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**PROBLEMS RELATING TO
TECHNOLOGY TRANSFER MECHANISMS
IN THE CARIBBEAN**

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PROBLEMS RELATING TO TECHNOLOGY TRANSFER MECHANISMS IN THE CARIBBEAN

The 1979 Vienna Programme of Action on Science and Technology for Development acknowledged that the most striking difference between developed and developing countries is their technological capabilities. In order to promote development in the developing countries and, mindful of the lack of resources from these countries, it has proposed that every effort should be made on the part of developed countries to transfer technology to developing countries.

Recognizing also that even among developing countries there was great disparity and that some developing countries had capabilities to share technology, the United Nations actively encourages those developing countries with such capabilities to transfer their technological skills to their less fortunate compatriots.

As part of its own efforts the United Nations set up the Technical Cooperation among Developing Countries (TCDC) Unit within the United Nations Development Programme (UNDP) to assist in the process of technology transfer by making funds available on a cost sharing basis to facilitate the process

Even before these initiatives there were attempts at technology transfer programmes, some of which still exist today. The jury is still out on whether technology transfer programmes have helped to improve the lot of citizens in developing countries. Some claim to have had positive results while others assert that nothing has changed. What is indisputable, though, is that some developing countries have been able to do better than others through technology transfer, while others have actually declined in standards of living. There is also general consensus that the gap between rich and poor in the world is widening. Why is this so with all the technologies that are available?

In the Caribbean context early attempts at technology transfer have been in the agricultural sector, primarily with the introduction and cultivation of crops for export. As the agricultural sector matured and some manufacturing was introduced, technology transfer took different forms becoming more legalistic rather than operational. Branch plants were established and entire plants were transported into the region and licensing, joint ventures, franchises and consultancies became commonplace methods of technology transfer in the private sector in the Caribbean.

While there have been a number of private technology transfer or transactions, the efforts of five institutions will be mentioned since they have been particularly important in both the promotion and the implementation of the concept of technology transfer. These are the

UNDP/TCDC, the Organization of American States (OAS), the Commonwealth Fund for Technical Cooperation (CFTC) of the Commonwealth Secretariat, the United States Agency for International Development (USAID), the Peace Corps and the International Development Research Centre (IDRC). However, the paper will deal more with the situation within countries, which will be parallel to that of among countries.

Technical Cooperation among Developing Countries (TCDC)

TCDC is the execution and management of developmental activities and projects by institutions of developing countries in which they share one another's experience and technical capacities and utilize, whenever necessary, advice and financial support from external sources including organizations of the United Nations development system.

The main features of TCDC activity are:

- The deliberate, voluntary cooperation between developing countries on an institution-to-institution basis;
- Sharing, pooling and exchange of know-how, information, and experience among developing countries;
- Actions initiated, organized and managed by developing countries themselves. Governments would normally take the lead in initiating TCDC, while national public institutions and private organizations can also play key roles. External assistance and institutions play a role in supporting the efforts of the developing countries;
- Key responsibility for mobilizing resources for TCDC rests with the developing countries;
- Countries are often simultaneously donors and recipients of TCDC benefits. They provide as well as receive capacities thereby broadening the experience of their institutions and personnel.

TCDC focal points are located within governments, United Nations development system organizations, UNDP country offices, and other institutions wherever commitments have been made to support and enhance TCDC. The cooperating developing countries themselves have the primary responsibility for mobilizing financial resources for TCDC activities.

Organization of American States (OAS)

The oldest international institution in the Americas, the OAS was initially established to promote peace within the hemisphere, specifically as an institution for dispute resolution between countries, to avoid the possibility of disputes escalating into war. In time, the OAS recognised the need to promote economic integration and collaboration in the region and to provide for resource mobilisation and technology transfer in such areas as agriculture through the Inter American Institute for Cooperation on Agriculture (IICA), in environment, water resources management, education and economic development, in general.

Commonwealth Science Council (CSC)

The CSC is an intergovernmental organization with membership drawn from all Commonwealth countries. At present there are approximately 35 members, represented at Council meetings by senior scientists or science executives. The CSC is an innovative, creative and proactive organization that seeks to leverage the science and technology capability in the public and industry domain within the Commonwealth. It does through networking of both knowledge and finance, using modern information technologies to facilitate its application by member countries for sustainable economic, environmental, social and cultural development.

Commonwealth Fund for Technical Co-operation (CFTC)

The CFTC is the principal means by which the Commonwealth promotes economic and social development and the alleviation of poverty in member countries. Established by Commonwealth Heads of Government in 1971 to put the skills of member countries at each other's disposal, the CFTC is administered by the Commonwealth Secretariat in London.

The CFTC operates on the principle of mutual assistance, with member governments contributing financing on a voluntary basis and obtaining technical assistance as needed. It is largely demand-driven and responds to requests from governments for such technical assistance as the provision of experts to fill specific development needs in the short or long term. In-house and external consultants assist in export, enterprise and agricultural development, advise on economic and legal matters, and assist in implementing programmes of training, capacity-building and public-sector reform.

United States Agency for International Development (USAID)/Peace Corps

The USAID is the principal United States' agency for the promotion of technology transfer in developing countries. The mandate of USAID is to provide assistance to countries recovering from disaster or striving to improve their quality of life. The United States foreign assistance has the twofold purpose of furthering America's foreign policy interests and expanding free markets while improving the lives of citizens of the developing world. Spending less than one half of one per cent of the federal budget USAID works around the world to achieve these goals. USAID works to support long-term and equitable economic growth and advancing United States foreign policy objectives by supporting:

- Economic growth and agricultural development;
- Global health; and
- Disaster prevention and development relief.

The agency works in close partnership with private voluntary organizations, indigenous organizations, universities, American businesses, international agencies, other governments and other United States government agencies.

Peace Corps

When John F. Kennedy became president in 1961, he issued a call to service to Americans with these words: "Ask not what your country can do for you, ask what you can do for your country." He manifested this vision by establishing the Peace Corps to promote world peace and friendship. The Peace Corps has the following three main goals:

- (a) To help the people of interested countries to meet their need for trained men and women;
- (b) To help promote a better understanding of Americans on the part of the peoples served; and
- (c) To help promote a better understanding of other peoples on the part of Americans.

Currently, more than 7,300 Peace Corps volunteers are serving in 70 countries, working to bring clean water to communities, teach children, help start new businesses and stop the spread of AIDS. Since 1961, more than 163,000 Americans have joined the Peace Corps, serving in 135 nations. Volunteers receive intensive language and cross-cultural training in order to become part of the communities where they live and help to impart the transfer of technology.

International Development Research Centre/Canadian International Development Agency (IDRC/CIDA)

The IDRC is a Canadian-based corporation that was created in 1970 to help developing countries find long-term solutions to the social, economic and environmental problems which they face. IDRC/CIDA's architects believed that the powers of science and technology could be harnessed to promote economic growth and development in the South. Their mandate is to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means of applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions. The objectives are to:

- Assist scientists in developing countries to identify sustainable, long-term, practical solutions to pressing development problems;
- Mobilize and strengthen the research capacity of developing countries, particularly the capacity for policies and technologies that promote healthier and more prosperous societies, food security, biodiversity and access to information;
- Develop links among developing country researchers and provide them access to the results of research around the globe, in particular, through developing and strengthening the electronic networking capacity of institutions in developing countries that receive IDRC funding;
- Ensure that the products from the activities it supports are used by communities in the developing world and that existing research capacity is used effectively to solve development problems; and

- Assist national agencies, including non-governmental organizations to arrive at solutions to particular developmental problems.

To achieve the above objectives, the IDRC/CIDA funds the work of scientists working in universities, private enterprise, government and non-profit organizations in developing countries and provides some support to regional research networks and institutions in the Third World. The Canadian Government also supports the Voluntary Service Overseas (VSO) programme, which is similar in implementation to the United States of America's Peace Corps Programme.

The Green Revolution

A prime example of international technology transfer is the green revolution which represents the most striking example of international cooperation in technology transfer. It epitomizes what international institutions and efforts could achieve by working together for a common cause. Unfortunately, however, it also points out the consequences of inappropriate technology transfer and the ultimate problems that are encountered when dealing with development issues.

The term "Green Revolution" was coined in the 1960s to highlight a particularly striking breakthrough when improving seeds through experimentation produced varieties of wheat that dramatically increased yields in test plots in northwest Mexico. Much of the reason why those "modern varieties" produced more than traditional varieties was that they were more responsive to controlled irrigation and to petrochemical fertilizers, allowing for much more efficient conversion of industrial inputs into food. With a big boost from the International Agricultural Research Centres created by the Rockefeller and Ford Foundations, the "miracle" seeds were introduced into Asia and soon new strains of rice and corn were also developed. By the 1970s the term "revolution" was well-deserved, for the new seeds, accompanied by chemical fertilizers, pesticides and, for the most part, irrigation, had replaced the traditional farming practices of millions of Third World farmers.

The Green Revolution demonstrated that introducing any new agricultural technology into a social system without addressing the social questions of access to the technology's benefits, will over time, destroy the very resource base on which the technology depends for its growth.

The introduction of these new farming technologies, however, came at a cost. Additional resources had to be allocated from the scant resource base of developing countries to provide for the requirements of the new seed varieties. Supporting institutions to conduct research and development had to be established to monitor the technological advances. However, the good intentions notwithstanding, only a few countries could benefit directly from this revolution, with India as a prime beneficiary.

National technology transfer mechanisms

The lack of success in developing countries with technology transfer has prompted numerous papers, seminars and studies on the causes of the lack of progress. The research has

generally concentrated on the worldwide, regional or national level, while a major factor has not been considered - the fact that in the poorest countries there are pockets which mimic the developed world, where technology transfer takes place and does make a difference. However, the size of these pockets is usually quite small in comparison to the country and may be overlooked by national development efforts.

If this area that is often overlooked can be brought into the mainstream of activity through technology transfer from within, then it is possible that advances at the global or regional landscape will improve. It is this concept that is being advanced in this paper and it is within that context that the various methods of national technology transfer will be analysed.

Rationale

Most Caribbean islands have area disparities in development leading to skewed development regions. The most developed areas are around the capital cities where infrastructure, institutions of higher learning and government ministries are located. For example, most agricultural activities take place in the rural areas, but the ministry, which is the administrative centre, is usually situated in the capital city.

Conversely, rural areas often lack adequate supplies of potable water, no electricity and little access to learning institutions. These areas may be described as being technologically poor and therefore require assistance from urban institutions. Unfortunately, not unlike the underdeveloped or developing countries, the avenues for technology generation and development do not exist and technology transfer is equally difficult. This situation can be compared to that whereby technology transfer is encouraged from developed to developing country.

While the problem of technology transfer among countries has been the subject of many studies, there has been almost total neglect of technology transfer within a country. However, if a country is to develop, it is important that the means of improving production and productivity be afforded to all areas, both urban and rural, in order to arrest that rural-urban divide, reduce unemployment and create a more just society.

Types and methods of technology transfer (Needs/requirements, cost and benefits)

In-country technology transfer mechanisms have generally taken any one or a combination of the following forms:

- (i) Agricultural extension;
- (ii) Health inspectors;
- (iii) Technical schools;
- (iv) Seminars and workshops;
- (v) Media advertising;
- (vi) Apprenticeship programmes; and
- (vii) Fisheries extension.

(i) Agricultural extension: Because the islands of the Caribbean were primarily agricultural estates, technology transfer within the agricultural sectors is well-established.

The dismantling of the estates and the increase in small farmers mandated that mechanisms be established to provide advice to farmers. The Ministry of Agriculture therefore established the extension service. A fundamental problem with the extension service was that it had to deal with the difficulty of introducing new crops for export to a group that had previously engaged in subsistence farming. As incentives to grow the crops, cash payments were made to these farmers to practice soil and water conservation and other land preparation techniques. Planting material was distributed at reduced cost or often at no cost to the farmer. While this approach helped to introduce the crops, it made the task of imparting the lessons to the farmer very difficult in that the farmers expected to be paid, even if the practices were introduced for their own benefit. In addition, extension officers were not adequately trained. The majority had some training but most lacked the necessary experience in the field that would be convincing to the farmers whom they were to advise. Thus, while in most cases crops were introduced, poor husbandry resulted in poor yields, depleted soil fertility and erosion. Quality assurance was also not a major concern and it was therefore difficult to introduce the concept at a later stage when competitiveness became a major issue in the marketplace.

Successful agricultural extension programmes have been shown to be those that:

- (a) have support systems in place to provide continuous information to the donor;
- (b) require as much effort and commitment on the part of the recipient as on the donor; and
- (c) allow the donor to be involved with the activity and lead by example, thus gaining the confidence of the recipient.

The structure of the agricultural extension programmes in the region were not structured to facilitate these requirements. Except in the United States Virgin Islands where agricultural extension is an integral part of the University programme that operates the experiment station, Extension Programmes in the other islands are all under the aegis of the Ministry of Agriculture with little linkages to universities that do research or teach. As well, extension officers are public servants who are not allowed to engage in private practice and therefore have very little experience with the very problems which they are called upon to solve.

As a technology transfer mechanism, it can be said that agricultural extension failed to realize its potential, primarily in terms of the manner it was introduced and the lack of receptivity on the part of the recipients. The donors were ill-prepared and the recipients lacked the absorptive capacity in terms of receptivity and entrepreneurship.

(ii) Health inspectors: Public health inspectors had the dual responsibility of training and prosecuting persons in areas of vector control, sanitary and phyto-sanitary issues and other matters relating to the general health of the community. It was hoped that through training, the general public would be aware of the various steps necessary to combat such issues as mosquito

eradication, poor meat quality and solid waste disposal. Unfortunately because these inspectors also had punitive powers it was easier to exercise those powers rather than taking the longer process of educating the public. There was also the problem of these officers working in isolation from other community groups which could have helped in the general education programmes. There was no coordination of activities at the community level between the agricultural extension officer and the primary school system in the community. Hence, in most cases ways to circumvent the requirements were found and the magnitude of the various areas to be covered by the inspector made it impossible to effect control using the punitive approach. As a technology transfer mechanism this process had limited success.

An effective health inspection programme required a change in the mandate of the officer. It needed coordination and cooperation with the school system, the extension service, the village councils and some aspect of the community policing programme, where persuasion rather than prosecution would be the means of influencing behaviour. To achieve this, a change in the policy framework at the national level through devolution of authority from central government is needed.

The benefit of such a programme would be to approach health issues on a community basis, involving nutrition, insect control and waste disposal as integral parts of the programme. The task of doing this within the present administrative system is Herculean.

(iii) Technical schools: Technical education in the region has generally targeted the less academically inclined, but it is still concentrated within the urban areas. In most cases entry requirements are high and secondary or post secondary cost may be a limiting factor for those most in need. The curriculum is usually geared or fashioned to enable the passing of an external examination and in most cases is limited in the hands-on approach. Some effort has been made to increase the activity part of the curriculum, but the high cost of equipment and maintenance limit the number of schools that can be adequately furnished. As a replacement for the apprenticeship programme that existed in the region, the technical education programme has not attained the goal of providing trained technicians than can service equipment as well as create self employment. It does have the benefit, however, of preparing students and providing the environment for technology transfer, after the student receives on-the-job training within a firm, a garage or a machine shop. In that respect it best serves as a precursor for technology transfer, an important element in the process itself. There is still some discussion in the region as to what admission requirements should be, where should these institutions be placed, and what should be the major curricula focus given the limited resource constraint.

Technical training is still too formalised and rigid in approach. It appears that technical skills are being sacrificed for standards as defined by educational institutions and not by the need to meet the needs of a particular area represented by the majority of carpenters, masons, joiners and mechanics, who still receive most of their training from the non-formal school sector. There is therefore the need to seriously address the intake levels of students in order to provide improved skills to those who now fill an obvious deficiency in the market. In addition, there needs to be flexibility in the system to allow for the more academically inclined to participate in programmes that will be link directly with the information technology industry, and at the same

time catering the simpler requirements such as equipment maintenance and repair, which remain a very pressing problem in the region must be addressed.

This dual approach would provide a good spring-board for the more entrepreneurial groups as well as substantially improve the skills of the less adept. Both would no doubt improve the quality of workmanship as well as improve standards in such areas as construction, furniture making and small engine repair, areas that are vital for the maintenance of the industrial base of the country.

(iv) Seminars and workshops: Taking as a guide the number of seminars and workshops on various topics in the region, this method of technology transfer remains the most dominant. For example, not less than 10 seminars and workshops were conducted on resource management in Saint Lucia during the year 2000. A general criticism of these is that they were usually conducted outside of the areas where they could have the most impact on the areas dealing with issues under consideration. Most were conducted in the capital, targeted at audiences that may not be directly involved in the solution process. In addition, the materials were not usually appropriate to the specific areas, and there was inadequate analysis and knowledge of area specific issues. A number of other weaknesses of this method have also been identified. These seminars and workshops generally take the form of formal presentations and discussions with limited case study analyses. Cost considerations usually limit the time spent on demonstrations. Participants are usually not given timely notice to prepare for participation. Often, the wrong persons are invited to attend. Opportunities and avenues for imparting the knowledge gained at the community level or even at the private level usually do not exist. Follow-up activities and monitoring mechanisms are absent.

As a mechanism for technology transfer the seminar and workshop method has had limited success in the region. It generally serves more to create awareness and can sometimes serve as a vehicle for support mobilization. As a problem-solving approach, especially in the agricultural sector where it has been used extensively, it has had success only in catastrophies, for example, in the control of the pink mealy bug and swine fever, where immediate action is needed. However, as a learning or culture change process its success is negligible, especially in the areas of health, agricultural and waste disposal, sectors where it probably could have the greatest impact.

(v) The media: The vehicle with the most potential is still underutilized in the region. While rural areas may not be well served with the infrastructure, or the numbers to support newspaper circulation cost, or have the same level of literacy as in the urban areas, the media, both audio and visual, remains the most effective agent of behaviour change. Even in the urban areas the number of locally produced articles or materials for technology transfer or knowledge dissemination is limited. A number of institutions, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Caribbean Council for Science and Technology (CCST), the Caribbean Agricultural Extension Programme (CAEP) and the International Labour Organisation (ILO) have tried to address the problem of lack of trained personnel to prepare science-oriented material for the media by hosting workshops and seminars on the topic. Out of these seminars and workshops a number of audio-visual materials have been prepared. Yet the frequency of these on the airwaves and the screens remain low, suggesting that

the same problems that hinder the effectiveness of seminars and workshops as transfer mechanisms also come to play in the effective use of the media as a medium for technology transfer.

While it has been argued that the cost of producing these articles is high, there has not been a comparative costing of not producing articles for local consumption that may increase productivity by the State. The ease with which foreign produced materials are available on the multitude of foreign channels in the region may itself be a disincentive to capitalize on a captive audience. With very little relationship between what is seen or heard and everyday life, it is difficult to transfer what is seen into productive activity.

(vi) Apprenticeships: A technology transfer mechanism that existed in the region previously is beginning to regain prominence. Recognizing that the school system at all levels is now turning out the type of students that are required for the productive sector, most firms, institutions and companies are offering opportunities to persons to undergo a period of training in-house. In fact, one of the most successful programmes in Trinidad and Tobago has been the Youth Training and Employment Partnership Programme (YTEPP) that is tailored to train persons for specific jobs based on market surveys. Direct relationships with industries have been developed as a result.

Early apprenticeship programmes targeted those persons whose educational skill were minimal and were usually focused on the trades such as carpentry, masonry, joinery, tailoring and vehicle repairs. From these, the crop of persons for the continuity of these enterprises was assured. Although many of them could not read a plan or blue-print they acquired sufficient mastery of the art to improve on what they were taught and even came up with designs of their own. It is interesting to note that in the islands that still have sugar factories, most of the equipment is still maintained by persons trained through apprenticeship and who continue to operate lathes to this day to make parts which are not easily obtained. Changes in economic activity, the introduction of new materials and advanced technologies, however, required a higher level of understanding and entry requirements. It was not enough to have a desire for a particular trade to qualify as an apprentice, and the apprenticeship programmes were fast being replaced with technical programmes at learning institutions. Unfortunately these institutions were not directly involved with industrial activity so theory replaced practice to the detriment of the industries.

It is this deficiency that is now being addressed with the new on-site training programmes and the recognition that practice and experience remain critical elements for efficiency and performance, themselves critical factors in the technology transfer process.

(vii) Fisheries extension: Recognizing the need to boost marine fish catch while at the same time conserving the fisheries, resource fisheries extension has become a new feature in technology transfer in the region. Because of the nature of the industry, fisheries extension has been very successful as a technology transfer mechanism. At the Caribbean Fisheries Training Institute in Trinidad, programmes are run for both fishermen and fisheries officers, but the most successful programmes are those that train these two groups together, establishing a bond between trainer and trainee. This is possible because both trainer and trainee need to be at sea or

to be interconnected with the sea in order for technology transfer to take place. The expertise of the extension officer in the areas of resource management is reinforced by further training and the results of work done at such institutions as the Institute of Marine Affairs (IMA), the University of the West Indies (UWI) and the National Resources Management Unit (NRMU) of the Organisation of Eastern Caribbean States (OECS). They are able to influence fishermen in these fields by virtue of their earlier acceptance, and thus impart knowledge and information that is critical to the survival of the fisheries on which the fisherfolk depend. No where is that more evident than in the programmes to rehabilitate conch, lobster and sea egg (*Treponeutes esculentes*) populations. The success of these programmes has brought what was a near-depleted species into sustainable populations within a 10-year period. Not a long time considering the length of time of over-fishing, the biology of the species and the effects of other factors such as pollution, over which the extension officers do not have control.

Fresh water fisheries had been introduced in the region from as far back as the 1940s but never caught on for a number of reasons not the least was the cultural preference for marine fish. However with the dwindling of the marine fisheries, there were concerted efforts in the early 1970s to promote fresh water fisheries. Successful programmes in this area have been established in Jamaica, the United States Virgin Islands and Dominica. Other islands like Saint Lucia and Barbados have some inland fisheries but not on a commercial scale. Tilapia remains the most dominant fish specie, while some shrimp is also produced. Guyana and Belize have had large commercial enterprises for a long time.

Technology transfer in the fresh water fisheries sector has also been successful, because from a very early stage both trainer and trainee made contributions to policy and implementation of the projects.

Conclusion

The approaches outlined above do not represent all of the local technology transfer situations. They do, however, represent the major formal methods of technology transfer within the State and, as has been mentioned before, the success of the methodology appears to be similar to the situations and conditions that enhance success for transfers between States.

These situations and conditions are, *inter alia*:

- (a) The availability of infrastructure within the area for efficient application of the technology;
- (b) The extent to which the technology builds on existing knowledge;
- (c) The readiness of recipients to incorporate technology;
- (d) The extent to which the recipients understand or are made to understand the meaning, operations and consequences of the use of technology;

- (e) The extent to which the provider of the technology can obtain the trust of the recipient;
- (f) Commitment on the part of the recipient to contribute to the success of the technology;
- (g) The extent to which the provider is supported by continuous new knowledge or information than can help to address problems posed by the technology;
- (h) The acceptance of technology by the recipient as providing improved conditions to existing and future situations;
- (i) The cost of the technology does not become onerous to the recipient.

There are other factors of culture, educational level, political affiliation that do affect the transfer of technology, but these are not as insurmountable as the above demonstrates, and they can usually be addressed in the planning stage of the technology transfer exercise, especially within countries.

Additional reading on technology transfer mechanisms.

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