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**THE PROMOTION AND ADOPTION OF NEW TECHNOLOGIES
WITHIN THE CONTEXT OF SUSTAINABLE DEVELOPMENT**



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TABLE OF CONTENTS

INTRODUCTION	1
THE SUSTAINABLE DEVELOPMENT ISSUE	2
TECHNOLOGY TRANSFER, ADOPTION AND PROMOTION	3
TECHNOLOGY PROMOTION AND SUSTAINABLE DEVELOPMENT	5
ENDOGENOUS TECHNOLOGICAL CAPABILITY AS A MEANS OF SUSTAINABLE DEVELOPMENT	6
<i>Agriculture</i>	7
<i>Tourism</i>	9
<i>Industry</i>	9
THE CULTURE OF TECHNOLOGY AND THE TECHNOLOGY CULTURE	10
CONCLUSION	11
<i>Some specific recommendations</i>	12
<i>At the regional level:</i>	12
REFERENCES.....	14

THE PROMOTION AND ADOPTION OF NEW TECHNOLOGIES WITHIN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

Introduction

It used to be said that, "Old concepts and habits die hard". This is no longer the case when speaking of technology. However, because technology is so pervasive it may be necessary to hold on to habits and concepts until proper analysis of the new technologies has been made. The Caribbean region is awash with technologies that are considered either not appropriate or are obsolete, keeping in mind that these terms, however, are generally applied to technologies used and compared with other technologies available, but not necessarily within the context of sustainability. For example, agencies and/or government ministries responsible for fishing activities in the region, especially in countries of the Organization of Eastern Caribbean States (OECS), have been urging fishermen to invest in bigger boats and gear, and to develop the type of fishing that is more suited to temperate waters with large fish stocks. This approach to fishing has been taken, because the majority of technical assistance programmes comes from the Japanese, who fish in that particular way. However, it is a well-known fact that compared with temperate waters, fish stock is not as plentiful as in tropical waters, although there are a large variety of species.

On the other hand, the local artisanal fishermen in the OECS, have over the years, developed an approach to fishing that is sustainable. They have generally divided the year into two seasons – line fishing from November to June; and trap fishing from July to October. Coincidentally, part of the latter period corresponds with the hurricane season in the region when the fishermen are concerned about their well-being. Why is it then not recognized that the fishermen's system of fishing is more sustainable? The answer may lie with our concept of "sustainability". Is it sustainability of the fisheries resource that we care for, or the sustainability of the fishing-enterprise/cum bank loans?

In the agricultural sector the situation is no different. Earlier farmers understood the benefits of mixed farming, integrated pest control practices and the use of organic fertilizers, manuring, etc. The introduction of mono-cropping to increase total yield resulted in the need for inorganic fertilizers instead of manure, and chemical pesticides instead of biological pest control. Now nutrient depletion in soils in the region is a recognized fact and pesticide residue levels are almost intolerable in our soils in the ground-water system and in primary products. There were some harmful practices, for example, "slash and burn", undertaken by farmers that would have contributed to soil erosion and therefore reduced fertility. However, to the extent that of necessity, farming on slopes was not curtailed, even with the introduction of so-called "new" technologies, these new technologies probably helped to accelerate the decline in soil fertility and the increase in insect infestation.

The examples cited in the preceding paragraphs serve to emphasize the fact that in order to efficiently introduce a technology into a society, at least two aspects of the technology must be considered, analysed and understood: (i) the sector of the society requiring the technology and (ii) the impact of the technology on the sector and society. The dilemma faced by most Small Island Developing States that do not develop technologies, but simply use technologies, is that the preparatory analysis that, of necessity, needs to be done in the development of the technology, does not take place.

Old practices and technologies, therefore, are simply replaced, sometimes without any prior preconditioning or preparation for absorption and management by the work force, sector and society in general. Only when problems arise are questions asked as to the suitability or sustainability of the technology. For technology to be meaningful and beneficial, the meaning of technology and its power and ability must be fully understood.

The sustainable development issue

Definitions and concepts abound on sustainable development, with various interest groups employing the meanings and concepts that are most advantageous to their cause. Some groups equate sustainable development with conservation; some with preservation and others try to justify their arguments with *quid pro quo* statements, especially pitting sustainable development against unemployment. Regardless of the position taken, however, one indisputable fact remains – matter cannot be created or destroyed but simply transformed from one form to another. In other words, no resource/commodity is infinite. Most who argue against sustainable development, therefore, do so out of a lack of understanding of the nature of natural resources and the true role of technology.

The meaning of “sustainable development” with probable universal acceptance is that coined by the Bruntland Commission, which states:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

It contains two key concepts – the concept of needs, in particular, the essential needs of the world’s poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs. Within this definition is recognized the rights and obligations of all, and the need to utilize resources for mankind, while at the same time ensuring that successive generations of mankind are afforded no less favourable starting points than the present generation. The greatest difficulty is to educate the present generation sufficiently so that they accept this idea as a responsibility.

On the other hand, the development of technology has, by and large, been prompted by the need for conquest and domination, whether of humans or of markets. Early man made changes to his habits in order to master his environment and thus survive, while looking for food and shelter. Societal and communal living developed more from a realization of the concept of

strength in numbers, than from the inherent goodness of man and forced him to care for the less fortunate. The family unit as the first communal unit also bestowed complementary benefits that enabled each member to survive in a hostile environment and succeeding communal or societal arrangements always took the hierarchical form. Thus power, control and, in some cases, greed were always major factors in society, ancient and modern.

How then can a tool like technology, developed as a means of control by men bent on power and control, be employed to ensure that the modern concept of sustainable development is engrained in society? Little wonder that the countries that have done the most devastation to the planet are the ones most advanced technologically. Equally, the poorest countries, by sheer ignorance and want, have contributed to environmental degradation. What can be deduced from these observations is that education seems to be able to play a significant role in the sustainable development debate. The education mentioned here is both in terms of the level of education of the society as a whole, as well as the education standard necessary to support research and development programmes that can determine, shape and service the technology development agenda.

Thus, in a society where the population has a relatively high level of education and the researchers themselves have some modicum of ethical values instilled through education, there may exist the possibility for policy development to be more sustainable-friendly. In such a scenario, not that greed is tampered, but domination takes a more humane form and long-term benefits are preferred over short-term ones. That is the beginning of the acceptance of sustainability and sustainable development. In such a setting then, technology, when developed and applied will have a different focus away from a tool for control and closer to tools for management.

From that historical perspective, and given that Third World countries do not necessarily control markets but need to compete in them, developing countries will more likely recognize the need to orient their promotion, adoption and utilization of technologies within a sustainable development context that will allow them a greater margin and even some leverage in the arena of global competition.

Technology transfer, adoption and promotion

One of the hallmarks of research and development, and which results in technological innovation, is experimentation and analysis. In most cases, the technology is repeatedly tested for a number of factors, both positive and negative. In addition, there are usually regulations governing the application of the technology. Because most of the technology in the world is generated by the developed countries, these steps and safeguards are generally absent in developing countries. As such, the genesis of the technology is not known and, when transferred to a developing country, is applied under conditions that may be contrary to the developers' intentions.

A case in point is the new yield hybrid seeds developed to bring about the so-called "green revolution" in the 1960s. While these seeds performed admirably under ideal conditions

in the laboratory and in field trials, they performed dismally when introduced into some developing countries, the same countries in which they were supposed to increase yields. It was later realized that plants from these seeds require an optimum amount of fertilizer to realize maximum yields. The problem was, of course, that these countries could not afford the quantum of fertilizer required by the plants. In addition, the introduction of new cultivars in the area led to increased insect and other pest problems, even in indigenous species.

If the wider meaning of technology is taken to include not only the technique of carrying out a task, solving a problem or the development of a new product, and include in that meaning, the introduction of a new product in a market, then the introduction of soya oil in the Caribbean which, together with negative advertising effectively killed the coconut oil industry, it can then be argued that the technology was not appropriate and therefore not contributing to sustainable development. The introduction of oil from the soya bean can be considered as new technology because it was suggested that it could replace coconut oil that was supposedly saturated with cholesterol, high levels of which is not good for one's health. Of course, it is well known that the facts proved otherwise and that coconut oil does not have any more cholesterol than does soya oil, both being vegetable oils.

A particular problem of Third World countries is the lack of finance needed for technological development. Invariably, technologies are introduced into developing countries. There are, in fact, programmes widely promoting technology transfer from the developed to the developing world financed by the United Nations system and other agencies, public and private. However, the overall record of technology transfer to developing countries is not encouraging, although some countries have been able to take advantage of these transfers and benefit from them. Those countries that have benefited have set up research and development institutions and expend resources on the adaptation of the technologies transferred. They have had, though, to pay a high price in terms of sustainable development in respect of their natural resource depletion and environmental degradation. The cost of correcting these mistakes may be beyond their financial capability.

In order to realize benefits from the promotion and adoption of new technologies, it is imperative that the government institutes a rational science and technology and development policy - a policy that will guide the activities in the areas identified as crucial and deserving of new technologies. The wholesale introduction of new technologies can be more detrimental to the welfare of the State. In the implementation of policy, a systematic analysis of the areas should be undertaken to determine when and how technologies should be introduced. The absence of a clearly enunciated policy and a programme of implementation has been a major cause of unsustainable development and failure of technology transfer efforts.

Another major problem is the tendency to ignore existing local technological activities and the lack of attempts to improve their operations. Too often when a problem develops involving an activity, solutions are not sought in existing operations. Usually a completely new system is introduced without the necessary training and retraining of staff. As an example, the production of cassava is a very old activity in the Caribbean. However, the processing of cassava remains very antiquated although there are simple technologies that can significantly increase both yields and product development, as well as reduce the long period in present

processing methods. If these simple technologies are applied, a large percentage of marginal lands more suited for cassava cultivation but now under banana cultivation at a very high cost, can be used. Instead, a number of recommendations are being made for the administration of the banana industry rather than dealing with the problem of production and productivity, quality control and proper land use.

Another example, this time at the other end of the technology scale, can be cited. When plastic bags replaced paper bags in the shopping arena, the stage was set for serious environmental problems in the region. The introduction of plastic bottles, especially in the soft drink industry, without a recycling programme, further aggravated the situation. Ironically, while some developed countries are taking steps to reduce the use of such plastic items, developing countries are doing the opposite and increasing what they perceive as conveniences and a sign of modernization.

Technology promotion and sustainable development

There is widespread consensus that technology transfer, usually from the developed countries to the developing countries, offers possibilities for the promotion and adoption of new technologies. It is also generally agreed that the record of such transfers has not lived up to expectation and the major reasons for failure have been identified as the inability of the receiving State to properly introduce the technology. Such inappropriate introduction may take the form of lack of supporting personnel to service the technology, lack of resources for providing the necessary inputs for the new technology to be efficient, poor timing in the introduction of the technology and lack of understanding of the requirements of the technology. Whatever the causes, considerable damage is being done by the use of the new technology, sometimes at a tremendous cost to the environment.

There are, to be sure, some cases where transfer of technology, both north-south and south-south have been successful. However, it will be shown through analysis, that where these examples exist, the receiving State has put into place the necessary mechanisms for the incorporation of the technology, including a science and technology policy and institutions to support the transfer.

New technologies can be classified into three categories:

- (a) Problem solving;
- (b) Efficiency promotion; and
- (c) Product development.

For the purpose of this discussion, environmentally friendly technologies will be included in the problem-solving category. It is important to distinguish among these types of technologies so that an analysis of the use of the technology can be undertaken before promotion and adoption.

An example of a *problem-solving technology* would be waste-treatment technologies where a particular method of waste disposal is employed. The method will depend on the nature and quantity of waste generated, recognizing that no type of waste can be allowed to accumulate indefinitely. In many of the small islands, the disposal of waste from breweries is a challenge for most brewers. The stench and waste emanating has negative affect on property values in surrounding areas. The introduction of technology to minimize the stench and allow for the reuse of the wastes and/or by-product, would serve to remove both deleterious effects of the operation.

Efficiency-promoting technology – One such example can be illustrated by the change in a plant design or layout to streamline operations, or the introduction of a piece of equipment that significantly increases input and quality. The replacement of a typewriter by a computer is not necessarily an efficiency decision, unless the operator is sufficiently computer literate in the beginning, to make maximum use of the computer. Equally, the introduction of vehicles with larger engines in the region, where relatively short distances are traversed, would not qualify as efficient technology application.

New product technology – An example of new product technology would be the introduction of pasta into the region. If the pasta was made out of breadfruit or any other indigenous crop, it could qualify under problem-solving technology, that is, the transformation of a product that is in abundance in the region. Instead, it is made out of imported raw material and therefore must be classified as a new product introduction technology. In many cases, there is a tendency to mistake the introduction of a new product with the introduction of a new technology.

This latter group of technologies, although of benefit in some cases, can also be the most damaging to the local economy, as it invariably leads to replacement of a local product and a drain on foreign exchange reserves. There is of course, the argument that these technologies generate employment. This would be true if a local resource was transformed into a saleable product. It is precisely because new product technology is research and development dependent and, therefore, costly that new products are most often seen in Third World and developing countries. With new international trade regulations being introduced, especially with regard to quality assurance and certification, competition for the use of scarce financial resources keeps increasing, there will continue to be a lack of available funding to be channeled into research and development.

Endogenous technological capability as a means of sustainable development

Technology is also introduced into a country via branch plants or subsidiary companies. These companies operate with technologies purchased or developed by their parent companies. The branch plant pays licenses and/or fees to the parent company for use of the technology. In most cases, however, these technologies may not promote sustainable development or be environmentally friendly, since the research and development work that went into the technologies may not have factored in the local situations in the developing world where the technology is now employed.

Problems associated with the promotion and adoption of technology are also demonstrated in the operations of small and medium-sized operations utilizing technology indigenous to a country. Because of the lack of resources for research and development, there is very little, if any, technological advances that would result in products meeting the stringent requirements of the export market. It is not uncommon, for example, to see jams and jellies bottled in jars associated with body-care products or peanuts in rum or beer bottles. The old method of roasting peanuts on a coal-pot filled with sand is still practised in most Caribbean islands, although solar dryers have been developed for that purpose. It is also very difficult to get whole cashew nuts as a local product, since the de-shelling process is still archaic. By continued use of these older technologies, the product cannot advance, nor can new products be developed. The packaging is not appealing enough, not to mention that they seldom meet international labeling standards. The fact of the matter is that they cannot, as the cost would be exorbitant. Yet, it is precisely for these micro and small enterprises that strategic interventions of technology would make a difference to both the quality and quantity of products and the acceptability of local products on the international markets.

Another example of inappropriate technology transfer is given in the case of the Canadian trained agricultural officer. The officer decided that "English", "white", or "Irish" potato should be introduced into the Caribbean because it was imported and used extensively. Seeds were obtained and the land prepared for cultivation. The first crop was highly successful and everyone praised the officer. Successive crops, however, were complete failures and everyone wondered as to the reasons. No one remembered that the potato belonged to the same family as tomatoes and was therefore susceptible to nematodes, also a problem in banana cultivation. The result was an increase in *fusarium* wilt in tomatoes and an increased incidence of nematodes in bananas.

In Chile, it was observed that the anchovy population had increased significantly. A plant was, therefore, immediately set up to produce fishmeal from the anchovy catch. Needless to say, plant capacity exceeded replenishment of stock and after some years, the plant had to be shut down, since the fish stock could not support the scale of operations.

In the Caribbean, technology transfer and promotion will have the greatest impact on those sectors that are of greatest value economically, to the region. These sectors are agriculture, tourism and industry. The second part of this paper will evaluate the promotion and adoption of new technologies in these sectors and attempt to analyze their successes or failures, make recommendations for advancement and suggest the conditions within which the promotion and adoption of new technologies can be successful in the region. Apart from a few examples where the introduction of new technologies did not add any value to products or services or were detrimental in some way to the environment, emphasis will be placed on the endogenous sector and not on technology introduced by branch or subsidiary plants.

Agriculture

The new technologies introduced in the agricultural sector in the region have been primarily in agronomy and horticulture and to a lesser extent in post-harvest technology. Institutions such as the Caribbean Agricultural Research and Development Institute (CARDI),

the Inter-American Institute for Co-operation on Agriculture (IICA) and the regional universities, have all concentrated most of their efforts in primary production. The reasons for this are simple. The absence of a time-related, institution-specific agricultural policy for the region has made it such that the primary production of traditional and peasant crops remains the major agricultural activity. As such, less equipment and funding is required for the continuation of these technologies. Another reason lies in the fact that a specific agenda for research and development is not set by the demands of the community, but rather by the interests of researchers and professors. A third possible reason is that since there is little product transformation in the agricultural sector and the major exports consist of primary products, there is no demand for transformation technology.

Ironically, one would have thought that, precisely because of the need to develop transformed products for the export market, the need for new technologies would have been realized. However, given the relatively high cost of research and development for product development, it is unlikely that there will be any increase in activity in this direction. Thus the Caribbean remains a major producer of rum and not wine, of fresh bananas and not many banana by-products, of dasheen, breadfruit, yams, etc., all as fresh produce. Some efforts have been made in making yam flakes, and pepper sauce manufacturing is well developed in the region. However, because of the glut that exists during certain times of the year, added to the lack of proper storage facilities, emphasis continues to be placed on the export of fresh fruit, avoiding the burden of transformation expenses.

It was indicated that the comments made here relate primarily to the non-branch plants and not subsidiary operations of overseas companies such as Nestlé, or Grace Kennedy Limited, both of which operate modern technological concerns in Trinidad and Tobago and Jamaica respectively. That reminder is necessary because these plants employ new technologies in their operations. However, because the focus of this paper is to help explain the duality of the technological base in the region and the need to concentrate efforts at providing technology to the indigenous sector in order to bring it to a level of competitiveness, the points raised here do not reflect what occurs in the case of branch plants or foreign-owned companies.

In the Caribbean, as noted above, there is a noted absence of a time-related, institution-specific agricultural policy that would address the issue of technology adoption and sustainable development. By comparison, in the United States of America, agricultural and mechanical universities were established specifically for the development and promotion of new technologies, especially in agriculture and industry. They employ a holistic approach to agricultural development by including home economics, agribusiness and extension services within the faculty of agriculture. Therefore, produce from the farm by the students of agronomy, horticulture and livestock science is prepared by the home economic students for consumption in a cafeteria managed by agribusiness students. Research and development work at these universities supports new product development that is subsequently tested out on students in the cafeteria, later in the community and, eventually nationwide and worldwide. The backbone of agro-industry is at the university. The agricultural extension agents also take the problems from private individuals to the university for solving and pass on the results of the research to the community. A nexus is thereby established between the university and the wider community. The university therefore becomes a source of technology for the State.

This is in direct contrast to the situation that exists in the Caribbean, even when vast resources are spent on the university. In the absence of other credible research institutions, the premier institution of learning remains apart from the community.

In the banana industry, large amounts of cellophane bags are now used to protect the fruit from insect damage. Ironically, the technology exists to manufacture a fibre from the plant's pseudo-stem, from which bags may be manufactured. Paper bags, exercise books and cardboard boxes can also be manufactured from this fibre. With these products, the use of plastics can be significantly reduced in the region. Unfortunately, neither the university, the private sector nor the public sector seems to be interested in such development work. The debate over economics versus the environment and sustainable development continues.

Tourism

The demands of the international market drive the technologies employed in the tourism sector. Because the sector is mainly controlled by foreign interests, it has kept abreast of the latest technologies in the service component of the sector, for example, in communications. However, in areas of energy conservation, waste treatment and water conservation, the situation is very different. Since there is no policy to force compliance, even the larger hotels are unwilling to incur the additional cost of retrofitting to introduce new and sustainable technologies. Most hotels in the region do not harvest rain water in cisterns; few recycle gray water for irrigation; few utilize renewable energy sources like solar water heaters; or even the new electric light bulbs and gadgets that are energy efficient and readily available on the market.

Few chefs at the hotels utilize local produce to prepare exotic dishes for foreign guests and, with the open market policy, it is not unusual to find items made in Taiwan, Korea or China, sold in gift shops. In short, the new technologies introduced to the sector are those that were brought in from outside the region and are dictated by external requirements. Local components of the tourist industry suffer from the same lack of policy and strategy as the agricultural sector.

Industry

It is fair to say that the Caribbean approached industrialization from a very negative perspective, when import substitution was used as the basis for promoting industrialization. As such, there was no local resource or product on which the industrialization strategy was based and that is still so today, with the possible exception of Trinidad and Tobago with that country's downstream activities from hydrocarbon. Wheat flour introduced into the region remains a staple to rich and poor. Attempts to introduce flour from local sources such as cassava and banana have failed miserably supposedly because of poor quality. It may however, be that the taste of flour from these sources is different to that of the wheat flour and thus not totally acceptable on the local market. Codfish too, introduced as food for the slaves, has become a most sought after food, with attempts to produce it from shark and other species. The region should have been in fact, attempting to create a different delicacy that could be exported. Crops like mango, breadfruit and bananas virtually litter the region, while we import apples and do nothing to transform our crops into marketable products as was done with the wild apple in North America.

Thus, in the industrialization programmes, not only the machinery, but also the raw materials, is imported. In that scenario the technology, of necessity, has to be imported since not enough is known about the nature of the equipment, the raw material or the finished product.

The examples cited are by no means unique but reflect the pervasive nature and role of culture in technological development, which is little understood by most.

The culture of technology and the technology culture

A common fallacy in Third World countries is that technologies can simply be imported and applied without a nation having developed a minimal capacity in technological development. In fact, many technology transfer projects have not succeeded because of the limited technological capability of the receiving State. This false notion has prevented many States from investing resources in technology-related institutions that could provide the necessary platforms to transformation.

The history of technology shows that many technologies have been developed by accident, or by observation, while working on other technologies. Many of these technologies, too, have come about on shop floors due to observant and diligent technicians. This suggests that, whereas there is a place for large-scale research and development in the generation of technologies, there is also a case for the tinkering with technologies for the development of new technologies. The latter case is probably more appropriate to developing countries that face financial constraints and are not able to undertake research and development. Recognizing that research and development work is not always geared towards the agenda of developing countries, it is particularly important that the imported technology be adapted to suit the local situation. That adaptation can take place only when the nature of the technology or the force that drove the invention or discovery is understood. Only then can the technology be made efficient and sustainable-friendly to the recipient country.

Much has been said about the phenomenon of globalization. While it is generally believed to be able to bring new benefits to countries, there is the counter-argument that it will also reduce the export capacity of developing countries. That need not be so. It is clear that with globalization and the new rules of the export/trading game, it is those countries that are most systematic in their approach, and those that carve out market niches for themselves within their limited capabilities that will benefit from any increased globalization opportunity. It will not be enough for countries to enter markets in an ad hoc manner, given the specific requirements of the markets for the products and services now outlined under new operating guidelines. Limited resources will have to be focused and narrowed in order to meet those demands. This selectivity and focusing of resources and activities are probably the best benefits of the evolution of a system over which developing countries have very little control.

Once it is recognized that a systematic approach to development is necessary, developing countries can take stock of their resource base and capabilities, identify the technologies available, the modifications necessary, the strategies for implementation within the sustainable development context, and last, but not least, the financial requirements necessary for

implementation. A time and result specific plan can then be developed for the implementation of the promotion and adoption of new technologies within the identified sectors, with the necessary evaluation mechanisms put in place to determine success or failure. This approach will remove the non-methodical approach to technology implementation so prevalent in developing countries.

It is recognized that the above scenario is most applicable in situations that lend themselves to long-term planning. A strategy must be found to deal with the promotion and adoption of technologies in situations that call for immediate action for problem-solving, and those activities over which the public sector has limited control. Because of the lack of a policy on technology introduction and promotion, the absence of national institutions to provide information on technologies and assist in technology analysis, the private sector has, by and large, been free to introduce any technology that is deemed to be in its best interest, without a commitment to sustainable development and environmental concerns. Thus, most breweries in the region operate without adequate disposal facilities; electricity companies do not consider the use of renewable energy as a viable option; and chemical companies have a free hand as to how they dispose of chemicals, either via sale or containment. However, when problems develop, as in the case of the gold mining operations in Guyana; or the high coliform levels found in most beaches of the region; or the outbreak of pink-mealy bug; there is near panic and calls for regulation of activities in the private sector.

The absence of technology centres also poses problems for the banking sector, in that when a proposal is submitted for funding, it may be difficult for bank officials to assess the proposed technology to be utilized in a project. In most cases it is accepted by the bank's project unit that the client has done the necessary research in identifying the best technology. While this may be true in some cases in terms of the proposed venture, the same may not be said in terms of the effects of the technology on the environment. Sufficient attention is not then paid to the technological component of the project, while emphasis is put on the potential of the entrepreneur to repay a loan. Such a situation may have the additional effect of skewing loans and development assistance in the areas in which project assessors and evaluators feel most competent, at the expense of other, more environment-friendly technologies and areas of activity.

Conclusion

The issue of technology promotion and adoption is not an easy task for developing countries. When sustainable development issues are added to the equation, the problem becomes even more complex as, in most cases, the country has to decide on employment generating activities versus conservation and preservation. The choice could have been made less painful if the necessary tools for resource management were readily available to the State. However, it is precisely in these areas that technology is lacking in developing States, especially in the Caribbean, because of the paucity of applied research and development work. Hence, large mangrove areas have been cleared in the region to build marinas and land reclamation projects and hotel building continue to be undertaken on beaches without proper analyses of shore dynamics having been undertaken, even when concerns about *sea level rise* are being openly discussed.

Only when the concept of technology, its meaning and power are understood, will technological advancement become the credo of the society and new technologies that are sustainable be sought and introduced. There will be greater commitment by all to research and development work for the development and validation of technology, and succeeding generations will strive to build on what was inherited from previous generations, to continue the cycle of new technology generation and sustainable development.

Some specific recommendations

1. Each country of the Caribbean should adopt a Sustainable Development Policy that outlines the role of science and technology in the development strategy.
2. National institutions, especially those relating to technology issues, should be identified and given mandates and resources to carry out the tasks identified in the implementation of the policy.
3. National institutions should draw up long-term programmes for the implementation of the policy and supported by non-partisan financial commitments.
4. National institutions should be mandated to undertake research on existing activities and products and be given incentives for breakthroughs in improving on these activities and products.
5. Technology Extension Services should be established at the national level to assist in the dissemination of technology, as well as noting problems that may be solved by using appropriate technology.
6. Bureaux of Standards should be established in each country in order to provide testing and certification of technologies, practices and products.
7. A central national institution should be mandated to provide information on new technologies, undertake intelligence work, promote a technological culture in the society, articulate the technological needs of the State and, if possible direct and finance research and development work.

At the regional level:

1. A regional institution should be given the mandate to promote collaboration among national institutions and agencies.
2. The regional institution should, as far as possible provide some coordination of national efforts to ensure that concerns of a regional nature are addressed collectively and that issues that affect the region as a whole are dealt with from a holistic, integrated standpoint.

3. The regional institution should be responsible for developing projects that will strengthen capacity in science and technology at all levels and identify funding for said programmes at the international level.
4. The regional institution should be able to provide support to national efforts by establishing linkages with international agencies, especially where such linkages would be onerous on individual States.
5. The regional institution should be responsible for the promotion of a regional science and technology culture and popularization programme, and should represent the region at international forums, articulating the region's position on science and technology issues, particularly with regard to the introduction of new technologies for sustainable development.

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