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THE CARIBBEAN: PROBLEMS AND PROSPECTS

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THE CARIBBEAN : PROBLEMS AND PROSPECTS

Abstract

To talk about the problems and prospects of the Caribbean is no easy task, since it requires an intimate knowledge of all the countries which are constituent members of the CDCC, and this is indeed a tall order. Even when limited to the english-speaking countries, generalizations can be risky since the Caribbean is not strictly an homogeneous assembly. At the same time there are sufficiently strong similarities for one to be able to speak meaningfully about problems and prospects of the Caribbean especially at a seminar/workshop on science and technology planning, so long as it is recognized that whatever one says has to be qualified by statements such as 'generally speaking' or 'on the whole' wherever such qualifications are not made explicit.

The topic, "The Caribbean : Problems and Prospects" lends itself to various interpretations and to a variety of treatments. The bias of this treatment is the problems and prospects associated with science and technology for development; which can be justified, not only by the theme of the seminar, but also because of the fact that unless the problems of science and technology are addressed, the prospects for development of the Caribbean are truly bleak. A fundamental problem in this regard is that, with few exceptions, the countries of the sub-region do not have a clear set of objectives for science and technology, there are no established priorities and, in a large number of cases, there is not even a development plan. So even as we continue to talk about the application of science and technology to development in the Caribbean, we remain uncertain and unclear what this development is.

There are many who argue that science and technology should be directed towards ensuring minimum levels of consumption and access to

2.../

social services for the poor masses. And perhaps we need to ask ourselves at a forum of planners how far science and technology are addressing some of the critical socio-economic problems which the countries of the sub-region are currently facing. Unemployment for most countries is running at a level of 20-30%, and among the 15-19 age group the figure is reportedly as high as 50% in some LDCs and Guyana. Although at the level of policy all countries espouse agricultural development, the english-speaking countries alone import in excess of US $1.0 billion worth of food annually. A PAHO study on nutritional status of children under 5 showed that during the 70s only about 60% of children in the Caribbean satisfied the PAHO norm of normal nutrition. Aside from Cuba illiteracy remains a chronic problem, some LDCs having rates in excess of 15%.

If they are to address these issues, Caribbean countries have need to develop an endogenous scientific and technological capability, which will enable them to determine by themselves the nature of the intervention of science and technology in the socio-economic development process, and not have to rely on the capricious and often doubtful benefits of external help. In this respect the absence of a national science and technology policy, and hence of a science and technology plan, in all but Cuba, remains perhaps the most critical deficiency among Caribbean countries. However, it is true to say that over the last couple of years there has been a growing determination in several countries to establish a national S&T policy, and this can only improve propsects. It will certainly have the effect of mobilizing more effectively the not inconsiderable S&T institutional infrastructures that exist in the sub-region.

Strides have certainly been made within recent years in the development of endogenous S&T capability, but Caribbean countries still remain by and large overwhelmingly dependent on imported science and technology. For many LDC countries this dependence is likely to

3.../

be a permanent feature. What this means is that countries have to acquire the capacity to identify technological options and to make choices. A major problem here is the lack of information and of the ability to evaluate it. Some attempt is however being made to address this problem, and to have in place the basic machinery.

If science and technology are to be more than marginal to the development process in the Caribbean, countries will have to commit themselves to greater investment in their potential. At Vienna in 1979, Member States were exhorted to mobilize greater resources for the development of science and technology, to reorient national sources and mechanisms of financing, and to involve in those efforts the national financing institutions more directly. Review of sub-regional sources and mechanisms of financing science and technology, greater consultation with regional and international financing institutions, and a more coordinated approach to avoid duplication in the use of financial resources, are all activities which need to be pursued more vigorously in the Caribbean in order to mobilize greater resources for the application of science and technology to development.

Finally, given their size and limited resource endowments regional and international cooperation in science and technology take on added significance for the countries of the Caribbean. Developments in this regard have been modestly encouraging, but much more needs to be done as regards rationalization of the use of human and institu resources and greater coordination is required of the inputs of donor and technical assistance agencies.

THE CARIBBEAN : PROBLEMS AND PROSPECTS

A well-to do country lady formed the ambition to establish a fine pedigree herd of beef cattle. Local opinion, including that of the Ministry of Agriculture, doubted her ability to do this and she was well aware of these doubts. When the herd had been assembled, she invited the Ministry Officer to come and inspect it, and he was compelled to admit that it was indeed a very fine herd. 'But', he continued, 'if I had a herd of thirty head, I would have twenty-nine cows and one bull and not, like you, fifteen cows and fifteen bulls'. 'Yes, I know', she replied, 'but that's a man's point of view'.

Superfluous as it may seem, I wish to emphasize that what I have to say this morning represents a point of view and, I say it in all humility, a point of view of one who does not consider himself truly qualified to speak to the topic I have been asked to address. Even for someone qualified the topic would not be easy, for it presumes an intimate knowledge of all the countries of the Cari ean which are constituent members of the CDCC, and that is a tall order indeed. For my part I have to declare at the outset the limitations of my knowledge about the countries which do not come under my portfolio as Unesco Sub-Regional Adviser. These are Cuba, the Dominican Republic, and Haiti; and I apologize for any assumptions or conclusions I may draw which are not strictly applicable to them, or for which their circumstances constitute an exception.

Of course, this is not to say that other countries will not find that in some things I say their situation is not also exceptional. Generalizations about the Caribbean cannot escape this fate since, even when limited to the english-speaking countries, the Caribbean is not really an homogeneous assembly. At the same time there are sufficiently strong similarities for one to be able to speak meaningfully about . . problems and prospects of the Caribbean especially at

a seminar/workshop on science and technology planning, so long as it is recognized that whatever one says has to be qualified by statements such as 'generally speaking' or 'on the whole', wherever such qualifications are not made explicit.

The topic, "The Caribbean : Problems and Prospects" obviously lends itself to a variety of treatment so it is important that I declare the particular bias of this talk. To a large extent it will be concerned with science and technology for development in the Caribbean, an examination of some of the critical problems as I perceive them in this context, and a consideration of some of the prospects for the future. A fundamental problem in this regard is the fact that, with few exceptions, the countries of the sub-region do not have a clear set of objectives for science and technology, there are no established priorities and, in a large number of cases, there is not even a development plan. It is hardly surprising then that science and technology continue to be marginal to Caribbean development. Denis Goulet touches on the issue in his article in 'Impact on Society'. Vol.2 1983. "The essential problem", he observes, "is not technology itself, but the successful management of it which requires wisdom and clarity as to the kind of society desired and the ways in which technology can help construct it. A living link ought to be explicitly formed which binds together the values any society seeks to promote, the development strategies it favours, and the criteria it adopts to solve problems in any arena". This he defines as technology policy,

It would probably not be unfair to say that our problems in the Caribbean begin with the definition of the values we seek to promote and of the kind of development we wish to see. Nor would it be unjust to conclude that for the most part we have accepted the westernized view of the meaning of development, equating quality of life with the acquisition of more and more material goods. Like the industrialized

societies, economic values and ever increasing levels of wealth have become the dominant focus of public policy, and our experiences seem to have taught us nothing about the inappropriateness of this approach. At a World Future Studies Conference in Berlin in 1979, Sushila Gosalia asserted that the ultimate goal of accelerated achievement in science and technology is the betterment of socio-economic environments of human society. "For the developing countries it means", she says, "to correct and re-orient the misplaced priorities and to design the technology policies aiming more directly than those of the past to ensure certain minimum levels of consumption and access to social services for the poor masses."

In order to fully appreciate the import of Sushila Gosalia's recipe in the context of the Caribbean, we need only to look briefly at some of the critical socio-economic problems which the countries face. None of them has caused more concern than unemployment which, for most countries, now stands at between 20-30%. Among the 15-19 age group the figure is reportedly as high as 50% in some LDCs and Guyana. What is particularly disturbing is that since 1980 unemployment has been on the rise. Various causes have been suggested - rapidly expanding population; high growth rate of the labour force; increase in female participation in the labour force; rural-urban drift; importation of labour saving, capital-intensive modern technology; unbalanced mix of education and training - but the solutions have remained elusive. The contribution of science and technology towards alleviation of the unemployment problem in the Caribbean has been less than impressive. Few countries have specifically employed science and technology for the purpose of addressing rural poverty, a problem endemic to almost all the countries of the sub-region and which is itself at the root of a number of other social and economic problem .

Although at the level of policy all countries espouse agricultural development, the english-speaking countries alone import in excess of

U.S. $1.0 billion worth of food annually. A PAHO study on nutritional status of children under 5 showed that during the 70s only about 60% of children in the Caribbean satisfied the PAHO norm of normal nutrition, even if admittedly the figure for children who could be described as falling under the definition of malnourished was not excessive. Judging from statements made from time to time in various countries it is more likely that the situation has worsened rather than improve in the 80s. With the exception of Cuba illiteracy remains a chronic problem, some LDCs having rates in excess of 15%. Even when literacy is relatively high according to the statistics, the reality is tha there is a high level of unskilled people who swell the ranks of the unemployed. Basic needs of shelter and clothing are lacking for a significant proportion of the population.

I have cited these socio-economic features of Caribbean societies simply to illustrate the point that the potential of science and technology for development has for the most part eluded us. I believe it will continue to elude us, for no other reason than that the goals of development which we espouse, explicitly or implicitly, are invariably false and frequently unattainable. Governments no longer have to be convinced of the importance of science and technology to development, but their perception of what this means is derived from a view of the industrialized world, and they tend to see science and technology helping them, to use an unfortunate phrase, "catch up" with the so-called developed countries. I say 'so-called' because the entire concept of development is currently being re-examined by scholars worldwide, so it is no longer clear cut what characterizes the label 'developed'. It would appear, in the circumstances, that a prerequisite perhaps for talking about prospects in the Caribbean is defining what is development in a Caribbean context. Until we do, it may well be that the problems we are asking science and technology to address are not only intractable but simply irrelevant. All this, however, is in the realm of public policy and well outside my own competence. The issue is clearly important for any consideration of science and technology for development, and I hope that it receives due attention at this seminar. However, I shall limit the horizons of my

talk to what is within my capability, and it is to this end that I now turn to problems and prospects as they relate to the development itself of science and technology in the Caribbean. In a sense one can argue that without the development of science and technology the prospects for the Caribbean are bleak. By extension then, the problems inhibiting that development are of critical importance.

In the words of Koehler and Segal, "the mobilizing of science and technology for development in the Caribbean is proving to be agonizingly slow. Although reliable information on research and development (R&D) expenditures and research personnel is not available, the region and each of the member states remain overwhelmingly dependent on imported science and technology. Efforts to foster indigenous capabilities are at very different stages from country to country but their impacts are still limited. While rapid progress has been made in a number of countries science and technology remain marginal and precariously institutionalized." Hard as it may be to accept the conclusions of Koehler and Segal, their words ring painfully true. Their final judgment may in fact be said to epitomize the theme of this talk - rapid progress in S&T representing the prospects on the one hand, the fact that they are marginal and precariously institutionalized being the core of the problems on the other. In much the same vein Wiltshire, referring to the isolation of scientific and technological research, sees this as "symptomatic of the broader problem that science and technology activities are often perceived as an abstraction unrelated to overall national development plans and programmes." I have referred to this state of affairs elsewhere as the crisis of policy.

By all accounts Cuba has invested most in science and technology, and is probably the only Caribbean country with an active policy and a well established and sophisticated infrastructure. However in the light of Koehler's and Segal's comments it will be of some interest to learn at this seminar how effective the system is. Koehler and Segal ass t

that S&T in Cuba are not contributing to economic growth or reducing dependency, and claim that the major equity gains in extending education, health and other services have been through management and investment not R&D. Outside of Cuba, the absence of a national science and technology policy, and hence of a science and technology plan, still remains perhaps the most critical deficiency among Caribbean countries as a whole. A major cause is a lack of real interest at the national policy making level, which is highly correlated with the lack of appreciation at this level of the importance of S&T policy. The situation is not helped by the fact that most countries lack the necessary trained personnel, so that the knowledge of what constitutes S&T policy is just not there.

An equally serious limitation to policy formulation has been the absence of assessment of the national scientific and technological potential (STP). Jamaica, Trinidad and Tobago, Guyana, Barbados and Grenada have all carried out surveys of their R&D personnel and ongoing research, but the format of the surveys has not made them helpful tools for policy-making or for management purposes. Most recently Unesco has embarked on a survey of STP in 10 countries, so that for these countries at any rate data should be available within another 6 months or so to assist them to "solve their research and STS organization and administration problems, determine the appropriate steps for encouraging the development of science, effectively guide the research effort or, in other words, formulate a national science and technology policy, draw up a global national R&D (multiannual programme) and a national S&T budget".

An encouraging sign over the last couple of years is the growing determination in several countries to establish a national S&T policy. The Government of Guyana is committed to tabling such a policy before Parliament before the end of the year. At the request of the

Government of Barbados Unesco provided a consultant mission last year to assist in the framing of a national S&T policy. The Central Planning Unit of the Government of Saint Lucia has, with some help from Unesco, drafted a science and technology sector paper. Jamaica is expected to have a national S&T policy, possibly before year end. Most recently, the Government of Trinidad and Tobago has initiated a process of consultation designed to lead to a strategy for enhancing the contribution of S&T to national reconstruction. At the sub-regional level, a sub-regional S&T policy for Caricom countries is in the f al stages of drafting. The objectives of the policy, which has already secured the approval of Heads of Government in principle, is "to provide the framework to guide the choice and judicious application of science and technology at the national level ..... "and within which specific national and regional programmes and plans can be developed." The policy addresses general areas - planning and infrastructure, research and development, human resources -, as well as specific critical concerns e.g. S&T management skills, electronic repair and maintenance, scientific and technological services, and new technologies.

The extent to which these initiatives fulfill their promise and potential will depend in no small part on the strength and capability of the scientific and technological infrastructure, and not least on the mechanisms in place for translating the high-sounding intentions of policy into the realities of effective action. Over the years, for instance, there has been a steady progression in the establishment of national policymaking bodies or their equivalent in the sub-region, with most laudable objectives and terms of reference. One could argue perhaps that in most cases these Councils, far from providing a solution have themselves become part of the problem. Few have succeeded in becoming an integral part of the planning and decision-making process. Generally, they have lacked authority, and are

rarely consulted on important development projects, even where these have a significant component of science and technology. A study of why these Councils have been less than effective would undoubtedly be instructive. What is clear is that their inability to deliver the goods, so to speak, has served to strengthen the hands of those who have little faith in indigenous S&T, and who cite the ineffectiveness of national and regional institutions as justification for looking outwards.

Yet, as far as institutional facilities go the sub-region is by no means badly served, and provided these can be effectively mobilized the prospects for the future must certainly be promising. A preliminary estimate in connection with the STP survey being conducted by Unesco suggests between 300-320 institutions engaged in R&D or STS in the 10 countries. Taking only the countries within the portfolio of the Unesco S&T office in Port of Spain, they can boast three first-rate national R&D institutions in the Scientific Research Council (SRC) in Jamaica, the Caribbean Industrial Research Institute (CARIRI) in Trinidad and Tobago, and the Institute of Applied Science and Technology (IAST) in Guyana. All three are beginning to make a significant economic impact, and their potential have only been scratched. The countries can also boast a regional University of the West Indies with a relatively long and indisputably proud record of teaching and research in science and technology, as well as Universities in Guyana, the Netherlands Antilles, and Suriname; very good Bureaux of Standards in Barbados, Guyana, Jamaica and Trinidad and Tobago; and a Central Meteorological Institute of the first rank. In the LDCs there is an Agro-Lab in all but St. Kitts-Nevis, though for the most part their full potential remains unrealized for lack of staff and equipment. Add to these the impressive array of institutions in Cuba and the Dominican Republic, in particular, and one is left in no doubt of the sub-region's S&T potential, especially when taken as a whole i.e. within the context of regional cooperation.

9.../

Despite the strides that have been made within recent years to develop an endogenous S&T capability, Caribbean countries remain, as Koehler and Segal has observed, overwhelmingly dependent on imported science and technology. For many countries, such as the LDCs, this dependence is likely to be a permanent feature; for others the shift from dependence to relative independence, where it occurs, will be a slow process. The general problems associated with the importation of technology are well known and need not be reiterated here, except perhaps to observe that the countries of the Caribbean by virtue of their size, weak resource endowment, and other related factors, encounter these problems in greatly magnified form.

The late Professor Nayudamma who carried out a mid-decade review for UNIDO in 1985 of the implementation of the Vienna Programme of Action observed that "the choices of technology can only come from alternatives and from a systematic evaluation of information set against set objectives and priorities and impact statements on costs, benefits, employment, environment etc. His findings were that there was not much evidence to show that decision-makers were being provided with much alternatives. "No doubt", he confessed, "many countries have a review of technology imports in developing countries. But even here the screening and evaluation of technology are focused only on the terms and conditions of technology acquisition, rather than on the impact of technology itself. The technology regulations are largely confined to foreign payments, investments, restrictive clauses etc. Only a few countries have mechanisms to effectively coordinate and mesh the imported technology with domestic competence with a view to adapt, absorb, and even improve upon imported technology."

Within the Caribbean, Girvan and the co-authors of "Technology Policies for Small Developing Economics : A study of the Caribbean"

10..../

have referred to the limitations on the technological options that are available and known to enterprises because of the weak information and transmission mechanisms used by them, and their bias towards a narrow range of sources in the United States, Canada, Britain and Western Europe. "There is little evidence", they state, "that Caribbean manufacturers on the whole are strongly motivated to seek out and identify a broad range of technological options for the products and processes that they decide to go into, or that they are aware of concrete possibilities for selecting appropriate technologies that have been revealed by empirical research. The same comment could be made about government and public agencies, whose decisions regarding techniques of road construction, irrigation and the like, are hardly guided by an awareness of the existence of wider ranges of alternatives than those normally considered, or the need to make appropriate choices."

It is ironic, but perhaps understandable, that the prospects for technology acquisition and development, hitherto a major problem for nearly all countries, should begin to show signs of promise just as their economies have shown signs of declining. Attempts are being made to establish mechanisms to deal with the problem of technology evaluation, and Unesco is currently supporting a pilot project in Trinidad and Tobago as the first phase in the setting up of a technology evaluation information support system for countries falling under the purview of the Port-of-Spain office. Complementing this is the work of ECLAC, Port of Spain, in the coordination of the network for planning information (CARISPLAN), and of the network for Patent information. At the CDB, the Caribbean Technological Consultancy Services (CTCS) has been successfully responding to the needs of small scale industries, primarily in the LDCs, for technical assistance of one kind or another. The CTCS delivers this assistance largely by means of a network of Caribbean resource persons and institutions whose contributions are essentially voluntary. The importance of CTCS goes well beyond the

assistance it provides to industry. It is making no less a valuable contribution to the strengthening of the consultant engineering capability of the region, a requirement considered by all the experts as critical to industrial development.

It is not uncommon to hear in the Caribbean that people are our greatest resource. One suspects that this was the rationale for the suggestion by Koehler and Segal that perhaps emphasis in the smaller island of the Eastern Caribbean should be on science education and popular science for adults. There are certainly prospects ahead in investment in human resources, but the problems will not be easily confronted. During the last two decades the arena of science and technology has altered dramatically. Not only are science and technology evolving at an unprecedented rate, but the changes taki g place, and the prospects for the future, are qualitatively different from anything to which we have been accustomed. Consider some of these changes and their implications :

1. Continued escalation of the rate of scientific and technological development, and a more immediate impact of scientific discovery with the increasingly smaller lead time between research findings and technological application. Education in science divorced from technological considerations is already jeopardizing the capacity of today's youth to face tomorrow's challenges.

2. Increasing pervasiveness of the influence of technology, and in particular microelectronics technology, in every facet of life. The Caribbean cannot escape the impact of the microelectronics revolution. It is both a promise and a threat for the region's future. Our response to the problems which microelectronics development poses

for our educational system, for our industrial and agricultural policies, and for our whole social and cultural fabric, will determine which of these two alternatives we shall inherit.

3. Fundamental technological and social changes arising from the new biotechnology. The potential of biotechnology for the good of the Caribbean is enormous, but it is not without its social and ethical implications. We ought not to repeat the mistakes of the green revolution. Biotechnology offers hope through its impact on agriculture, health, energy and the environment to address many of the issues of basic needs, but that hope will be realized only through the right policy and proper planning. Our education system will need to readjust to meet the requirements for greater numbers of microbiologists, geneticis: , biochemists, immunologists, bioprocess engineers and the like, so that we in the Caribbean will be able to determine for ourselves the problems for which solutions are to be sought through biotechnology.

4. Greater degree of global interdependence. The nations of the world are increasingly becoming emeshed in a web of economic, ecological and other linkages. Increasing levels and rate of communication between countries are placing indigenous cultures, traditional practices and beliefs at much greater risk. In the Caribbean this process is already almost on an irreversible path. In the absence of definite policies to counterbalance the effects of the dominant technological culture, uniformity of life style and loss of rich heritages of the past will be inevitable. We cannot turn our backs on technology, that would be suicidal; but can we while reaping the fruits of technology

retain a Caribbean life style and Caribbean values? Can we use the new technologies to upgrade traditional technologies so as to achieve the best of two worlds? There are problems to be sure, but there are also exciting prospects.

According to the Unesco publication "An Introduction to Policy Analysis in Science and Technology", which should be required reading for all S&T planners, the budget, conveniently defined as policy-in-action is "the complement of planning and programming whose operational elements it present in the form of annual expenditure and financial structure." Noting that scientific and technological activities are not visible components in the budgets of many countries, the authors of the publication discuss the merits of functional budgeting with science and technology singled out as a separate function. This form of budgeting does not currently exist in any of the countries associated with Unesco's Port of Spain office, and it would be interesting to discover if it has been tried in any other Caribbean country, and with what result. Given the present state of affairs, it is doubtful if any country in the former category knows how much it spends on science and technology, what correlation exists between financial allocation and national priorities, or how closely overall expenditure approaches the recommended figure of percentage of GDP.

At various international fora, developing countries have been exhorted to make every effort to attain an expenditure of 1% of GDP on S&T, with roughly half of this going to R&D. There is a danger for small countries like those of the Caribbean taking too literal an interpretation of this recommendation, since there is obviously an absolute financial threshold below which there can be no significant impact on S&T development. Thus extrapolation of the recommendation from large to small countries is questionable. Despite this, little

or no consideration has been given to the question of what constitutes a desirable percentage of GDP to be spent on S&T in the case of small countries. One can perhaps draw a parallel here with expenditure on education, where in many small countries the percentage of GDP was above normal by general standards, and has continued to remain relatively high even in the face of the most serious recession in their economies. It has to be emphasized of course that the problem of investment in S&T will not be solved by simply increasing expenditure. The findings and observations of Girvan and his colleagues are pertinent in this regard. They found in their 1973 analysis that a discouragingly low share of S&T expenditure went to the category "development" - 15% in Jamaica and 6% in Trinidad and Tobago. They attributed this in large measure to the fact that "in both countries the S&T effort is dominated by the expenditures of central government and the university .... The expenditure pattern of these two groups which is marked by the importance of research, dissemination, associated activities and education, and the insignificance of development, therefore exerts a strong bias on the overall pattern of S&T expenditure".

That was fourteen years ago, and it would certainly have been useful for a seminar of this kind to have had a more up to date picture. Itis probably a fair assessment that the S&T effort is still dominated by the expenditures of central government and the university, but within the expenditure pattern one has the perception that development has increased in significance. However, much more can, and needs to be, done. In particular, there has to be a considerable strengthening of the link between R&D and the productive sector. And here I see a critical role for the planners.

At Vienna in 1979, Member States were exhorted to mobilize greater resources for the development of science and technology, to reorient national sources and mechanisms of financing, and to involve in those

efforts the national financing institutions more directly. Review of sub-regional sources and mechanisms of financing science and technology, greater consultation with regional and international financing institutions, and a more coordinated approach to avoid duplication in the use of financial resources, are all activities which need to be pursued more vigorously in the Caribbean in order to mobilize greater financial resources for the application of science and technology to development. The financing of S&T at a level which could be considered adequate is a major problem for Caribbean countries. But we have far from exhausted the possibilities in this regard, and for this reason we may realistically entertain some optimism about prospects for the future. What is clearly crucial is to convince the potential investors, not by rhetoric but by results, that investment in science and technology locally and regionally does make economic sense.

It is impossible in a 45-minute exposition to encompass all that might logically be argued falls within the ambit of a topic covering the problems and prospects of the Caribbean, even where the topic is limited to its scientific and technological aspect. I make no apol[illegible]ies for not attempting the impossible, and I shall conclude by focusing on one further dimension which I believe to be of signal importance to the topic at hand. I refer to the matter of regional and international cooperation in science and technology.

Sagasti, in his book "Technology, Planning, and Self-Reliant Development" cites the following areas where programmes of cooperation may be usefully instituted :

" (a) activities that require a minimum critical mass to be performed. This includes research and development for which it is necessary to depend on personnel, equipment and financing at a level

below which the activities are not viable;

(b) scientific and technological activities in which there are economies of scale (information systems, training programmes, engineering capabilities, common research and development, and so on;

(c) activities that must involve an international dimension to make sense;

(d) problems common to more than one country, linked to geographical zones that extend beyond national frontiers. This includes research into ecological conditions, the exploitation of natural resources, use of water systems, and so on;

(e) large undertakings in which it is necessary to share risks among several countries because of the magnitude of resources required. This has been the case of investments in nuclear energy, computers, satellite telecommunications, and so on."

While it is pretty certain that Caribbean countries are unaware of these guidelines of Sagasti, it is true to say that they have influenced instinctively the not inconsiderable efforts at cooperation in science and technology in the sub-region. I do not propose to chronicle these efforts here. It is enough to observe that progress in regional cooperation has been modestly successful. At the same time much more needs to be done as regards rationalization of the use of human and institutional resources, and greater coordination is required of the inputs of donor and technical assistance agencies. The professional associations clearly have an important role in strengthening regional cooperation, but their contributions have so far been very low key and marginal.

To quote from Koehler's and Segal's paper, "the scope for regional and sub-regional cooperation is extensive; the prospects so-so. Even Cuba, Puerto Rico, Trinidad, and Jamaica will within a decade exhaust the R&D they can effectively perform at an island and national level. The smaller countries lack the resources to get started. The organizational mechanisms, funding, and political will do not exist for more than the lowest level regional cooperation. Satisfying the demands of the poorest countries rules out projects of most interest to the advanced." While not denying the validity to a large extent of Koehler's and Segal's conclusions at the present time, one would be unwise to ignore the narrowing of the gap between the demands of the so-called LDCs and MDCs in the Caribbean with the growing congruenc of their perceptions about development. As the emphasis changes to basic needs and to the quality of life, as more focus is given to the problems of energy, agriculture, ecology and appropriate technology, so will the commonality of interests become more visible and the need for cooperation in S&T more apparent. Koehler's and Segal's prognosis of the prospects for regional cooperation is perhaps premised on the continued near-sighted parochialism that has so far been a characteristic feature of most Caribbean societies. I tend to take a more optimistic view. There is certainly a problem in getting governments to appreciate that there is no quick fix in science and technology and, equally, no overnight panacea in regional cooperation. But I believe that there are encouraging possibilities for development through cooperation if seen from the prospective of the medium and long term. The role of the planner in all this cannot be overstated.

I end this talk by giving the last word to Koehler and Segal. The conclusion to their paper seems so apt to the theme, 'problems and prospects', and I quote it in extenso without comment. "How to get from nowhere to somewhere? The Caribbean at present does not have sufficient science and technology capabilities to affect its own future. Compare this to India which was able to demonstrate, adapt, and diffuse

18.../

the Green Revolution to change from a new food importer to being food self-sufficient. Compare this to Singapore which has developed the ability to increasingly design and produce its own industrial exports. It is possible for the Caribbean within a decade to have the indigenous capability to alter its future in energy, agriculture, and ecology. This does not mean that these capabilities will be used or used wisely. Nor does it mean that all Caribbean societies will share in those capabilities, even if some are regional. Nor does it mean that dependency on imports will be necessarily reduced although the import mix could be changed. Surely it is better to import computers rather than apples and dried fish?

The alternative is also visible. It is a perpetuation of the status quo. Most energy is imported depending on the vagaries of world markets, prices, and politics. More and more food is imported and more and more rural people leave for Kingston, Port-au-Prince, Miami, or New York. Ecological pressures increase, more beaches erode, forests denuded and finite resources dwindle. The alternative is not apocalyptic but it is not pleasant. Science and technology do not have the answers to the outstanding problems of the Caribbean but they tell us how to look."

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