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LATIN AMERICAN AND CARIBBEAN INSTITUTE FOR ECONOMIC AND SOCIAL PLANNING

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

ORGANIZATION OF AMERICAN STATES

REPORT OF THE SEMINAR/WORKSHOP ON SCIENCE AND TECHNOLOGY PLANNING IN THE CARIBBEAN: METHODS AND OPTIONS

Bridgetown, Barbados
13-17 July 1987

ORGANIZATION AND ATTENDANCE

1. The Joint ECLAC/ILPES/UNESCO/OAS Seminar/Workshop on "Science and Technology Planning in the Caribbean: Methods and Options", was convened at the Dover Convention Centre, Christ Church, Barbados, from 13-17 July 1987.

2. The purpose of the Seminar/Workshop was to promote a dialogue among planners and specialists about the most appropriate ways of incorporating the variable science and technology into development planning in the Caribbean, and in particular:

(a) To discuss procedures to improve the formulation, execution and evaluation of science and technology development plans, programmes and projects;

(b) To undertake a critical assessment of the application of science and technology planning in the Caribbean, its present situation and perspectives, risks, challenges, options and opportunities; and

(c) To propose means to improve the multi-sectoral linkages of technological development, its orientation and promotion.

3. Representatives from Barbados, the British Virgin Islands, the Dominican Republic, Grenada, the Cooperative Republic of Guyana, Haiti, Jamaica, Saint Vincent and the Grenadines, and Trinidad and Tobago attended the meeting. A List of Participants is attached at Annex I.

4. The following Organizations/Institutions were also represented: Barbados National Standards Institution, the Caribbean Community Secretariat (CARICOM), Caribbean Development Bank (CDB), Caribbean Food and Nutrition Institute (CFNI), Caribbean Industrial Research Institute (CARIRI), Caribbean Network for Educational Innovations for Development (CARNEID), Caribbean Subregional Biogas Network, Caribbean Tourism Research Center (CTRC), Centre for Resource Management and Environmental Studies (CERMES), Delegation of the Commission of the European Communities (EEC), Inter-American Development Bank (IDB), Inter-American Institute for Cooperation on Agriculture (IICA), National Institute of Higher Education (Research, Science and Technology) (NIHERST), United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), University of the West Indies (UWI). A list is attached at Annex I.

5. The opening ceremony which was chaired by Sir Sidney Martin, former Chairman, National Council for Science and Technology, Barbados, included addresses by the following persons:

Mr. Edgar Ortegon	- Co-ordinator, ECLAC/ILPES Planning Unit for the Caribbean
Mr. Clyde Applewhite	- Director, ECLAC Subregional Office for the Caribbean
Mr. Orlando Mason	- Specialist in Science and Technology Affairs, OAS Washington Office
Mr. Wendell Goodin	- Director of OAS Barbados Office
Mr. Rolf Stefanson	- Resident Representative, UNDP Barbados
Mr. Eduardo Martinez	- UNESCO Programme Specialist, Uruguay

6. The feature address was delivered by Senator Anderson Morrison, Parliamentary Secretary, Ministry of Finance, Government of Barbados.

7. In his presentation Mr. Ortegon noted that the co-sponsoring institutions of the Seminar/Workshop were convinced of the close correlation between the problems of development and the need for more appropriate approaches to science and technology. He indicated that, however one perceived the problems of development and whatever strategy one chose to solve them, the incorporation of science and technology was a pre-condition that would ameliorate or aggravate these problems.

8. Mr. Applewhite in concurring with the sentiment expressed by Mr. Ortegon, stressed that there was no greater area for improvement in the Caribbean than the application of science and technology to all spheres of economic and social activity. He hoped that the scientists and planners could advance a step further in the pursuit of this goal and he looked forward to the application of the findings of the meeting.

9. The OAS specialist, Mr. Mason, stressed the need for an organization to strengthen the science and technology approaches in the Caribbean, while the UNESCO specialist, Mr. Martinez, highlighted the technical nature of the meeting, noting that the exchange of experiences and information on science and technology would prove to be valuable.

10. In noting the purpose of the Seminar/Workshop, Mr. Goodin observed that science and technology was a wide and all-encompassing field, incorporating several disciplines and requiring a large expenditure of funds, which were more often than not beyond the means of individual countries in the Caribbean. He suggested that discussions should therefore focus on research and development, as it pertained to increased production in agriculture and industry, also noting the need for greater co-ordination, within each country, between the public and private sectors, and among those governmental bodies throughout the subregion, having responsibility for science and technology policy.

11. Mr. Stefanson, the Resident Representative of UNDP, Barbados, asserted that the chief reason for the UNDP involvement with science and technology is its potential for increasing national productivity and accelerating development. However, in applying science and technology in developing countries, some problems were noted which include: lack of explicit science and technology plans; where they do exist they are often not implemented; the strategies do not properly reflect the available resource base, comparative advantages or social and cultural habits of a majority of the population; inadequately qualified technical personnel; poor support to research and development institutions; and, weakness or non-existence of science and technology information systems for collection and dissemination of data/information to research and development institutions, decision-makers, and investors.

12. In noting that science and technology provided the motive power for economic growth and development, Senator Morrison observed that while the application of science and technology to the development of the region was not new, the process had been historically skewed towards semi-processing of indigenous material for foreign markets utilising foreign technology. This, he added was to the detriment of the development of the domestic non-traded sector and an indigenous technology. Hence the need to formulate and implement development plans and, within the context of such plans, to use science and technology as a tool for economic development.

13. Senator Morrison stated that planning for the application of science and technology to development must depend upon a priority ranking of national, social and economic requirements and a detailed knowledge of human, physical and financial resources. The extent to which these priorities were achieved was determined by the capability of the various economic sub-sectors, and science and technology has a major role to play in enhancing the potential of each sub-sector. He noted that given the limited resource endowment in countries of the region, a portion of the requirement for development through science and technology will be foreign in origin. The selection of that requirement must be carefully monitored, not only because of cost considerations, but also to avoid a continuation of the situation where development of indigenous technology and the ability to effectively adapt foreign technology is neglected. He stressed that careful selection implied knowledge of alternatives and hence the development of an effective information resource system was critical to the application of science and technology.

14. Finally, Senator Morrison spoke of the need to develop a competence for planning in science institutions. He described planning for effective performance as an on-going process which necessitated the existence of organizational structures to allow for the development of a planning capability up and down the organizational ladder. Senator Morrison called for a serious examination of science institutions to discover whether they were able to plan the effective application of science and technology so as to satisfy regional social and economic needs. A schedule of activities is set out at Annex II.

Session I

The Caribbean: Problems and Prospects

15. Dr. Dennis Irvine in his presentation indicated that his focus was on the problems and prospects associated with science and technology for development; the focus could be justified, not only by the theme of the seminar, but also because the prospects for development of the Caribbean would be bleak unless the problems of science and technology were addressed. He noted that with few exceptions, the countries of the subregion did not have a clear set

of objectives for science and technology; there were no established priorities; and, in a large number of cases, there was no development plan. Many,therefore, remained uncertain as to what the application of science and technology to development in the Caribbean entailed.

16. Dr. Irvine noted that it was argued that science and technology should be directed towards ensuring minimum levels of consumption and access to social services for the poor and planners needed to ask themselves how far science and technology addressed some of the critical socio-economic problems which the countries of the subregion faced. He noted the high level of unemployment for most countries and the fact that the English-speaking countries alone import in excess of US$1.0 billion worth of food annually despite an espousal of agricultural development. He noted a PAHO study on the nutritional status of children under five, which showed that during the 1970s only about 60 percent of children in the Caribbean satisfied PAHO's nutritional norm, and observed that illiteracy remained a chronic problem for many countries in the region.

17. If Caribbean countries were to address these issues, he said that they would need to develop an endogenous scientific and technological capability, to enable them to determine by themselves the nature of the intervention of science and technology in the socio-economic development process which would be needed, and not have to rely on the capricious and often doubtful benefits of external help. In this recpect the absence of a national science and technology policy, and hence of a science and technology plan, in all but Cuba, remained perhaps the most critical deficiency among Caribbean countries. He noted, however, that there had been a growing determination in several countries to establish a national science and technology policy, which would ultimately have the effect of mobilizing the not inconsiderable science and technology infrastructure that exists in the subregion.

18. Despite strides which have been made in the development of endogenous science and technology capability, many countries remained by and large overwhelmingly dependent on imported science and technology. As this dependence was likely to be a permanent feature for many LDC's, they would need to acquire the capacity to identify technological

options and to make choices; to collect the appropriate information and develop the ability to evaluate it, due recognition being paid to efforts already being made in this regard.

19. Dr. Irvine expressed the view that Caribbean countries needed to commit themselves to greater investment in their potential. This could be achieved by: a review of subregional sources and mechanisms for financing science and technology; greater consultation with regional and international financing institutions; and a more co-ordinated approach to avoid duplication in the use of financial resources.

20. Finally, given their size and limited resource endowments, regional and international co-operation in science and technology took on added significance for the countries in the Caribbean.

21. In the ensuing discussions the following observations were made:

(a) There was a discrepancy in the approach to science and technology by those responsible for: development policy-making and planning and science and technology policy-makers and planners. These were seen as two major fronts seeking to advance the development of plans and implementation strategies for science and technology in the absence of effective co-ordination;

(b) The problems of co-ordinating the various sectors which need to become involved in the planning process;

(c) The absence of systematic approaches to the transfer of technology was seen as a significant contributor to the problem of adoption of inappropriate technology, particularly the prolongation of the learning curve in situations where there was a significant mismatch between the available support resources and the technology employed;

(d) The apparent lack of appreciation and under-estimation of the investment approach to technology acquisition and adaptation;

(e) The political directorate in Jamaica had over the years become oriented to the potential contribution of science and technology to developing economies and was consequently more receptive to ideas and suggestions for employing it in the development process;

(f) The concept of development was now being re-evaluated to determine its meaning in the context of nations such as those in the Caribbean. The important ingredient being employed is the enhanced capabilities of science and technology to solve problems;

(g) The fundamental problem facing these nations was a structural one where the following factors were highlighted:

(i) Lack of confidence displayed in those charged with planning, organizing, etc;

(ii) Separate pathways pursued by: (a) economists interfacing with government in the planning process separately and distinctly from (b) scientists replicating the same.

This situation has lead to discrepancies in the membership of councils.

(h) The problem of getting the attention of relevant persons involved in the planning process, as evidenced by the inability to attract a quorum at some of the important meetings attempted. The problem seems to stem from a focus on introspection and lack of perception of the benefits and significance achievable through collaborative efforts;

(i) The importance of moving away from the all-encompassing approval and focus on the incremental approach which through informal arrangements had demonstrated positive results. Another speaker supported the incremental viewpoint and anticipated further discussion on the approach. Reference was made to the area of agricultural production;

(j) The need to channel resources both through the university system as well as industry for purposes of research was stressed. Note was taken of the Japanese method of using the low-level workers to assist in improving the work models and devising production plans.

22. In concluding, Dr. Irvine expressed concern at the lack of awareness of the publication of Dr. Norman Girvan on "Technology Policies for Small Developing Economies", as many of the points of contention and concerns were well articulated and addressed in this document. He emphasized the point that we need to know where we would

like to go so that the policies can be focussed on charting a proper course along such a path, lest we run the risk of applying science and technology in a vacuum.

Session II

Critical Assessment of the Caribbean Experience

23. In making his presentation on the above topic, Mr. Donatus St. Aimée highlighted the experience of the OECS which revolved around the process chemist laboratories (PCL's). In contrast to the thrust by the agricultural experimental stations which were not focussed on commercialization as were the PCL's.

24. He cited the lack of financial support which contributed largely to the lack of success of the PCL's, and stressed the critical role of the university without which no country can be expected to successfully enter into ventures such as the one represented by the PCL's.

25. He then went on to question the initial approach of the Workshop, seeking to distinguish between science and technology, stressing its application to specific activities. He referred to comments made which questioned the viability of the small developing state and their viability so far as the development activities especially related to science and technology are concerned. If indeed this were true then the next logical question would be: why pursue science and technology?

26. Notwithstanding the above, the need to look at return on investment in applying science and technology processes to development must be taken into account.

27. It was necessary to determine where we want to go. The example of Singapore was quoted and it was suggested that a viable approach would be to exploit narrow market niches for production of specialty items using indigenous capabilities to develop products geared to such markets. Such efforts would at times require us to unpackage foreign technology in order to better develop our own although caution was needed so as not to invest in technologies which were becoming obsolete.

28. It was not necessary to attempt quantum leaps to get to where others are. An incremental approach which takes social and economic factors into consideration should be adopted to bring about change and more effort needed to be directed to technology as it was the primary lacking ingredient compared to science which is abundantly available.

29. It was concluded that Japan's prosperity was not a recent phenomenon as evidenced by the level of sophistication achieved in technology as early as 1904 demonstrated in their war with Russia. Such success stems from the prolonged efforts to maintain an aggressive assault on the application of science and technology and may reflect a particular trait in societal arrangements.

30. A number of comments were made on Mr. St. Aimée's presentation as follows:

(a) It was observed that the relationship between population size and skills requirements, poses a dilemma especially for smaller states. The type of investment required for technological development is an issue requiring more detailed examination. For example, should more engineering or more science be promoted. There is thus a need to arrive at a proper balance which will give Caribbean people the type of incremental breakthroughs suggested. The alternative proposed is maximization within a geographical region;

(b) It was asserted that science shows why, while engineering shows how, and machine-building capability was critical to the development of indigenous capabilities. Reference was made to the civil engineering capabilities presently existing, and the fact that a significant number of non-formal scientists had contributed immensely to the development process. Lack of knowledge of these contributions suggested that better information capabilities were needed if we were to benefit from them;

(c) It was noted that institutions related to the development and application of science and research are often created without much effort to co-ordinate their activities, while these organizations tended to focus on day-to-day problems instead of

striving for a long-term perspective. It was suggested that any strategy for linking these organizations to the productive sector must be at the national level

(d) In spite of the abundant supply of civil engineering skills in the Caribbean many related areas like roads have not improved commensurably, and the adoption of a multi-disciplinary approach was proffered as a response to that problem;

(e) Dependence and its underlying comforts often inhibited innovation. The shortage of financial resources in Guyana had precipitated innovative approaches to the supply of the required spare-parts and maintenance for the rice mills, while the subsequent availability of external funds caused such efforts to dissipate rapidly;

(f) In concluding the session, it was observed that only in desperate situations which are precipitated by crisis have we witnessed the flourish of our capacity to innovate. The ability to develop this capacity on a sustained basis was a matter of concern for all;

(g) Several areas were cited which require close and constant attention: reduction of illiteracy through science and technology; self-sufficiency in health through science and technology; and health for all through science and technology;

(h) Concern was expressed about the lack of planners at the Workshop and it was accordingly suggested that the focus of the meeting should be re-directed.

Sessions III and IV
Incorporation of Science and Technology in the Planning Process in the Caribbean

31. Dr. Norman Girvan's presentation focussed on the mechanisms and methodology of incorporating science and technology policy into overall national policy. In dealing with technology policy, he made the distinction between the sectoral and the functional, pointing out that the secotral affected the behaviour of sectors, enterprises and individuals whereas the functional was the responsibility of specific institutions. The bottom line of the policy related to individuals who must display both competence and confidence.

32. With respect to the approaches to technology policy, Dr. Girvan mentioned the comprehensive, the partial and the strategic, noting that the comprehensive was unrealistic for developing countries as they had neither the resources nor the institutional infrastructure. Both the partial and the strategic alternatives were however relevant; the partial tackling specific areas therefore being highly selective, while the strategic was oriented to resolving specific problems.

33. Technology transfer from abroad was necessary to support selective development of local resources, and capabilities which in turn further supported controlled technology imports. Imported technology must be the basis of learning while the objectives to be achieved should determine what technology to import and not the other way around.

34. In developing policy, Dr. Girvan mentioned three necessary stages:

(a) Preparatory;
(b) Formulation;
(c) Implementation;

with each having a number of clearly defined steps that needed to be expounded.

35. Finally, Dr. Girvan identified the following criteria to guide selection of areas for policy intervention:

(a) Relatively low resources requirements;
(b) Positive and preferably high internal payoffs;
(c) Positive external benefits through opportunities and learning;
(d) Political appeal.

36. In the ensuing discussion the following points emerged:

(a) There was agreement that the elements being proposed by Dr. Girvan were indicative rather than prescriptive

(b) A major point of focus during this discussion and also later in the day was the fact that the Seminar/Workshop was pitched at another audience, that is, the planners in the various governments, but given the fact that this was an entirely different audience, it was nevertheless important to determine what the technocrats could do to influence future courses of action;

(c) Dr. Girvan's proposal that in small developing countries with limited resources attention should be on partial strategic areas of technology policy, found wide favour with participants who stressed the need to be functional so that real outcomes of such policy instruments could be demonstrated;

(d) The role of institutions and individuals in initiating courses of action was mentioned by several speakers in the context of showing how the "bottom-up" approach could be successful in motivating change;

(e) The need for technological change initiators was crucial to illustrate local capability; such change agents being individuals in institutions whose views and perspectives were wide and progressive and who had the ability to mobilize resources for change.

Session V
Incorporation of Science and Technology in the Planning Process in the Caribbean

37. Dr. Long's presentation drew attention to the fact that science and technology planning was a recent phenomenon in the developing countries but that in the Caribbean context, science and technology planning was not an integral part of economic planning. However, since science and technology offered the greatest single promise for change and development, it was important to rationalise science and technology in overall developmental planning. It was argued that a constraint faced is the "openness" of Caribbean economies, that is, that most technologies were imported so that the external environment played a strong role in science and technology. Dr. Long explored the options available stressing that approaches must be such that they impacted on the firm, on the industry and on the sector. He

also referred to the comprehensive approach, viewing it as an extended partial approach that could move through the entire economy. Finally, he viewed science and technology planning as being wide, because of the implications of science and technology to development, so that it must be considered outside the purely technical framework.

38. In the discussion, the following main points emerged:

(a) It was now necessary to define science on the one hand and technology on the other. The phrase "science and technology" grew up as scientists, especially in developed countries, tried to win political and financial support for scientific activities by arguing that investment in such science could lead to technological and hence economic gains. However, the history of technology showed that science-driven technology was a phenomenon of the last ninety years and that for most of the time, technology had preceded science. In addition, while the relationship between technology and development had been documented, the relationship between science and development was tenuous at best and non-existent at worst. Thus we should perhaps be talking about a technology policy for development and a science policy in the context of education and training. Perhaps, we had really done ourselves a disservice by talking about science and technology and ought now to re-orient our thinking and talk about technology and science;

(b) Technology and science was but one tool used by development planners so that it was necessary to define the ingredients of development in order to sharpen the focus of technology and science involvement;

(c) Finally, in planning it was necessary to develop proactive strategies rather than reactive strategies to deal with past mistakes. It was suggested that the developed countries in general, and transnational corporations in particular, would not sit idly by and allow the developing countries to dictate terms to them and reflect their modus operandi. In this context it was necessary to consider the information systems required to inform such proactive strategies.

Session VI

Incorporation of Science and Technology in the Planning Process: Methodological Aspects

39. Mr. Eduardo Martinez' presentation was based on "Technology Indicators in Latin America: from standardization to specificity". He gave a brief history on the interest in measuring national science and technology activities with a view to its planning and programming. The three standard methodologies used in measuring science and technology activities in Latin America and designed by OECD, UNESCO and the OAS, have some common fundamental characteristics.

40. The standard or conventional indicators have basically been used to make comparisons between the past and present, or to compare countries in the region with industrialized nations. The presenter believed, however, that the level of the national science and technology activities in Latin America was so heterogeneous, both in quantity and quality, that such indicators were of little use, and could be misleading and cause counter-productive policy conclusions. Neither could they help Latin American countries in defining goals, in determining priority activities, and in organizing and financing them.

41. Accordingly, there appeared to be an urgent need to develop paradigms that reflected the nature, distinctive elements, dynamics and magnitude of indigenous science and technology activities. This would lead to relevant information systems which would contribute to problem analyses, decision-making and resource allocation. Such national indicators, when developed, should not be used to conceal or justify low quality, superficial, or irrelevant science and technology activities, and should consider, *inter alia*: the weak links between research and development; the higher education system; the productive sector; low level academic achievements and low level of data availability and reliability.

42. Priorities should include the study of local technological innovation, processes and capabilities based on tangible outputs. However, it was felt that Latin American countries needed to go beyond conventional output indicators, to improve the understanding and measurement of their specific technological capacity.

Session VII

Planning for the Application of Science and Technology to Development - Grenada

43. Dr. James De Vere Pitt asserted that the Grenadian experience portrayed an historical interest in science and technology by the political leadership. This interest, however, at times lacked the dedication and commitment required for purposeful work and manifested itself in the tendency for science and technology organizations to work in an un-coordinated manner.

44. An examination of the human resources in these organizations revealed the existence of serious manpower shortages in some, and a lack of organizational provision for certain initial science and technology services. Re-organization of research and development and science and technology institutions under an influential National Science and Technology Council which incorporated senior government officials in the science and technology decision-making process would result in a co-ordinated and co-operative effort and a more efficient deployment of human resources.

45. It was pointed out that in the area of regional co-operation Grenada had been party to various technical meetings and had participated in regional organizations such as the Organization of American States and the University of the West Indies. In the ensuing discussion, it was suggested that until a determined effort to strengthen national science and technology institutions was made regional co-operation would not materialize in a structured way.

Session VIII

Analysis of National Cases - Guyana

46. Dr. Ulric O'D Trotz noted that among the challenges facing science and technology in Guyana was the full utilization of its vast resources, and the expansion and diversification of its manufacturing activity.

47. The National Science Research Council was set up in 1975 to determine priorities for scientific and technological activities and to advise on national science and technology policy. Through the National Science Research Council, a number of sub units had been set up with specialized roles such as: the Institute of Applied Science and Technology, the Bureau of Standards, the National Agricultural Research Institute and the Science and Technology Policy Unit.

48. The role of the Institute of Applied Science and Technology as a lead institution in one field of indigenous technology and other forms of technological application was highlighted.

49. Since 1974, however, the National Science Council has been placed under various ministerial jurisdictions at various times, i.e. Economic Development and Planning, Higher Education, Manufacturing and Industry, Office of the President and finally in the Ministry of Development and Planning. A National Science and Technology Policy had been produced in 1979 and revised in 1985 but has not yet been approved although Government had announced its intention of producing a National Science and Technology Policy during 1987. The National Science Research Council had been relatively inactive since 1985 and its function is now brought into question in light of the sub units subsequently developed.

Session IX

Comments on Science and Technology

50. Mr. Orlando Mason observed that Latin America and the Caribbean had focussed their science and technology efforts on the development of research and development infrastructure without receiving significant contributions to the development of their economies. These developments were concentrated around specific products particularly around the production unit structure much the same as the paradigms of the Western developed countries. Countries invested in the science rather than the technology element in effect ignoring the relevance to the economy, that is, to the development, production and marketing of goods.

51. Mr. Mason contended that studies showed that the application of science and technology to socio-economic development requires adopting a multi-disciplinary research and development team which should include expertise

in economic, financial, technical and social aspects of the delivery of the particular good or service. The acquisition of technology must therefore include the complete package: - technology; finance; market; development; and training.

52. There is a need also to focus attention on the factors which constitute the demand (capital goods, firms, markets) for technology, to ascertain market acceptability, the timing of risks, the financial package, the training component, which were all factors outside of purely technical considerations.

53. He observed that it was for these reasons that research and development effort had not resulted in any significant level of production increase. He suggested that it might be better to structure policy instruments to a priority sector or particular priority circumstances within a sector as this might enable focusing on financial mechanisms and training.

54. Science and technology policies should be formulated by a strategic combination of production, entrepreneur, technical and government personnel who can affect financial, technical and social feasibility and provide a better evaluation of the feasibility of the technology change.

55. Technology change in turn must be gradual, while being able to significantly contribute to further technological change through joint efforts of the private and public sectors.

56. In terms of selecting an appropriate technology for development, there was a pressing need to adopt a pragmatic approach examining and evaluating all technological options until the appropriate mix was achieved. For countries, the common goals must be:

(a) To support decision-making for investing in technology change by providing a wide information delivery mechanism (seminars, statistics, data, market research);

(b) Training personnel to play the role of technology promoter by combining resources and facilitating the efforts of all entities and parties involved;

(c) To identify a product or a group of products and the related activities which are feasible to cover the given resources available and constraints prevailing.

57. After Mr. Mason's presentation, the participants made the following comments:

(a) There was need to have personnel with unusual level of related ability and competence on the localized aspect of the object of the change;

(b) It was useful to investigate all activities specific to the object of the change - product related information, activities and institutions, skills to be involved in the change; and

(c) There must be a critical process of interaction by all participants in the change of technology.

Session X
Field Trip to the Sugar Technology Research Unit at Edghill, St. Thomas, Barbados

58. A field trip to the Sugar Technology Research Unit (STRU) formed an integral part of the Seminar/Workshop. At the STRU, Dr. Brookes the Officer-in-Charge, explained the major sections of the entity: Technology, Entomology, Agronomy and Agricultural Engineering.

59. The STRU is served by various laboratories. The various tests all relate to improving the quality and volume of output of sugarcane, sugar, and molasses principally. In addition tests are carried out on onions, peanuts, animal feeds, cassava and cherry, among others, in an effort to further the agricultural diversification programme.

60. The STRU also undertakes assignments for other Caribbean countries.

Session XI
Perspectives and Possibilities for Island Economies

61. Mr. Donatus St.Aimée's presentation was intended to reflect some of the key considerations for the application of science and technology for development in small states, highlighted during the previous sessions.

62. He contended that the small state must define its development goals as precisely as possible, beyond the sector, to identify products and if possible by quantities and a time frame by which stage the necessary technological innovations could be applied to achieve results.

63. For the small state the focus should be on the application of science and technology for development, rather than the development of science and technology. Applied research which is needed to support the first might nevertheless have some effect on the second part and this should be encouraged.

64. Public research institutions should have interlocking directorates in order to facilitate coordination and information flow and as much as possible be put under one umbrella to avoid duplication.

65. In order to support indigenous and innovative product development, a science and technology extension service should be instituted to provide information both at the formal and informal levels (i.e. field type visits) to entrepreneurs, and the community at large.

66. Attempts should be made whenever possible to select plant and machinery that is multi-purpose and not just for one operation.

67. Science and technology units, if established, should be in the Ministry of Planning and Finance but with Cabinet reporting responsibility. They should be staffed by senior persons whose responsibility it would be to keep ministries informed of regional and international developments in their fields, liaise with technical and policy-making persons in the various ministries and make recommendations on technological imports relating to major projects envisaged by government and the private sector.

68. The science and technology unit should host seminars and workshops not only on aspects of ongoing science and technology activities, but also to initiate discussion on new technologies and scientific and technical subjects or topics.

69. The science curricula in schools at all levels should have a more hands-on approach, and attempts to devise simple operations, differing from those practised in the formal laboratory manuals, should be encouraged.

70. Every attempt should be made to provide technical education and develop technical skills both at formal and non-formal (village) levels.

71. A comprehensive programme of home economics to encompass food preparation and nutritional aspects should be developed to support the agro-industrial thrust now undertaken by most of the regional governments. This should start at the primary and progress through to the tertiary level.

72. In the absence of a local university, a higher education system should be developed to serve as the focal point for science and technology education and innovation.

73. Regional and international organizations should assist in the facilitation of national workshops as the area of emphasis, while, as far as possible, encouraging and facilitating information exchange and contact between scientific/technical personnel and organizations in the region, and including policy-makers and planners. They should also assist in the preparation and funding of sector specific but multi-disciplinary projects.

74. On completion of Mr. St. Aimée's presentation, the following observations were noted:

(a) There is need for maximizing the use of available resources, to eliminate the duplication and overlap of institutions and, wherever possible, use physical plant and personnel for multi-purpose tasks;

(b) National workshops should be the medium to exchange information;

(c) It was observed that National Councils were also given implementation roles and, as such, execution problems, whereas they should be used to promote, co-ordinate and establish policy. The question, nevertheless, remained one of how to incorporate the community into the work programme. Science and Technology Councils should play a catalyctic role in this regard, they should be agents for change, and so impact on science and technology matters;

(d) The need for better co-ordination between the university and research organizations in the search for funds was stressed. Some participants were of the opinion that most of the research work done on agriculture within the university tended to remain there, thus rendering the work inaccessible to some persons. It was, however, observed that society expects the university to be teaching and not researching. The university can do both, but must, in particular, demonstrate its capability in technology research.

SYNTHESIS AND CONCLUSIONS

75. In addition to the overriding concern which was the incorporation of science and technology in the planning process and which was mentioned in several presentations and the general discussions, there were other areas of concern that met with general consensus. These included:

(a) The need to focus on proactive technology, technology policy, and technology incorporation for the furtherance of socio-economic development of the Caribbean;

(b) The importance of promoting a better dialogue between science and technology planning at the central level as well as at the sectoral level. It was furthermore pointed out that in most of the countries science and technology was considered as a consumption item instead of an investment item, thus affecting the adoption of appropriate policy measures;

(c) Non-governmental organizations of technologists and scientists should guide and advise decision-makers on the utility value of selecting appropriate science and technologies in the development process. They should operate as a lobby group with long-term interests, transcending the term of any politician in office;

(d) The lack of proper organization and well-structured institutions which took into consideration persons at the lower end of the scale was mentioned. This phenomenon reflected the need for proper training of new planners, new technologists and scientists in a way to facilitate their achieving their full potential in order for them to make maximum and meaningful contributions. The experience of the incorporation of science and technology into planning in

Barbados illustrated this point. The new government brought planning into the Prime Minister's Office and the Science and Technology Council was also brought into the Prime Minister's Office as part of a Planning Division. Prior to this there existed many organizations which were aiming in different directions. Senator Morrison in his opening speech had touched on the politician's responsibility to taxpayers and the need to know what technologists and scientists are doing. He considered the latter to be the crux of the matter. Scientists/technologists and socio-economic planners needed to develop competence in their particular fields. It was necessary to correct organizational structures for the proper development of competence of the individual. The human resource and behaviour must also be understood and considered;

(e) It was observed that planners, technologists and scientists might need to emphasize technology at one time and science at another. However, presently the areas for emphasis in science and technology would seem to be: food, transport, housing and the health sector;

(f) The need to disseminate information on technological innovation was stressed. Such information should highlight the kinds of services which were available and the extent of usage of indigenous resources;

(g) Technologists and scientists must demonstrate confidence in themselves and at the same time sensitize the politicians to the impact of indigenous technology on development;

(h) It was necessary to understand the bureaucracy and the power structure within which the planners, technologists and scientists operate. The point of contact with the bureaucracy and with the power structure must be identified and strategies must be devised to influence them;

(i) Some selection criteria for identifying priority areas for policy intervention were noted. They included:

(1) Modest requirements for scarce technological manpower, money and foreign exchange;

(2) Utilization of locally available resources, especially human resources;

(3) Direct profitability with a high ratio of expected benefits to costs;

(4) Externalities where expected spin-offs and benefits to other areas are high;

(5) Where the technological aspect is a critical constraint for the successful completion of the project;

(6) Usefulness for "learning" and "demonstration" purposes;

(7) High probability of success; and

(8) Political appeal.

Annex I

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