genesis of the problems associated with its introduction. The background suggests that historically, and to some extent at the present time, policy decisions regarding development does not originate from the local elite. The weak or non-existent private sector and a public sector that depends on grants-in-aid for development funds used primarily for administrative structures and recurrent expenditure continue to be features of Caribbean economies.

In the quest for factors that lead to the sustainable development of the subregion, it was eventually determined that the absence of reliable data on production technologies, types and levels of industries operating in the countries and the information bases of these industries were seen as major hurdles in providing assistance to the small- and medium-sized enterprises. The

development of this sector was beginning to become an important part of the future development of the region. The work of the Red Iberoamericana de Indicadores de Ciencia y Tecnologia (RICYT), the agency responsible for collection and analysis of S&T indicators in Latin America, was becoming available to the region and it showed gaps in the information base for the Caribbean. Exploratory talks were held to determine how the Caribbean countries could be incorporated into the programme. This led to a first meeting in 1997 in Trinidad and Tobago where the indicators programme was introduced to members of the CCST national focal points by Adam Holbrook of Simon Frazer University, Canada, and Edson Kondo of RICYT, Brazil. Immediately following the meeting, Trinidad and Tobago and Jamaica, the larger economies of the subregion, embarked upon programmes to collect indicators to inform their efforts at writing national science and technology policy papers and programmes.

In 1998 another meeting was held to determine the status and needs of Caribbean countries in developing both national and regional S&T indicators programmes. On learning of the progress of Jamaica and Trinidad and Tobago, members of the CCST expressed a willingness to undertake the collection of indicators, but recognized the need for additional assistance in the development, use and evaluation of these indicators. With assistance from RICYT, a third meeting was held in Jamaica at which some simple indicators were developed in an attempt to identify those considered to be most relevant to small States. At this meeting the Frascati, Oslo, and Canberra manuals on S&T indicators were examined and discussed. It was agreed that these manuals were of little assistance given the scope of activities measured by them, which were considered beyond the scope of activity of Caribbean countries. The Frascati manual's focus is on measuring the amount of research and experimental development undertaken in a country, while the Oslo manual's focus is on technology and the balance of payments. Together, the manuals record data or indicators on innovation, including patents, which are not especially relevant to small Caribbean countries. Some of the indicators measured in the manuals were:

- Numbers and distribution of enterprises
- Government spending on science and technology
- Amount of small technology-based enterprises
- Numbers of persons trained in various disciplines
- Employment levels
- Quality of life.

However, in order to ensure uniformity of the data for comparison to other States, a small working group was established to develop a systematic set of indicators that would be useful to any small State while, at the same time, be uniform enough for comparison. The purpose of these indicators, it was agreed, would be:

- To support formulation of S&T policy, in support of economic and social objectives including analysis of the national system of innovation.
- To provide advice to ministers and other officials.
- To provide support for and justification of S&T programme expenditures.
- To provide information on scientific activities for the public and private sectors.

As a first step, these basic indicators would provide information on the state of S&T in the countries and in the subregion as a whole. Given the relatively weak resource base, it was agreed also that emphasis be placed, at least in the initial stage of the programme, on human resource indicators. This meant examining changes in the levels of human and financial resources devoted to science and technology as inputs and the change in the level of national development, as the desired output. The attached annex is taken from the report of the Working Group and shows the set of indicators developed and the justifications for them. The traditional economic data have been included to ensure that the science and technology indicators are not measured in a vacuum and that the ultimate goal is the improvement of the quality of life of the citizenry.

The status of science and technology indicators in the Caribbean

At present (2002), six countries are at various stages in the data collection and analysis exercise. These are the Bahamas, Barbados, Guyana, Jamaica, Saint Lucia and Trinidad and Tobago. Of these, the exercise is at its most advanced stage in Trinidad and Tobago, where NIHERST is responsible for the publication of six documents[1]. Barbados has published one document with the data set, while Belize, Guyana, Jamaica and Saint Lucia are at various stages in data collection.

In the case of Trinidad and Tobago, the data have been analysed and policy decisions taken based on the findings. For example, the findings for the survey on G.C.E. Advanced Level results in mathematics and science subjects for the years 1997 and 2000 have resulted in specific and additional training provided to mathematics and science teachers. The training has been aimed at improving the ability of teachers to help students excel in these subjects and to keep abreast of modern trends in these subjects. In addition, in deriving a S&T policy document for Trinidad and Tobago (1996), it was recognised that there were not enough data to implement the recommendations and form a plan of action. As with previous S&T policy documents, there was insufficient data to inform policy. With the baseline data now available, while not exhaustive, it is now possible to address specific sections of the policy document to develop the necessary action plans to correct deficiencies or to stimulate dynamism where necessary.

From the start of the programme on the development of S&T indicators for the Caribbean subregion, a decision was taken to focus on human resources in science and technology and on S&T activities, rather than on research and development. The validity of the decision is being

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[1] Cambridge G.C.E. A'Level Results in Mathematics and Science 1997 & 2000 – A comparative review: NIHERST, February 2001
Human Resources in Science and Technology in the Public Sector. NIHERST 2002
Report on Survey of Science and Technology Indicators 1999. NIHERST 2000
Science and Technology Indicators 1992-1997. NIHERST 1999
Innovation and Science and Technology Establishments 2000. NIHERST 2001
Utilisation of Information Technology by Households, 2001. NIHERST 2002
Report on Survey of Science and Technology Indicators 1999. NIHERST 2000
Cambridge G.C.E. A'level results in Mathematics and Science 1997 & 2000 – A Comparative Review. NIHERST 2001.
Human Resources in Science and Technology in the Public Sector 2001. NIHERST 2002

borne out by the responses to the survey questionnaire used by NIHERST. It had long been suspected that very little research and development was undertaken in the subregion and this was confirmed by the responses to the questionnaire. However, it is also recognised that a large percent of expenditure in S&T activities in the subregion is incurred in human resource development. This, therefore, needed to be properly identified and analysed.

The Caribbean S&T programme is at the primary stage of development, but it is expected that as more data is collected both at the national and regional levels, comparisons can be made among countries and also between the Caribbean and Latin America. This will allow for the correction of any deficiencies, the stimulation of quality assurance and entrepreneurship in production and process development. These activities will, in turn, translate into more effective use of financial resources and increased use of science and technology in the development paradigm, which has been proven to be the catalyst for growth in successful economies. It is expected that the other countries will complete the surveys and begin analysis of data collected very shortly. In the meantime, efforts are being made to encourage more countries in the Caribbean to undertake the survey and to participate in this very important indicators programme.

Annex

A Pilot project

A first task will be to try to collect these indicators from five countries in the region as a pilot project to determine the level of difficulty in obtaining the information. The results of this exercise will be presented at a regional meeting to be held in November-December 2000 where the wider region will be exposed to the programme and a commitment given by all States to collect the data. It is hoped that these indicators will help to complete the RICYT database. Following that task, seminars would be held on the analysis of these results and the determination of methodologies for the presentation of these indicators to the public and private sectors to inform policy, to promote innovation and competitiveness and promote a culture of S&T in the region. The programme will be coordinated by the regional institution, the Caribbean Council for Science and Technology (CCST).

Format and Questionnaire for the project

National S&T performance data

National S&T performance data is keyed to the identification of S&T activities, as defined by S&T-related occupations, and the activities, whether S&T or not, of individuals trained in S&T-related fields of study. It was felt that the national responses should include both an S&T policy statement, as well as specific quantitative measures of performance.

The proposed common Caribbean S&T questionnaire is based on the collection of data from all projects, institutions, establishments, etc. which employ S&T professionals. If a program has S&T professionals working in it (as defined in the OECD Canberra manual) then it is included in the survey.

HRST, as defined by the Canberra manual includes individuals trained in both the natural and social sciences, and individuals working in occupations that are contained within the definitions of natural and social sciences. The test as which should be included and which should be excluded is whether the particular field of study or occupation falls within the mandate of a nation's S&T policy or programme. If there is any doubt, then the test is whether the field of study or occupation would contribute to the development of a new product or process within the establishment in question. Some draft definitions are attached.

Economic and Social Data Relevant to S&T activities

1. Population
2. Labour force
3. % of population with post-secondary education
4. GDP (US$)
5. GDP/capita (US$, ppp)
6. Exports as % of GDP
7. Imports as % of GDP

8. Foreign Direct Investment
9. KwH/capita
10. Telephone lines per 1000 population
11. Internet hosts/ 1000 population
12. Computers/ 1000 population

An excellent source for national economic and social data are the figures published by the UNDP in the annual Human Development Report.

Specific CCST S&T indicators

13. Public sector personnel performing S&T (including R&D) as a percent of total public sector employment - Public sector as defined in the Frascati Manual; use either full-time equivalents or total employed for both HRST and all employees.
14. Public sector S&T expenditures (including R&D) as a percent of government budgetary allocations – Government budgetary allocations are the forecast current and capital expenditures, including funds from international development agencies, but excluding debt repayments.
15. HRST workers as a percent of employed labour force – Employed labour force is all individuals active in the formal economy.
16. HRST-trained workers as a percent of total labour force – Total labour force is the employed labour force plus all individuals 15 years and older available for work
17. Percent of total labour force with post-secondary education.
18. GERD as a percent of GDP
19. Distribution of HRST by sector:

Sector	**HRST (number)**	**% females**	**%< 35 yrs.old**	**HRST %employed labour force**	**Expatriate HRST % of total**	**Expatriate HRST % CARICOM**
Non-renewable resources, plus associated primary mfg.						
Renewable resources plus associated primary mfg.						
Secondary manufacturing						
Private sector services (except tourism)						
Tourism						
Public sector services (except tourism – related)						

Notes:

4. HRST is defined as all individuals who have tertiary level post-secondary education in at least one of the fields of study as defined in the Canberra Manual, Annex 3, Table 6, sections 1, 2, 3, 4, 5.1, 5.2, 5.3, and 6.1, or are employed in an HRST occupation as defined in Annex 4 of the Canberra Manual.

5. An expatriate is an individual who is working in the nation who is normally resident elsewhere regardless of citizenship or place of birth.

6. Primary manufacturing is any sector of industry where the major inputs are raw natural resources, whether renewable or non-renewable.

7. Tourism activities are those as defined by the local tourist board.

20. Distribution of S&T Spending by Sector (National Currency)

Sector	**S&T Expend.**	**R&D Expend.**	**S&T % Extramural**	**S&T % Capital**	**S&T % Salaries**
Non-renewable resources, plus Associated primary mfg.					
Renewable resources plus Associated primary mfg.					
Secondary mfg.					
Private sector services (except tourism)					
Tourism					
Public sector services					

Note: S&T expenditures are those expenditures resulting from the activities of all individuals in HRST occupations.

21. Each national contribution would also include an S&T policy statement, as outlined above.

Future Studies

As a result of focusing on human resources for S&T rather than S&T related expenditures, the workshop identified areas where there is need for additional coordinated studies within the CARICOM region. Specific studies could include:

- The magnitude and sources of remittances to CARICOM nations from CARICOM nationals with HRST training or who are in HRST occupations resident in other countries.

- The potential for repatriating CARICOM nationals from other nations, whether into HRST occupations or as retirees.

CCST Draft Questionnaire

Survey frame (establishment level):

- All government S&T agencies
- All government-supported institutions (hospitals, libraries, etc.), excluding education
- All post-secondary educational institutions (UWI faculties will fill out separate questionnaires)
- All S&T NGOs and private-non-profit institutions
- All S&T professional associations – doctors, engineers, etc. (private practice members only)
- All business enterprises with any S&T employees as defined as HRST in Annex 4 of the Canberra Manual
- CCST will send questionnaires to international S&T organizations operating in the Caribbean

1. **HRST**	# Males	# Females	% Expats	% Expats from CARICOM	%<35 yrs. Old
STA professionals (level 6&7)					
STA technicians (level 5)					
STA support staff					
R&D professionals (level 6&7)					
R&D technicians (level 5)					
R&D support staff					
Other employees with level 6&7					
Other employees with level 5					
Total all employees, all levels of education					

2. **Expenditures** (National Currency)	Salaries	Operating	Capital	Total
STA expenditures				
R&D expenditures				
Total				
	Internal	External Public sector	External Private. Sector	Total
STA expenditures				
R&D expenditures				
Total				

Concordance with RICYT indicators (1999 edition)

RICYT Ind.#	**Description**	**CCST Indicator #**
1	Population	1
2	Labour force	2
3	GDP	4
4	Total S&T* expenditures	Available from CCST quest.
5	Total S&T* expenditures/GDP	Data available from CCST quest.
6	Total S&T* expenditures/capita	Data available from CCST quest.
7	R&D expenditures/researcher	Data available from CCST quest.
8	S&T* expenditures by funder	Data available from CCST quest.
9	S&T* expenditures by performer	Data available from CCST quest.
10	S&T* expend. By socio-ec. Object	Data available from CCST quest.
11	S&T* personnel	Data available from CCST quest.
12	S&T* personnel/1000 labour force	Data available from CCST quest.
13	S&T* personnel by gender	Data available from CCST quest.
14	R&D personnel by sector	Data available from CCST quest.
15 – 17	University graduates by level	Approx. data may be available from Min. of Education
16 – 20	Patent data	Numbers may be too small and variable for valid comparisons
23 – 28	Bibliometric data	Numbers may be too small and variable for valid comparisons

*R&D data may also be available from the CCST questionnaire

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