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SCIENCE, TECHNOLOGY AND THE NEW INTERNATIONAL ECONOMIC ORDER

THE TWINNING CONCEPT IN THE CANADIAN FEDERAL GOVERNMENT CONTEXT

report

rapport

SCIENCE, TECHNOLOGY AND THE NEW INTERNATIONAL ECONOMIC ORDER

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J.A.S. Walker

Ministry of State for
Science and Technology

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"There is a new world in the making and a spreading awareness of that fact. No nation can afford to isolate itself in self-contemplation clasping to its breast its possessions in denial of others."

Pierre Elliott Trudeau,
Address to the United Nations
Habitat Conference, May 1976.

"Canadians are becoming increasingly sensitive to the fact that Canada cannot live in dignity as a nation while other people, in less fortunate lands, live in a state of deprivation and hopelessness.

It is not in Canada's economic, political or moral interest to allow the gap to widen between the wealth of the few and the poverty of the many. Therefore the Government will continue to participate in the task of shaping a new international economic order, designed to provide a greater measure of hope to nations seeking the opportunity to help themselves."

Speech from the Throne,
12 October 1976.

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V. Bradley, International Division, utilized his extensive knowledge of the UN to assist-particularly with the preparation of Section III; D. Rowat, Program Review and Assessment Division, provided statistical expertise; J. Stone, University Branch and R. Swann, Industry Branch, contributed from their knowledge of these sectors. Finally the total effort was ably rounded out by the patience and substantial secretarial skill of M. Pender, International Division.

To these colleagues the appreciation and thanks of the author are formally presented.

Few studies of twinning or indeed of the role of departments and ministries of the governments of developed nations in international assistance exist. In this initial phase therefore heavy reliance was necessarily placed upon informal interviews with those whose duties bring them into contact with the developing ccuntries. To the many officials who so willingly gave their time and experience a formal debt of gratitude is acknowledged. Not only their help but their interest in the project went a long way towards convincing those involved in the study of its timeliness.

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EXECUTIVE SUMMARY

INTRODUCTION

In spite of two decades of substantial international assistance the gap between the few industrialized nations and the many less Developed Countries (LDC) not only still exists but is rapidly worsening. This situation, fuelled by the recent world economic crisis, has resulted in a new international solidarity between the developing countries and a determination to bring about a radical reconsideration of the economic relations between themselves and the developed countries. The adoption by the United Nations in 1974 of a resolution aimed at a 'New International Economic Order' is one prime example.

Underpinning the initiatives of the developing countries, (collectively known as the 'Third World'), is the conviction that the road towards greater international equality lies in rapid industrialization. This fundamental strategic goal has been manifested in recent demands in international fora aimed at securing a more effective and accelerated transfer of technology from the industrialized nations, easier access to their capital and manufactured goods markets, and commodity price stabilization.

The physical transfer of technology is one thing, its successful adaptation and implementation however quite another. Differing social and economic environments demand different technological approaches; the enhancement of the national capability of developing countries to select, adapt and assimilate relevant technology has thus become a prime factor in the strategies of undeveloped and developed nations alike.

Bitter experience has, however, shown that imported expertise, no matter how well intentioned, is often of limited value. National, not foreign eyes must be brought to bear on local problems and priorities, and national expertise developed to judge the potential of science and technology (S&T) to solve them. The rapid establishment of a 'critical mass' of national or regional scientific competence in sectors of vital importance is therefore a prerequisite for both the most effective application of external S&T resources and the development of a self-sustaining capability.

The recognition of these factors has crystallized in a set of major interrelated demands being made by the Third World within the United Nations context. In essence these appeal to the industrialized nations to:

a) Increase their level of S&T assistance to developing countries to 0.05% of the GNP.

b) Devote 10% of their domestic R&D effort to the solution of problems of specific interest to developing countries; and

c) Move away from the old traditional forms of technical assistance towards new mechanisms emphasizing a cooperative approach.

While rejecting the specific targets proposed by the Third World as unrealistic, the developed countries, including Canada, are nevertheless moving towards an acceptance of the underlying concepts involved. One manifestation of this acceptance was the announcement by Canada's Secretary of State for External Affairs during the recent UN Conference on Trade and Development, (May 1976), that Canada intended to explore further the creation of links between National research institutions and their counterparts in developing countries.

As a first step towards meeting this commitment and in response to a request from the President of the Canadian International Development Agency (CIDA), the Ministry of State for Science and Technology decided to undertake a short, in-house study of the concept of such institutional linkages or 'twinning'. In view however of the limited time and resources available it was decided to concentrate exclusively upon the Federal Government sector rather than to cover, in a first preliminary examination, the universities, provincial and private sectors.

TERMS OF REFERENCE

1. To elaborate the concept of 'twinning' science-oriented organizations of the Canadian Federal Government with their counterparts in selected developing countries.

2. To carry out a preliminary assessment of the concept's feasibility and potential.

3. To make recommendations on the desirability of formal interdepartmental discussions concerning the possibility of implementation.

CANADA'S TECHNICAL ASSISTANCE PROGRAM

Data on Canada's technical assistance program to the degree of detail ideally required to support the Study was not readily available. Nevertheless it was possible to identify the broad characteristics of the National effort including the role

currently played by the scientific organizations of the Federal Government. From these it is concluded that:

1. CIDA's technical assistance program, though sizeable and effective, is traditional in nature and as currently conceived goes only some way towards meeting the stated needs of the Third World in the scientific area.

2. The IDRC represents a highly innovative and effective mechanism for building up the indigenous scientific capabilities of the developing countries and regions. Its present orientation however is aimed squarely at supporting research in the Third World itself which restricts its use of Canada's substantial scientific expertise.

3. The Nation's largest single scientific resource - the science-oriented departments and agencies of the Federal Government - is neither involved in international assistance in its own right nor, in terms of research, tapped to any significant extent by CIDA and the IDRC.

4. As matters presently stand Canada is not responding effectively to the Third World's request for a proportion of the National domestic R&D effort to be devoted to the problems of the developing countries nor to their desire for more cooperative research to be undertaken with them.

MAJOR PROBLEMS

That departments are not more involved in the Nation's international technical assistance program is due neither to lack of effort by CIDA nor to disinterest on the part of the departments themselves. Their response is conditioned by the present lack of both a mandate which would permit departments to engage in international development activities in their own right and of a clear policy encouraging them to do so. In the absence of either, only those 'spare' resources available after domestic priorities have been met can be committed to international assistance and these in the present financial climate are likely to be slim indeed.

The lack of appropriate departmental mandates in this area is considered to lie at the foundation of several other allied problems of which the question of the involvement of senior management is perhaps the most important. With some exceptions senior departmental management does not appear to be closely involved in international development activities and where such

participation does exist it is usually in a responsive mode to specific requests from CIDA or IDRC. The kind of high level professional expertise which could select and match Canadian Scientific capabilities to the needs of the developing countries is therefore not readily available - a situation reflected for the same basic reason at the interdepartmental level.

Major problems are also seen by participants in assistance activity: among those reported during interviews were adverse effects on career prospects, difficulties of reassimilation on return, lack of recognition by peers for research achievements and non-utilization, on return, of expertise gained.

The key to the solution or at least easing of this type of problem lies in an acceptance by departments - and particularly by senior departmental management - of international assistance as an intrinsic part of domestic activities.

While the development of suitable policy and policy mechanisms is a crucial issue, it is matched by the practical question of where the resources - both financial and staff - to meet an enhanced degree of departmental participation in international assistance are to come from. Policies and mandates may lead the departmental horse to water but it will not drink unless necessary resources are forthcoming to meet the new commitments.

Even where - as is presently the case - participation is fully funded by CIDA, departments are faced with certain hidden costs which make such participation unattractive. Man-years or sometimes funding may be provided to offset departmental experts seconded to technical assistance abroad; the experienced staff of most value to the developing countries are however needed to manage and execute departmental programs. Their loss cannot normally be offset by the employment of temporary external resources. Furthermore man-year credits do not appear to be available to cover that proportion of the time of departmental officials based in Canada devoted to directing international assistance projects or to training scientists from the developing countries.

It is therefore concluded that:

1. If departments are to respond effectively to the scientific needs of the developing countries a radical change in approach will be necessary. International assistance activities must become a recognized part of departmental research programs and not viewed as the exclusive prerogative of CIDA or the IDRC.

2. A policy mandating and encouraging departmental involvement is needed. This must however be complemented with decisions on how resources needed to support such participation are to be found and the mechanisms through which they should be applied.

THE TWINNING CONCEPT

The use of institutional linkages or 'twinning' arrangements to provide technical assistance to developing countries has been widespread for many years. They take many different forms and appear under various names in several sectors.

Twinning differs from the more traditional project approach by virtue of being a sustained activity of a more general nature. In a real sense it represents an overall framework within which several projects or related program elements can take place.

In the scientific context a type of twinning linkage is required which emphasizes the systematic exchange of research experience, training and technical cooperation between two scientific institutions. While acknowledging the experience and facilities available in the developed country it also recognizes that those closest to the point of application of R&D innovation best understand the problems of its adaptation and application.

In the narrow context of the scientific portion of the Federal Government the following definition is offered:

> "A twinning arrangement will be a formal sustained institutional linkage between a science-oriented Federal Government department, agency or institution and an institution with broadly corresponding aims located in a developing country or region. Its primary objective is to assist the LDC institution reach a state in which it has achieved a self-sustaining capacity for action in its field of concern."

Ideally such a linkage will meet all of the following criteria:

a) It will be the subject of a formal agreement between participating institutions.

b) It will be long-term in nature (probably not less than five years).

c) It will be general in nature and cover a series of activities such as a regular information exchange, provision of training in Canada and in the developing country, provision of Canadian experts, use of Canadian

laboratory facilities and/or equipment and will involve joint collaborative research projects in the developing country.

d) It should provide, if possible, for research to be undertaken in Canada directed towards the solving of problems of priority concern to the developing partner; and

e) Be of mutual - though not necessarily equal - benefit.

Properly selected, a twinning arrangement offers substantial advantages to both partners.

To the institute in the developing country these include:

a) The necessary continuity of policy, advice and assistance without which expertise transferred is often not durable or not further exploited - a major weakness of a short-term "one shot" project.

b) A more combined or systems response to a given development need with the separate technical assistance elements - training, provision of experts, joint collaborative programs, etc. - being provided under a single overall plan rather than as disparate activities involving several different organizations.

c) A more responsive and flexible type of technical assistance. Short visits - particularly by senior staff - can be quickly arranged to meet crises. Longer term secondments and training can be adjusted more conveniently to respond to changing circumstances and experts to meet unforeseen needs or to replace those returning more easily found.

d) Direct access to a major resource of knowledge, expertise and sophisticated equipment usually not available locally.

As far as the institution in the developed country is concerned such linkages can substantially enchance the potential contribution which can be made. Some major considerations are as follows:

a) A sustained linkage facilitates the development within the institution of general expertise in the international assistance field and a better understanding of the needs of developing countries - particularly those of its counterpart. Its response in terms of the type of training offered, experts made

available and technology transferred will therefore be more relevant - perhaps the single most important point being currently made by the developing countries.

b) By concentrating on a few well chosen twinning arrangements, the institution is likely to achieve more than if its limited resources are dissipated in a series of unrelated development activities.

c) The isolation often experienced by expatriate scientists working unsupported in a developing country will be largely offset by the existence of a home base committed as an institution to the activity in which he is involved and whose resources are therefore conveniently available to him.

While offering the advantages mentioned above, twinning arrangements nevertheless present certain characteristic problems. Compared to many traditional forms of technical assistance their cost in time and resources can be high and they require a long-term commitment to be made. Care must be exercised to guard against an undue influence being exercised by the 'developed' institution on the main objectives of the developing partner. Finally the arrangement should contain at the outset an agreement to gradually change the association to a more informal one to prevent an unhealthy dependence being built up. These and other potential problems can however be largely avoided by careful selection, preparation and management.

Although traditionally regarded as a bilateral mechanism twinning is also considered to offer potential in a multilateral context. The concept of the regional research institution founded and managed by a group of developing countries is being actively promoted by the United Nations. The effort is primarily aimed at those 'least' developed countries in which R&D resources are minimal and national priorities focused on very survival.

A regional approach can be most effective in such research areas as meteorology, fisheries and pest control, etc., where the problem area under consideration is not contained within national boundaries. It offers the possibility of a shared capability to countries whose domestic resources would not permit the establishment of national organizations and, to the institution in Canada, a means of obtaining a wider dissemination of the benefits resulting from its contribution.

In sum, the type of R&D twinning arrangement discussed in this study is considered to represent a most effective mechanism for building up the indigenous scientific institutions and infrastructures of developing countries - key factors in their drive towards industrialization.

FEASIBILITY AND SECONDARY BENEFITS

Detailed consideration of the three existing examples of "near twinning" which exist within the Federal Government, together with an evaluation of the concept's contribution to broader questions of trade and aid lead to the following conclusions:

1. The application of the twinning concept within the Federal Government context is considered to be feasible only if appropriate policies and mechanisms to facilitate the entry of departments into the international assistance field are established. Paradoxically this situation represents a potential benefit as twinning would thus bring about the very policy and administrative initiatives needed to enhance departmental participation in other forms of technical assistance.

2. Twinning relationships need not and should not be viewed in the traditional donor-recipient context but approached with the aim of jointly attacking scientific problems of common interest. Research of value to both partners can be identified providing the will exists and the right departmental experts are involved. Possibilities presented by the different environments and substantial scientific capability of the more advanced developing countries could be recognized and grasped.

3. Like many technical assistance activities twinning could offer the advantages of contacts, wider exposure and a broader international market base to Canadian firms providing appropriate services, equipment or expertise. The potential of contracting out services required either as part of a twinning relationship or to replace departmental resources committed to such a relationship should not be ignored.

OTHER INDUSTRIALIZED NATIONS

This Study has briefly reviewed new trends in technical assistance policy in six developed nations - Sweden, Japan, the Netherlands, France, Germany and the United States - and has pointed out some significant new orientations and initiatives.

Interestingly enough, two countries - Japan and the Netherlands - have used the twinning approach in their latest ventures.

Each nation reviewed has established one or more mechanisms aimed at focusing appropriate domestic scientific and

technological resources on international development problems. No such instrument presently exists in Canada.

RECOMMENDATIONS

Canada has gained a widespread and enviable reputatior for her efforts to help the developing nations of the world. In the field of science and technology the activities of CIDA have been substantially enhanced by the international programs of the IDRC. International development however, is an evolutionary process and CAnada's technical assistance program as presently constituted no longer responds to the new demands of the Third World. The question now is whether a further step should or could be taken to involve the substantial domestic R&D capabilities of the science-intensive departments and agencies of the Federal Government. The desire for such involvement is believed to be growing within the departments themselves and is coupled with an appeal to this end from CIDA.

The concept of twinning, as defined in this Study, is considered to represent not only a powerful mechanism for the transfer of scientific and technological expertise in its own right but also a 'cause celebre' which could focus attention on the problems currently inhibiting the diversion of some of Canada's single largest scientific resource to the benefit of the developing nations.

Though regarded as feasible its full potential will not be exploited until these obstacles are removed. Among major questions to be addressed are the following:

a) By what means are resources of funds and man-years to be channeled to departments? Direct to departmental budgets? Through CIDA? Through a central resource pool similar to current energy R&D arrangements?

b) How are such resources to be fitted into the overall National development assistance program, priorities fixed and assessments made? Who for instance will identify potential twinning partners in the developing countries and decide between contenders?

c) How will the various domestic and international components of departmental participation in a twinning arrangement be funded, through what mechanisms and by whom? What major financial and other control mechanisms will be necessary and how should they be established?

d) Should <u>domestic</u> research aimed at attacking specific problems of developing countries be classified as Official Development Assistance?

These questions have far-reaching implications for the many departments and agencies involved. It is therefore strongly recommended that:

1. Interdepartmental action be initiated to further examine the potential and benefits of, and modus operandi for, twinning scientific institutions of the Federal Government to selected counterparts within developing countries or regions with a view to recommending its early adoption on a pilot basis.

2. A concomitant interdepartmental review be undertaken of the present involvement of science and technology intensive departments and agencies of the Federal Government in the National technical assistance program with the aim of recommending measures to enhance the contribution made.

The science and technology component of the Federal Government is complemented by similar resources in the university, provincial and private sectors; resources moreover which are able to offer different expertise equally valuable and pertinent to the needs of the Third World. The twinning concept is currently being applied by CIDA within the university sector but only to a very limited extent in the other two. It is therefore recommended that:

3. Consideration be given to a feasibility study of the concept of twinning Canadian provincial and industrial research institutions with counterparts in selected developing countries and regions.

Time did not permit anything more than a fleeting examination of the policies and mechanisms currently used by other developed countries to respond to the scientific needs and demands of the Third World. Even this rough and ready approach however produced ideas and information of value and suggests that further more detailed study would be worth undertaking in parallel with interdepartmental activities in this area if the latter is subsequently authorized. In this event it is recommended that:

4. Consideration be given to a more extensive study of the technical assistance policies of other developed nations with particular reference to their use of the twinning concept and mechanisms adopted to involve their scientific and technological communities in the international development field.

LE DERNIER MOT

Progress towards meeting some of the major needs of the Third World in the area of science and technology and thus helping create a more equitable world order depends to no little degree upon whether the Canadian Government succeeds in mobilizing the opinion and support of its own scientific community. It is hoped that this study - in its own small way - will contribute towards this process.

SECTION I - INTRODUCTION

BACKGROUND

In spite of substantial assistance over the last two decades the gap between the relatively few rich countries of the World and the many poor not only remains but is widening.

Increasing pressure is being placed in international fora by the less developed nations - collectively known as the 'Third World' - upon the more industrially developed both to increase their international assistance and to vigorously search for new ways of making it more effective.

As part of this process the crucial role of technology in economic and social development is being increasingly recognized, with the question of how to effect its transfer to, and efficient absorption by, the developing countries receiving priority attention in the United Nations and other major international organizations.

Discussion of the concept and potential of institutional linkages - 'twinning' - between Canadian science and technology intensive institutions and selected counterparts in the Third World first arose during the presentation by the Canadian International Development Agency (CIDA) of its 1975-1980 strategy to senior representatives from developing countries. Further impetus was added during interdepartmental preparations for UNCTAD IV.[1]

Subsequently the President of CIDA wrote to the secretary of the Ministry of State for Science and Technology (MOSST) on 11 March 1976 expressing the wish for closer collaboration between the two organizations with a view to enchancing Canada's response, in the scientific field, to the needs of developing countries. In this context the question of a study of the potential of 'twinning' was specifically raised.

In May of the same year the Canadian Minister of External Affairs in addressing the Fourth United Nations Conference on Trade and Development at Nairobi, emphasized Canada's continuing

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[1] The Fourth United Nations Conference on Trade and Development, Nairobi Kenya 1976.

commitment to the development of relevant technologies for countries of the Third World and announced its intention of further exploring "the creation of links between research institutions in Canada and corresponding institutions in developing countries."[2]

In order to respond to the current interdepartmental search for initiatives which Canada could take to assist in the enhancement of the technological infrastructures of the developing nations, and in the context of national preparations for the forthcoming World Conference on Science and Technology for Development, MOSST therefore decided to carry out a short study of the concept of twinning and a preliminary assessment of the feasibility of such a concept in Canada.

The idea of linking an institute in a developed country to its counterpart in a developing country is not new. Such links already exist in various forms and between many countries. In order to limit the scope of the study to manageable proportions, however, and to respond as nearly as possible to the stated requirements of developing countries in the scientific area, the emphasis was placed on that type of linkage which provides scientific research, assists in the development of an indigenous capability to carry out research and enhances indigenous scientific infrastructures.

In view of the limited resources and time available a further decision was made to concentrate exclusively on the science-oriented departments/agencies of the Federal Government rather than to cover, in a first preliminary assessment, the universities, provincial and/or private sector areas. The Federal Government sector represents the single largest scientific resource in Canada and was, moreover the most readily available source of data.

AIMS

The main aims of this paper are therefore:

1. To elaborate the concept of 'twinning' science-oriented organizations of the Canadian Federal Government with their counterparts in selected developing countries or regions.

2. To carry out a preliminary assessment of the concept's feasibility and potential.

3. To make recommendations on the desirability of formal interdepartmental discussions concerning the possibility of implementation.

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[2] Speech by the Hon. A.J. MacEachen, Secretary of State for External Affairs at UNCTAD IV, Nairobi, 7 May 1976.

APPROACH

The transfer of technology and technical assistance to developing countries are both extremely broad subject areas in their own right. In attempting a short general 'pre-feasibility' study of the potential of twinning therefore, the major problem has been to achieve an appropriate balance between the detail represented by the special type of twinning arrangement under consideration and the far broader context of technical assistance into which it would fit.

This balance has been sought by using four broad approaches. First, a brief survey is made of the evolution of the demands and aspirations of the developing countries leading to the identification of their main current objectives in the scientific area. Second, the concept of twinning itself is addressed, models considered likely to meet these objectives discussed and some illustrative examples given. Third, the involvement of the Government's science-oriented departments/agencies in international assistance is briefly reviewed, some major problems identified and the potential of twinning both in its own right and as a means of enhancing the response of these organizations is discussed. Finally a short comparison is made of the approach of certain other developed countries including their use of twinning.

Data to the degree of detail ideally required to support the study is not readily available. It is, for instance, not possible in many cases, to accurately identify that part of the funding of a technical assistance project specifically covering the research element. Nevertheless sufficient data were at hand to indicate the broad characteristics and trends of Canada's technical assistance effort including the part played by the major science-oriented departments of the government. A more detailed analysis, if required, will have to form an element of future formal interdepartmental action.

By its very nature this study is designed primarily to identify major problems surrounding the implementation of Canada's commitment to find new mechanisms of providing scientific assistance to developing nations. Therefore while some pointers are given towards possible solutions it is emphasized that it will be for Phase II (the interdepartmental phase) to propose specific mechanisms needed.

SECTION II - THE DEVELOPING NATIONS' NEED FOR SCIENTIFIC ASSISTANCE

Science and technology, itself a broad and complex subject, is but one element of the far vaster area of international development. Even a cursory examination of either would be well beyond the scope - or need - of this paper. Nevertheless, some general background is considered necessary to form for the reader a framework into which the place and concept of twinning can be fitted.

The aim of this section is therefore to capture, no matter how fleetingly, the growing urgency of the world development crises, the increasing awareness of the inadequacy of "traditional aid", and the potential contribution foreseen-particularly by the developing nations-of new initiatives in the science and technology area.

THE WIDENING GAP

In spite of two decades of international development little is known about the ways in which the process can be successfully applied to the underdeveloped societies which form the bulk of the world's population. The greater part of the citizens of the Third World are still denied adequate food, shelter, health and employment possibilities, reflecting the failure of the early belief that the technology and capital of the industrialized nations would, if simply made available, galvanize underdeveloped societies into self-reliant growth.

While some progress has been made, the last few years have been marked by a global crisis in which a large number of developing countries have entered a period of "permanent emergency"[1] reflecting a growing polarization within the Third World itself of the more advanced and the very poor.

The very fabric of "traditional aid" which, no matter how well intentioned has led to an unhealthy donor-recipient relationship, is being called into question. New strategies aimed at the stimulation of national purpose and building self-reliance within the developing countries are being sought.

A NEW EMPHASIS

One direct and important result of the growing crisis has been the coalescing of the underdeveloped nations into a powerful voting bloc within the United Nations, (the so-called Group of 77). Recent UN sessions have been characterized by demands from the Third World for a radical reconsideration of the economic relations between the industrialized and the developing nations -

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[1] Strategy for International Development Cooperation 1975-1980 (CIDA 1975).

demands which at the Sixth Special Session of the UN General Assembly in 1974 resulted in the adoption of a resolution on a 'New International Economic Order'.

Underpinning the initiatives of the Third World is the conviction that the road towards greater international equality lies in rapid industrialization. This fundamental strategic goal has been manifested in the recent demands by the developing countries for a more effective and accelerated transfer of technology, easier access to the capital and manufactured goods markets of the developed countries and for commodity price stabilization. To these demands have been added others, such as debt relief, aimed at offsetting their growing balance of payments deficit.

THE TRANSFER OF TECHNOLOGY

The key role of technology in the development process of all nations of the Third World has long been recognized. Its importance in the context of industrialization is however a more recent phenomenon emphasizing the achievement of a certain stage in the development of the economic structures of a number of the more advanced developing countries.

Even in the more limited context of industrialization, technology (simplistically stated - the application of scientific knowledge towards the production of a process or product), and its transfer, (equally simplistically stated - the application of technology under a new set of conditions), is a broad and complex area. It embraces a whole range of subjects and fields from science, finance (foreign investment), rights (patents and licences) and information, (plans and designs), tc teaching (technical and managerial skills) and commerce (markets and foreign ownership). Its importance to the Third World is vividly illustrated by a recent UN study which estimated that in the late 1960s developing countries were paying some $1,500 million a year for patents, licences, knowhow, trademarks and consultancy services - a figure which was expected to reach $9,000 million by 1980.[2]

Issues related to the transfer of technology are currently the subject of intense debate in a large number of international fora, more particularly the various organizations of the UN. Examples range from consideration of the adoption of an international code of conduct on the transfer of technology to a possible revision of the Paris Convention on Industrial Property (patents) to give preferential treatment to the developing countries.

The physical transfer of technology is one thing; its successful implementation and adaptation however quite another.

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[2] UNCTAD doc, TD/B/AC.11/; Rev. 2, 1975.

The relevance of a given technology to a society depends on many factors - a good number of which are non-technical in nature. Technology embodies to some degree the social as well as economic objectives of the society in which it is developed and these in the case of the industrialized nations do not necessarily match those of far poorer countries. The application of a capital intensive technology to a labour intensive society is now seen as one of the more important mismatches. Thus assistance in the establishment and enhancement of national capabilities to select, adapt and assimilate foreign technology is a major new factor in the strategies of developed and underdeveloped nations alike.

THE PLACE OF SCIENCE

If an indigenous technological infrastructure - in its widest sense - is an essential prerequisite for industrialization then a research and development (R&D) capability, albeit modest, is an equally key component of the technological infrastructure. It provides the essential base resource needed to help identify and understand national problems susceptible to a technological solution, to choose and adopt the most appropriate foreign technology and to develop or adapt local technologies. In short, it brings national, not foreign, eyes to bear on national problems, needs and potential.

The current R&D effort of individual developing nations varies greatly not only in its breadth but also in the different scientific sectors. Even in the most advanced, however, the current level is not commensurate with their development needs. Figures of about 0.1% of GNP disbursed on R&D expenditures are typical compared with more than 2% in the most highly industrialized nations. In total, the Third World only accounts for some 2 - 3% of world expenditure on R&D.[3] There is moreover evidence that some at least of this effort is devoted to fundamental science rather than the applied science so badly needed to nourish technological development.

The traditional approach of the developed ccuntries to the scientific needs of the underdeveloped has been based on three major emphases: First, the education of scientists from the Third World in the universities of the developed countries; second, the secondment of scientists to the developing countries and; third, the implementation of projects/programs in the Third World by experts from the developed ccuntries.

Many substantial weaknesses in this approach have been revealed. The educational systems of the developed ccuntries, geared to meet their social-economic objectives, are often not relevant for the twinning of scientists who will subsequently return to developing countries. Returning Third World scientists find thus themselves in many cases poorly equipped to contribute

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[3] UN World Plan of Action for the Application of S&T to Development, 1971.

to the very different types of problems faced by their countries and with aspirations which cannot be met. The so-called 'brain drain' is one result.

In the same way expatriate scientists are faced on arrival in developing countries with an unfamiliar social and work environment and new problems which require considerable adaptation both personal and in terms of their skills. Often by the time the adaption process has been effected and experience gained, the period of secondment is over.

In the case of specific projects implemented in the whole or in large part by expatriate scientists, problems often occur when they depart. Experience suggests that even when so-called 'local counterparts' have been trained the end product is often not fully exploited because local expertise is neither sufficient to maintain momentum nor to build on the base left by the foreign scientist.

These and similar problems have led to a growing awareness of the need to build up as quickly as possible a 'critical mass' of indigenous scientific expertise in areas of vital importance to individual developing countries. New research must be carried out locally to deal with those particular problems posed by a given country's geographical location or social needs and a scientific community established which can make an impact on the development of its own nation.

THE 'TARGETS' ISSUE

As early as 1969 and in the context of the UN Second Development Decade debate the first steps were taken by the developing countries to persuade the developed countries to increase their support of science and technology for development.[4]

Subsequent moves in this direction were taken by the UN Advisory Committee on the Application of Science and Technology to Development (ACAST) in 1973 with the proposal for the adoption by all UN member nations of what became to be known as the R&D Targets for Development.

These targets were aimed, as far as the developed countries were concerned, at a commitment both to increase their aid in direct support of science and technology to a certain percentage of GNP and to devote an increasing part of their own domestic R&D effort to specific problems of developing countries. The targets were not accepted by the developed countries.

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[4] Paragraph 63 of the Second United Nations Development Decade.

In 1972 the targets issue was raised again under the auspices of the Third UNCTAD.[5] Specifically the pertinent part of the final resolution adopted[6] is as follows:

> "Takes note of the wishes of the developing countries that the developed countries should:
>
> a) Devote 0.05 per cent per annum of their gross national product to the technological problems of developing countries;
>
> b) Allocate at least 10 per cent of their research and development expenditure to programmes designed to solve problems of specific interest to developing countries generally, and as far as possible devote that expenditure to projects in developing countries."

The above acknowledgment by the developed countries of the wishes of the Third World did not commit the former to specific targets. In 1975 however a resolution was passed at the 7th Special Session of the UN which embodied the spirit of the demands but which left the question of specific targets to be agreed upon later.

CANADA'S COMMITMENT

Canada has a strong record in international development and in September 1975 publicly reaffirmed its determination to achieve the official UN target of 0.7% of GNP devoted to this end.[7]

During preparations for UNCTAD IV[8] Canadian officials and subsequently the Cabinet moved towards the acceptance of the concepts behind the R&D Target demands of the developing countries while rejecting the actual targets themselves as unrealistic. This acceptance is implicit in the formal intervention at the Conference by Canada's Secretary of State for External Affairs.[9] Because of its crucial importance to this study the statement is quoted verbatim:

> "Canada intends to explore further the creation of links between research institutions in Canada and corresponding institutions in developing countries. Such arrangements could provide Canadian institutions with a greater appreciation of the problems of developing countries - they could influence, over the longer term, the orientation of our domestic research and development programmes toward Third World problems, and they could provide a channel for the transfer of advice, assistance and technology to developing countries."

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5 United Nations Conference on Trade and Development.

6 39 (III) of UNCTAD (III), Santiago de Chile, 1972.

7 CANADA. Strategy for International Development Cooperation 1975-80 CIDA. 1975. (POint 6, page 24).

This National commitment has far reaching implications for the Canadian scientific community and particularly for that part of it within the federal government. Its execution will require a fundamental change in thinking away from the present conception of international assistance as being the exclusive prerogative of CIDA and IDRC and towards a new acceptance of assistance as an integral part of domestic R&D activities. New approaches and mechanisms will have to be conceived. The "Twinning Project" is one early manifestation of these.

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[8] UNCTAD IV was a major ministerial level UN conference held in Nairobi, May 1976, which dealt with four major development issues; commodity agreements, trade liberalization, debt relief and the international transfer of technology.

[9] Statement by the Hon. A.J. MacEachen; Secretary of State for External Affairs at UNCTAD IV, Nairobi, 7 May 1976.

SECTION III - THE TWINNING CONCEPT

INTRODUCTION

A major problem encountered in addressing the subject of 'institutional links' or 'twinning arrangements' is the fundamental question of what is meant by such links and what delineates a 'twin' from a specific project or program. This becomes particularly difficult in cases where the execution of a specific project involves two or more organizations in a series of activities such as training, the provision of experts and jcint collaborative work.

One major aim of this section therefore is to give the reader a concept of the type of twinning arrangement considered most likely to meet in large measure the needs of the developing countries as summarized in Section II. Thus while definitions of both a 'general twinning arrangement' and a specific 'Federal Government R&D twinning arrangement' are given these should be understood in the context of the discussion which follows.

Source material for this section was obtained from the personal experience of the many officials interviewed both within and outside the Federal Government and from two major studies. The first - "Bilateral Institutional Links in Science and Technology" (UNESCO 1969) - provides a survey of these links throughout the world. The second - "Institutional Links in Science and Technology" (written in 1972 by Dr. H. Glyde - a Canadian scientist then on the staff of the International Development Research Centre) - brings to the UNESCO survey a detailed analysis of sixteen links between the United Kingdom and Thailand. The two are thus in some sense complimentary and together offer the reader interested in more detail an excellent insight into twinning in the development context.

GENERAL

Twinning in its broadest sense may conveniently be defined as

> "A formal, sustained institutional linkage between an institution in a developed country and an institution with broadly corresponding aims in a developing country or region."

The concept of providing technical assistance to the Third World through the mechanism of twinning is not new. Some 500 such arrangements were identified in the 1969 UNESCO Report[1] and even these were emphasized to be illustrative rather than a complete list.

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[1] Bilateral Institutional Links in Science and Technology, UNESCO 1969.

University linkages aimed at providing education, training, institution building and, though to a far lesser extent, research, traditionally form the majority of such arrangements. To an increasing degree however other non-university research organizations in both the public and private sectors appear to be entering the field. These linkages vary from a simple agreement to exchange information on a regular basis to a full-blooded formal association encompassing a wide variety of activities. It is with the latter category that this study is concerned.

CHARACTERISTICS

Certain major characteristics delineate a twinning arrangement from the more conventional project. A project, generally speaking, tends to be very specific in its scope and time. In the international development context it could be a geological survey, the two-year secondment of an expatriate scientist, building and equipping a laboratory or a one-year post-graduate training scheme in an academic discipline. A twinning arrangement on the other hand is a more general, longer term relationship within which many diverse activities are carried out. In this case, as an example, not only is a laboratory built but assistance is given in planning the research programs, appropriate technical and management training is provided over several years, exchanges of scientists and visits are arranged and joint collaborative research is undertaken.

A formal sustained linkage with an institution in a developed country offers to its counterpart in a developing country the following main advantages:

a) The necessary continuity of policy, advice and assistance without which expertise transferred is often not durable or not further exploited - a major weakness of a short-term "one shot" project.

b) A more combined or systems response to a given development need with the separate technical assistance elements - training, provision of experts, joint collaborative programs, etc. - being provided under a single overall plan rather than as disparate activities involving several different organizations.

c) A more responsive and flexible type of technical assistance. Short visits - particularly by senior staff - can be quickly arranged to meet crises. Longer term secondments and training can be adjusted more conveniently to respond to changing circumstances and experts to meet unforeseen needs or to replace those returning more easily found.

d) The availability, in the shape of the developed country institution, of extra resources needed to build up an indigenous and self-sustaining 'critical mass' of scientists required to mount a national effort in a selected field. A concomitant benefit sometimes experienced is the enhanced local credibility accruing from the formal association with an institution in a developed country.

e) Direct access to a major resource of knowledge, expertise and sophisticated equipment usually not available locally.

f) Less vulnerability to changes in personnel. This of course applies to both institutions. The effectiveness of projects and in particular of less formal associations in the international assistance area seems to be very much dependent upon personalities. Serious loss of momentum can occur when senior staff (often those whose personal enthusiasm gave birth tc the particular association) are replaced.

g) Aid - no matter how willingly given - tends to build up animosity and to lower the self-reliance of the recipient. There is therefore a need where at all possible to introduce a sense of partnership and mutual benefit into assistance programs. A carefully chosen twinning arrangement can provide at least a measure of mutual benefit and, by virtue of being a sustained relationship, offers time to break down initial animosities and develop mutual trust and respect.

The advantages of institutional twinning are not restricted solely to the developing partner. Such linkages also offer major advantages to institutions in the developed countries in terms of their potential contribution. Some of these are:

a) A sustained linkage facilitates the development within the institution of general expertise in the international assistance field and a better understanding of the needs of developing countries - particularly those of its counterpart. Its response in terms of the type of training offered, experts made available and technology transferred will therefore be more appropriate - perhaps the single most important point being currently made by the developing countries.

b) By concentrating on a few well chosen twinning arrangements, the institution is likely to achieve more than if its limited resources are dissipated in a series of unrelated development activities.

c) The isolation often experienced by expatriate scientists working unsupported in a developing country will be largely offset by the existence of a home base committed as an institution to the activity in which he is involved and whose resources are therefore conveniently available to him.

d) When approached on a purely personal basis, involvement in international assistance projects often raises serious questions of job security, career development and in some cases, pension rights. A twinning arrangement, by formally involving an institution in international development as an extension of its domestic programs, goes a long way towards easing these problems.

While offering the advantages mentioned above, twinning arrangements by their very nature nevertheless present certain characteristic problems. The more important of these are as follows:

a) Compared to many traditional forms of technical assistance the cost in time and resources of a twinning relationship can be high. Careful selection, preparation and management are therefore critical.

b) Delays and difficulties in launching twinning arrangements are common and experience suggests that 'starting small and building on success' is preferable to a major initial initiative.

c) The motivation of the institution in the developing country is a key pre-requisite for the success of a linkage. Such motivation towards the further development of an indigenous capability is often manifested by the initiative for the establishment of a twinning arrangement coming from the developing country itself. In these cases the implication is that needs have been identified, objectives defined and the stage set for a commitment to a twinning association.

d) Care must be taken to guard against an undue influence being exercised by the developed institution on the main objectives of its developing twin. There is an all too human tendency to work on problems at the frontiers of science rather than the more mundane practical problems faced by many developing countries. The developing partner must be suitably structured, able to absorb the technology transferred and to develop its own capabilities without becoming a pale shadow of the developed institution.

e) A twinning arrangement can, if maintained too long, lead to an unhealthy dependence on the institution in the developed country. If allowed to progress too far, this tendency could prevent the very self-reliance that the linkage was originally conceived to achieve. The danger can be reduced if both parties accept at the outset the aim of gradually changing the formal relationship to a looser informal association as the indigenous capability of the developing country's institution is built up.

MATCHING THE NEED

Bearing in mind the general characteristics of twinning arrangements as discussed above it is possible to define more exactly that type most likely to meet the scientific and technological needs of the developing countries.

In the narrow context of the scientific portion of the Federal Government the following definition is offered:

"A twinning arrangement will be a formal sustained institutional linkage between a science-oriented federal government department, agency or institution and an institution with broadly corresponding aims located in a developing country or region. Its primary objective is to assist the LDC institution reach a state in which it has generated a self sustaining capacity for action in its field of concern".

Ideally such a linkage will meet all of the following criteria:

a) It will be the subject of a formal agreement between participating institutions.

b) It will be long-term in nature (probably not less than five years).

c) It will be general in nature and cover a series of activities such as a regular information exchange, provision of training in Canada and in the develcping country, provision of Canadian experts, use of Canadian laboratory facilities and/or equipment and will invclve joint collaborative research projects in the developing country.

d) It should provide, if possible, for research to be undertaken in Canada directed towards the solving of problems of priority concern to the developing partner; and

e) Be of mutual - though not necessarily equal - benefit.

The scope of the 'ideal' twinning arrangement will include:

a) Identification of sectoral needs and priorities, and the assessment of the feasibility of meeting them.

Mechanisms: Joint task forces, national development plans, international organization feasibility studies.

b) Selection and design of projects aimed at the creation of sustainable capacities in training, research and services in line with identified needs and priorities.

Mechanisms: Collaborative project planning, role assignment and division of labour, both nationally and internationally.

c) Experimental-Demonstration Phase.

Mechanisms: Conducting field trials, testing, surveys and setting up experimental stations.

d) Application-Extension Phase.

Mechanisms: Mobilizing resources to train manpower, and the arrangement of material transfer for 'extension' of project activities.

The underlying emphasis - which tends to make the above arrangement different from other technology transfer approaches - is the encouragement of the notion of 'partnership among professionals' (scientists and technologists) of both developed and developing countries. It assumes that those who are closest to the point of R&D innovation understand best the problems of its adaptation and application.

MAJOR CATEGORIES

The potential exists for three major types or models of research twinning arrangement; the traditional bilateral type, a more recent 'regional' model and an 'international' model. Each will offer certain advantages and drawbacks and a choice will be influenced by individual circumstances existing at a given time. Some general comments are however possible.

The Bilateral Type. The bilateral model would seek to promote, on a sustained long-term basis, partnership arrangements between Federal Government research institutions in Canada and a developing country to encourage and support research through

closer cooperation. It would involve joint studies/projects for the benefit cf bcth parties, and a related exchange of staff and information as described above.

Because of a long tradition in scientific research, the Canadian institution will have a broader knowledge-base, a familiarity with scientific methods of observation and evaluation, and a competence in handling the related technology. Its contribution could thus include the undertaking of exploratory research, assistance in its adaptation to specific problems and the enhancement of the expertise of the scientists of the develcping country in the particular discipline or area.

The institution in the developing country on the other hand, is in a better position to undertake adaptive research and experimentation on how to develop and apply the research breakthrough under local conditions. This will involve testing and dissemination of information through various national subsystems to discover its production potential.

The Bilateral model assumes the existence of a corresponding research infrastructure in the developing country which has sufficient facilities and manpower to enable identificatien of the need, relevance and usefulness of such joint research effort and to actively participate as 'partners'.

The Regional Type. A regional twinning arrangement would seek to associate a Federal Government research institution with a regional research institution located in a developing country.

The concept of the regional research institution founded and managed by a group of developing countries is being actively promoted by the United Nations.[2] The effort is primarily aimed at those 'least' developed countries in which R&D resources are minimal and national priorities focused on very survival.

A regional approach can be most effective in such research areas as meteorology, fisheries and pest control, etc., where the problem area under consideration is not contained within national boundaries. It offers the possibility of a shared capability to countries whose domestic resources would not permit the establishment of national organizations and, to the institution in Canada, a means of obtaining a wider dissemination of the benefits resulting from its contribution.

Political tensions and disagreements within the regional grouping are an obvious potential source of difficulty and tend to limit the value of twinning to those areas where political cooperation has been successfully demonstrated, e.g. South East Asia, (ASEAN) and Latin America, (ANDEAN PACT).

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2 One example is the 1972 General Assembly resolution authorizing the United Nations Development Programme to examine ways for developing countries to share their technological capacities and experiences with a view to increasing and improving development assistance. Others include the World Health Organization and the Food and Agricultural Organization

Canada has, at meetings of various international agencies, stated that special consideration would be given to requests for cooperation in projects emanating from regional institutions.

The International Research Centre Type. This model bears a strong resemblance to the 'regional' one except that the creation of international research centres and their support has evolved mainly through the efforts of private foundations and governments in the developed countries. The concept evolved mainly from the work of CIMMYT and IRRI,[3] two international research centres which became well-known for their breakthroughs in research pertaining to wheat and rice production technology in the 1960s.

International research centres have been used in the past decade to train scientists from other countries to extend and adapt the centre's research to national needs and systems. The exchange program has essentially revolved around two main educational objectives; to provide exchange scientists with an opportunity to develop the research skills and knowledge needed to operate a research extension/development program; and to encourage and develop the capability of these scientists to create new forms of technology.

However, in recent years, some of these centres have tried to diversify and extend their narrow specialized interests by looking into the broader international technology development and transfer-system related issue areas.

The potential of such centres can be tapped by sharing joint research projects, and providing support for involvement of a 'third' developing country in the project. CIDA, in association with the IDRC, has funded some international research projects in recent years. The Canadian commitment however has been limited to funding. There is no evidence of the explicit involvement of a federal science-based department in such collaborative ventures.

AN ILLUSTRATIVE TWINNING ARRANGEMENT

To round off and complement the theoretical treatment of the twinning concept a real life example is briefly presented below. Detailed case studies of the only three current twinning or 'near' twinning linkages involving science-intensive Federal Government organizations are given in Volume II of this study. The institutional linkage presented below was therefore deliberately chosen to broaden somewhat the spectrum of examples and to illustrate the use of the twinning concept by the university sector.

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which, for several years have strongly stated the need for regional cooperation institutions.

[3] Some International Research Centres which are presently involved in R&D activities are: International Centre for Tropical Agriculture (CIAI), Cali, Columbia; International Rice Research Institute (IRRI), Manila; International Centre for the Improvement of Maize and Wheat (CIMMYT) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

The Universities of McGill and Nairobi

Aimed at the development of two departments of medicine within the University of Nairobi, (pediatrics and internal medicine), this formal linkage was established in 1968 following feasibility studies by the World Health Organization and the Rockefeller Institute. The subject of formal agreements between the governments of Canada and Kenya and between both universities, the arrangement basically provided for the setting up of a training scheme in Kenya, advanced training for post-graduates in Canada and the secondment of McGill University staff to Nairobi.

Originally envisaged as lasting five years the formal linkage has been extended for a further five with funding to some $2.9 million being provided by CIDA.

The annual number of graduates produced by the new departments in Nairobi rose from 20 (after the first five years) to 76 in 1976. Annual graduation is expected to reach 100 in 1977 and will be stabilized at this level. At the five-year mark a graduate school was established and this effort further supported by the training at McGill University of post-graduate Kenyans to replace McGill teaching staff at Nairobi. This process of indigenization is well underway with Kenyan doctors already forming about half the teaching staff.

Many of the criteria discussed earlier were met by this twinning arrangement and their importance confirmed by the Canadian Director (Dr. D.G. Cameron). They include the existence of formal agreements covering several related assistance activities, the acceptance of a long-term association, and a degree of mutual benefit. Seconded experts remained on the staff of McGill and their periods away were regarded as beneficial both personally and to the university. Recruitment to the program of the best qualified people was therefore facilitated. Although not a stated priority some research has been carried out within the new departments, resulting in one case in the discovery by a Canadian doctor of a new blood group.

Finally, direct benefits accruing to McGill university have included the experience gained in a new environment by seconded staff, expertise in tropical diseases, experience in achieving results without expensive equipment and - more generally - a knowledge and understanding of the problems of developing countries.

CONCLUSIONS

The concept of twinning institutions in the developed countries to counterparts in the developing world is not new. Examples already exist in many forms and in many sectors. It is

however but one tool - albeit a powerful one - in the total inventory of technical assistance activities.

Twinning differs from the more traditional project approach by virtue of being a sustained activity of a more general nature. In a real sense it represents an overall framework within which several projects or related program elements can take place. As such it offers major advantages to each partner. To the developing country it represents a most effective means of obtaining necessary expertise and of building up indigenous institutions and infrastructures - key factors in the drive towards industrialization. To the institution in the developed country it brings the necessary understanding of the needs of the developing world and a concomitant enhancement of the contribution able to be made with a given level of resources. For both - if properly chosen - it provides a measure of mutual benefit and the sense of partnership so vital to the development of self respect and a self-sustaining capability.

In the scientific context a type of twinning linkage is required which emphasizes the systematic exchange of research experience, training and technical cooperation between two scientific institutions. While acknowledging the experience and facilities available in the developed country it also recognizes that those closest to the point of application of R&D innovation best understand the problems of its adaptation and application.

Finally, by having the potential of offering, in one package, joint collaborative research in both the develcping and the developed country it is considered to represent the single most responsive mechanism to the stated needs of the Third World.

SECTION IV - THE FEDERAL GOVERNMENT CONTEXT

The needs of the developing countries for scientific assistance together with the concept and potential of twinning as a mechanism for meeting some of these are discussed in Sections II and III respectively. This section deals briefly with the current response of major elements of the Federal Government in terms of their involvement in technical assistance activities and thus provides a background against which the feasibility of applying the twinning concept can be judged. It attempts to indicate in very general terms what major technical assistance is being given, by whom and through what mechanisms, and how far this already goes towards meeting the needs of the Third World.

The approach adopted is to consider first the role and activities of the two organizations wholly concerned with international assistance - CIDA and IDRC - and to follow this with a brief review of the involvement of the major science-oriented departments/agencies.[1] Finally, a short description of the three 'near' twinning arrangements identified and involving departments is given.

THE INTERNATICNAI DEVELOPMENT RESEARCH CENTRE, (IDRC)

IDRC is presented before CIDA because it is the sole National organization whose mandate lies exclusively in the area of research for development.

The Centre was established in 1970 by Act of the Canadian Parliament "to initiate, encourage, support and conduct research into the problems of the developing regions of the World and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions."[2] As such it represents one of the most direct and innovative responses to the scientific needs of the Third World made by any industrialized nation.

Though funded exclusively by Canada the Centre is governed by an international Board of Governors from ten countries, (six of whom are from developing countries), and has from its inception in 1970 to June 1976 initiated 375 projects calling for appropriations of some $70 million.[3] Its budget in terms of commitments has increased from $18.2 million in 1973/74 to $29.5 million in 1974/75 and is estimated to reach $41.2 million for 1975/76.

Simply stated the role of IDRC is to support research for the developing countries, by the developing countries and in the developing countries. This is in line with the emphasis placed by the Governing Board on the objective of "assisting the

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1 To facilitate reading the word 'department' will be used throughout this section to denote a science and technology oriented department or agency of the Canadian Federal Government.

2 Projects 1975, IDRC, page i.
3 projects 1976, Supplement, IDRC.

developing regions to build up the research capabilities, the innovative skills and the institutions required to solve their problems".[4] Research grants have been made to 75 countries and have covered a wide spectrum of scientific fields with the emphasis being placed in the agricultural sector, (38% of all funds since the start of operations). Recognizing that the benefits of research can be world-wide the Centre emphasizes collaboration between researchers and attempts to balance its support between international research centres and small national research groups.

While IDRC's concentration on supporting research within developing regions meets a major need it does nevertheless tend - understandably - to restrict the use by the Centre of the substantial expertise represented by Canada's scientific community. As illustrated by Table I, page 78 research activities undertaken in Canada represented only 8.6% of all the Centre's expenditures to June 1975 and this included research in the social as well as the natural sciences.

In terms of the natural sciences alone very little IDRC funded research was undertaken by Canadian industry or universities during 1975/76, Table II, page 79. During the same period the Centre's expenditures for research by the 'other Canadian' category - which includes departments of the Federal Government - amounted to only some $163,000.

While current policies continue therefore, the IDRC, although very effectively supporting the development of indigenous scientific capabilities and infrastructures within the Third World itself, is not designed either to help meet the demands for more of Canada's <u>domestic</u> research effort to be devoted to the problems of developing countries or to respond to their appeal for more collaborative research to be undertaken together with Canadian scientists.

THE CANADIAN INTERNATIONAL DEVELOPMENT AGENCY (CIDA)

The bulk of Canada's Official Development Assistance - estimated to reach one billion dollars for fiscal year (FY) 1976/77 - is administered by CIDA. The Agency has traditionally concentrated its assistance in three main areas; bilateral economic assistance, food aid, and loans and advances to international financial institutions. Expenditures in these three areas amounted to 76% of CIDA's total budget in FY 1972/73 and increased to 77% in FY 1974/75.[5]

Resources applied by the Agency to technical assistance totalled $40.48 million in FY 1972/73 and $55.47 million in FY 1974/75 representing 7.9% and 7.3% of the total budget respectively.[6] However technical assistance as defined both

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4 Projects 1975, IDRC

5 Table III, page 80.

6 Table IV, page 81.

traditionally and by CIDA covers a wide range of activities of which actual scientific research is but one.

The development of national infrastructures in the power, communications and transportation sectors coupled with improvements of national capabilities in the agricultural, rural development and resource management fields represent the major thrusts of the Agency's technical assistance strategy. The wide range of activities undertaken within this framework include the financial support of projects to develop and improve airfields, roads and railways; the arrangement of geophysical and resource surveys; the improvement of livestock breeding and crop production; and the development of water supplies. Training both in Canada and in developing countries is a major emphasis with 1,252 foreign students attending Canadian educational institutions in 1974, 813 Canadian educators assigned aborad and 512 Canadian experts seconded to developing countries within the same year.[7] A substantial proportion of foreign students and Canadian experts were involved in science and technology related sectors such as the natural sciences, engineering, medical and agricultural fields.

This effort, sizeable and effective though it is in the broad technical area, goes only some small way towards meeting the Third World's current needs for scientific assistance and in particular for a vastly increased emphasis on cooperative research programs. CIDA's current management and financial information systems do not specifically identify those elements of its technical assistance programs which deal with research per se but an examination of available data and discussions with CIDA officials strongly suggest that actual research represents a very small percentage indeed of the overall effort. Cooperative research - even in its broadest sense - amounts to an even smaller portion of the total research undertaken.

In the light of the existence of the IDRC and the very little use that CIDA has been able to make of the departments of the Federal Government this situation is very understandable. There appears to be a degree of overlap[8] between the roles of CIDA and IDRC which offers the practical advantage of permitting the Agency to respond to a need for research as an intrinsic component of a bilateral program. It does however at the same time tend to restrict the Agency to a fragmented response and low profile involvement which is not commensurate with the major initiatives called for if the demands of the developing countries in the scientific area are to be met. As far as Federal Government departments are concerned CIDA is restricted, in the absence of a broad policy encouraging their involvement, to making use of those resources available after departmental domestic priorities have been met.

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[7] Annual Review - CIDA 1974/75, pages 100-101

[8] It is understood that a study to clarify certain aspects of the relationships between IDRC and CIDA is currently underway.

The need to broaden the scope of Canada's development cooperation with the Third World into more integrated national effort using a mix of aid and non-aid instruments has already been explicitly recognized by CIDA and is reflected in the Federal Government's "Strategy for International Cooperation 1975-1980".[9] Although support for national and international research organizations acting as instruments for improving indigenous research capability within the Third World is promised,[10] traditional assistance offered through the Agency is to be concentrated on the very poorest of the developing countries.

This major new emphasis carries substantial implications for those portions of the Canadian scientific community - especially the Federal Government departments - presently only peripherally involved in international assistance. The more advanced of the developing countries are precisely those whose weight is behind the current call for an increased level of technology transfer and cooperative research, yet less, not more, of CIDA's financial and administrative resources will be available for this important area. The closer involvement of other appropriate Federal Government departments together with the creation of new mechanisms to facilitate such involvement both within the scientific community and within CIDA itself will therefore be necessary. Indeed they have already been called for.[11]

THE "SCIENCE DEPARTMENTS" OF THE FEDERAL GOVERNMENT

The science and technology intensive departments and agencies of the Federal Government represent a rich potential source of assistance to the developing countries. Agriculture Canada offers a wide range of expertise: - soil survey, crop and animal production and associated research of direct value to what is perhaps the greatest need of the Third World - food. EMR possesses the advanced techniques in geological and forestry surveys, remote sensing and resource management which match many developing country requirements. Environment Canada has the fisheries research and management expertise needed to enhance the local production of fish and assist the coastal developing countries meet their international obligations under the Law of the Sea. An expertise reflected also in the environmental protection and other important areas. NHW can do much to ensure the attainment of a better level of health and hygiene. NRC represents a single pool of applied research and technical information expertise rarely matched anywhere in the world. The list is large, the potential substantial.

To the above possibilities can be added a further two of more general value. The scientific expertise of departments is complemented by a capability in the policy area and often by an understanding of the interplay of research and commercial

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9 Point 1 of the 'Strategy'.

10 Point 11 of the 'Stategy'.

11 Pages 25 and 39 of the 'Strategy'.

activities. Furthermore as Canadian organizations they share the rather special reputation of Canada as an industrialized nation with no past history as a colonizing power and with a long established policy of international assistance.

The reader will judge for himself the degree to which all these and other possibilities have as yet been exploited in the research area.

Departments can participate in international assistance activities in two main ways: In their own right as an extension of their domestic programs; and as funded agents of IDRC or CIDA.

Most departments are involved to differing degrees in international development through Canada's membership in the various international bodies which address this area (e.g. FAO, WHO, etc). However participation at this level is almost wholly of a policy nature. No research aimed exclusively at solving problems of developing countries has been reported by any department (other than IDRC) in the "Federal Government Activities in the Natural Sciences" publications of Statistics Canada for 1974/75 and 1975/76 and none appears in the "Estimates of Federal Government Activities in the Natural Sciences" for 1976/77 published by the same Organization.

As discussed earlier the main emphasis of IDRC supported research lies in the developing countries themselves. As far as departments are concerned only six projects of a research nature have been carried out for the Centre since 1971 representing a total of $262,800 some $148,000 of which appearing in the 1975 budget. Three "departments" - Agriculture, Environment and NRC participated and project details are given in Appendix A, page 70.

No formal mechanism for involving departments in IDRC research programs appears to exist. Departments are viewed by the Centre as one of many potential sources of expertise and are paid for expenses involved. The replacement of man-years utilized by departments raises some difficulties as the Centre under present policies is not able to directly offset these. However the funding of replacement staff is possible in some cases and the current low level of departmental involvement reduces this problem to a minor category. It could however become serious in the event the Centre decided to make more extensive use of departmental capabilities.

By far the greatest involvement of departments in international assistance comes about through their participation in the bilateral technical assistance programs of CIDA which, like IDRC, views them as one of several sources of expertise. Traditionally such participation includes the provision of experts, (often seconded to the Agency or on 'sabbatical' leave

of absence), services (e.g. geological surveys) or actual projects. Particular use of departments is made in studying the feasibility of projects on behalf of CIDA and in the provision of training in departmental facilities for scientists from developing countries.

Two main types of mechanism have been used to "formalize" relations between CIDA and departments. The first is a general umbrella agreement negotiated between the Agency and certain departments (e.g. Environment, Agriculture and EMR) which defines in broad terms the scope of possible departmental involvement in the Agencies' activities. The second covers specific projects and lays down in detail the role and responsibilities of departmental staff assigned. In all cases the bulk of the funding is provided by CIDA.

In the technical area contact with departments is maintained primarily by the officials of CIDA's Special Advisors Branch. These experts, chosen because of their knowledge of a subject area and of the appropriate department(s) concerned, provide advice on the technical aspects of development projects and on where pertinent expertise can be sought in Canada. They are often matched by designated liaison staff within departments.

The actual degree of involvement of departments in CIDA's technical assistance program is vividly illustrated by the figures for 1975/76, given in Table V, page 82 and in the actual list of projects presented as Appendix B, page 72. In this year the Agency funded the participation of departments to a total of some $1,807,000 which represented only 3.3% of its technical assistance budget.[12] Of this amount $810,005.04 was committed to the re-fitting of a Canadian oceanographic survey ship.[13] In terms of the percentage represented by CIDA funded expenditures on international technical assistance in respect of each participating department compared to the expenditures of the same departments on intramural R&D, total involvement was to the tune of some 0.26% and varies between 0.86% (MOT) and 0.01% (NRC).[14]

Of particular pertinence to the Study was the amount of actual scientific research undertaken as part of the total technical assistance given. Although an exact figure could not be calculated a general impression can be gained from consideration of the projects listed in Appendix B by the Finance and Administration Branch of CIDA. Of the total of 52 projects at least 30 can be identified as <u>not</u> involving research. Examples are all the projects involving MOT and many of those involving EMR, the latter being primarily surveys.

An indication of the level of resources committed during 1975/76 to individual projects can be obtained from the following: Only 20 involved expenditures of <u>over</u> $10,000 while 7

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12 Table V, page 82.

13 Appendix B, project 66-808-00501, page 72.

14 Table V, page 82.

represented expenditures of under $1,000. Two, projects 62-524-00051 and 61-208-00401, were for $7.50 and $9.00 respectively!

Statistics can be misleading. Nevertheless the above data suggests very strongly that the current participation of departments in international scientific assistance is peripheral and that vigorous measures are needed if their substantial potential in this area is to be anything like fully exploited. This statement is not meant - nor should be taken as meaning - criticism of departments. The point, as made in the following section, is that under the current system international assistance is not yet seen by them to be their responsibility.

NEAR TWINNING ARRANGEMENTS INVOLVING FEDERAL GOVERNMENT DEPARTMENTS

The difficulty of distinguishing between an international development project which encompasses several different types of technical assistance and a twinning project is, as discussed in Section III, not an easy one to resolve. The border lines between the two become progressively blurred as the project becomes more complex. In terms however of the "ideal scientific research twinning arrangement" as defined on page 29 no examples currently exist in which departments of the Federal Government are involved. Nevertheless three current projects which go some way towards meeting the criteria proposed were identified. Details of these together with commentaries are presented as case studies in Volume II of this study. To complete this section and to give the reader a flavour for what could be possible a very brief review of each example is given below.

The Siamese Twin (DOE Fisheries and Thailand)

The object of this project is to develop in Thailand's Department of Fisheries a National Inland Fisheries Institute (NIFI) which will conduct the applied research needed to develop and manage Thailand's inland fishery resources. Initiated in 1972 the project is expected to be completed in 1977.

The management and execution of Canada's part of the program is carried out by DOE (Fisheries) and includes the provision of; laboratory equipment ($350,000), experts 12 MY[15] ($400,000) and training in Canada of Thai scientists ($250,000). $105,527.29 was expended on the project in 1975/76.[16]

Responsibilities of the Government of Thailand include the structuring of NIFI, the construction of buildings and the establishment of experimental and research facilities.

Although delayed due to administrative difficulties on the Thai side the project has already resulted in the establishment

15 Man years (MY) include 9 long-term (over six months) and 3 short-term (under six months).

16 Appendix B project 64-906-00094.

of an effective training scheme in Canada in which the facilities of both the University of Manitoba and the Pacific Biological Station and Freshwater Institutes of DOE have been utilized. Two Canadian scientists have been located in Thailand and have familiarized themselves with the Thai fisheries programs and problems. Research has been carried out by them in such areas as; potential suitable habitats for rainbow trout, the development of procedures for small swamp management and the evolution of pond aerators.

India Drylands Agriculture (CDA and the Indian Council for Agricultural Research)

The main aim of this project is to increase agricultural production in dryland (i.e. non-irrigated) areas of India. Techniques are being developed for conserving surface moisture and for more effective use of fertilizers. Plant varieties better suited to the particular soil conditions are being selected and adapted.

Conceived as the result of consultations between an agricultural scientist task force and Indian scientists the project began in 1970 with an expected life of 5 years. In 1974 an assessment showed that increased yields of up to 250% could be achieved by applying the results of research already undertaken and a decision was made to extend the project into a second phase from 1975 to 1980.

Costs to Canada of Phase I amounted to some $1.9 million. Direction of the Canadian participation was executed by the Research Branch of CDA with eight Canadian experts from within the Branch being supplied. Indian and Canadian scientists working through a network of research stations in India undertook research in key areas such as moisture conservation, crop selection and mixes, weed control and planting schedules.

Phase II of the project will concentrate on the demonstration and applicatien of the new techniques devised, the establishment of an agricultural training centre and further research of an "operational" nature. A team of Canadian advisors (144 man months) in such fields as agronomy, soil science, plant science and agricultural engineering will be provided by CDA together with associated equipment to a maximum value of $600,000.

A feature of particular interest is the provision for cooperative research to be carried out at Canadian agricultural research centres, 24 man-months and $40,000 being allocated for this purpose up to 1980.

The Remote Sensing Project (Peru and the Canadian Centre for

Remote Sensing, CCRS)

This project differs substantially from the other two in that the action takes place in Canada instead of the developing country. Although of only two years duration it is of interest because it represents a rather special type of arrangement whereby the scientists of the developing country are making a technology choice by simulating in the CCRS a laboratory model adapted to meet the remote sensing needs of their nation.

The aim of the cooperative venture is to develop a functional and justifiable laboratory design and to purchase necessary equipment - the acquisition of the latter being integrated into the program as a research problem in itself.

The Peruvian counterpart organizations of CCRS, (The National Office for Evaluation of National Resources and the Peruvian Geophysical Institute), have appointed a Peruvian project coordinator located full-time at CCRS. Scientists of the two national organizations are preparing problem-oriented research projects and visit CCRS for three-month periods to use the Centre's facilities in their execution. Follow-on research is undertaken in Peru to complete a fully coordinated program and ensure that a broader exposure is obtained beyond the visits of a limited number of specialists to Canada.

The project involves 15 man-months of Peruvian staff, (in addition to the coordinator), over a two-year period in Canada. The Canadian commitment amounts to $600,000 of which some $400,000 is earmarked for paying for visiting Peruvian scientists and the Canadian CCRS staff involved. Funding is provided by CIDA.

Comments

The three examples of 'near' twinning arrangements demonstrate the feasibility of using this mechanism within the Federal Government context. Though bilateral in nature they illustrate three important types of linkage activity: institution building (NIFI), the exchange of research expertise (India Drylands Agriculture), and technology choice (CCRS-PERU).

Each emphasizes the prime role of the developing country's partner in deciding what national needs are to be met and emphasizes the partnership approach to a given research problem. While substantial benefits are enjoyed by the developing countries involved these have not been entirely one-sided. The Canadian directors have confirmed the value of their involvement in terms of the broadening of the experience of staff involved, the application of Canadian research and its results to different

environments and the better understanding of the needs of developing countries which has accrued.

Departmental participation has however raised many problems discussed fully in Volume II. Examples include the diversion of staff from domestic priorities, the difficulty of attracting qualified and adaptable participants, and the hidden costs involved.

CONCLUSIONS

Canada, in the shape of the International Development Research Centre, is making an innovative and effective response to the need for the enhancement of the scientific capabilities of a large number of developing countries. This response however is concentrated on one aspect - albeit an important one - in the range of different types of scientific development assistance. It does not cover - nor is intended to cover - the Third World's requests for a sizeable proportion of the National domestic R&D effort to be devoted to solving their major socio-economic problems. Neither does it meet the desire expressed by the developing countries for more cooperative research to be undertaken with them.

Similarly, CIDA's technical assistance program, though sizeable, remains traditional in nature with very little indeed in the way of actual research being undertaken. Moreover the Agency's future strategy strongly emphasizes aid to a fewer number of the poorest developing countries and a concomitant appeal to other organizations - particularly in the scientific area - to shoulder more of the assistance burden relative to the more advanced developing nations.

Canada's single largest scientific resource, the "science departments" of the Federal Government, is neither involved in international assistance in its own right nor - in terms of research - tapped to any significant extent by the Government's two development assistance organizations.

Cooperative research in the scientific area between "science departments" and their counterparts in the Third World is very difficult to identify and is assumed to represent a very small portion indeed of the limited involvement by these organizations in technical assistance. Where it does occur - though even here to a small degree - is in the only three 'near' twinning arrangements identified.

The potentially powerful tool of twinning scientific institutions within the Federal Government with selected counterparts in the Third World is virtually unused at present. Neither the extensive use of this nor the enhanced response to

the Third World's needs in the scientific area to which Canada is committed are considered possible until new mechanisms and policies are established to overcome the several major deficiencies of the present system. These deficiencies are discussed in some detail in the following section.

SECTION V - MAJOR PROBLEMS IDENTIFIED

Three broad categories of obstacle standing in the path of a greater response by science-oriented departments to the needs of developing countries were identified. These are: the absence of an overall policy encouraging departmental involvement, the concomitant lack of resources to facilitate such a policy, and what can best be described as "personal career problems".

POLICY CONSIDERATIONS

The provision of international development assistance is an evolutionary process. Like many other developed countries Canada established an Agency (CIDA) to implement its national program. Unlike any other it recently supplemented this traditional approach with the innovative creation of an International Development Research Centre aimed squarely at the research element of international assistance. The question now is whether a further step in this process should or can be taken in involving more closely the domestic R&D capability of the science intensive departments and agencies of the Federal Government in attacking major problems of developing countries.

Departments, understandably, have their eyes firmly fixed upon domestic priorities and the problem of meeting these effectively within the present environment of severe financial restraint. As international assistance does not form an integral part of the departmental programming/budgetary process, the needs of the Third World and the potential represented by the federal science departments/agencies for making a substantial contribution are not addressed.

Furthermore, those departmental efforts and achievements which are made in this area tend not to be fully recognized either within the department itself or when the department, as part of the annual budgetary/programming cycle, seeks resources to meet its mandate.

As described earlier, two major demands of the Third World are: first, that some part of the domestic research effort of the industrialized nations be dedicated to helping solve major socio-economic problems facing the developing countries and; second, that greater efforts be made to assist them develop their own capacities for R&D.

If the science-oriented departments of the Federal Government - which together represent a substantial part of the National scientific capability - are to be able to respond at all effectively to these demands, particularly that respecting Canadian domestic research, then the close involvement of senior

departmental management is clearly required. This in turn requires the existence of a clear policy from the Cabinet encouraging and mandating such departmental activity.

The degree of involvement of senior management in international assistance projects appears to vary from department to department. In some instances the decision to respond to a request from CIDA is left very much in the hands of the individual manager of the appropriate institute or division concerned - on the clear understanding that the means are to be found from within his own resources. In other cases where senior management is more closely concerned it is on the basis of responding to individual specific requests from CIDA rather than as a result of a conscious departmental strategy in which international assistance is considered as being part and parcel of the overall domestic program.

The above comment is not made in a critical sense. To the degree that they are able under current circumstances, departments do respond to requests for assistance from CIDA and IDRC. Indeed, in one case, which seems to be the exception which proves the rule, assistance is being given by a department direct to developing countries. Current involvement, however, as illustrated in Section IV is peripheral and response oriented. It is considered likely to remain so until it becomes integrated into senior level departmental planning, for only such an integration will provide senior management with the necessary insight into the problems of the Third World and permit a change of emphasis of domestic R&D priorities in the direction of international development needs.

This situation seems to be reflected also in the interdepartmental area. It is at this level that senior policy consideration could, it is suggested, be directed at deciding what elements of Canadian scientific expertise would be most effective in assisting the Third World, senior advice given to CIDA and IDRC, and the scientific component fitted most efficiently into the broad framework of Canada's international development assistance strategy.

At present no such high level interdepartmental approach is in evidence. The Federal Government's scientific community is not represented on the Aid Board, (a group of Deputy Ministers which meets at irregular intervals to review the international assistance program and to advise CIDA). The Interdepartmental Committee for External Relations, despite its broad mandate, is mainly concerned with the review of administrative and budgetary questions respecting Canada's overseas missions. A relative newcomer, the Interdepartmental Committee on Economic Relations with Developing Countries, is as its name implies focussed primarily on economic matters. Its involvement in technology has

been limited to generating, through the mechanism of working groups at the middle management level, responses to the specific Third World demands formulated in multilateral fora. These working groups do not include representatives of R&D intensive departments, neither as yet have they been required to address the question of the relationship of domestic R&D to the problems of the Third World. The first opportunity of doing this may occur during the follow-up activities to UNCTAD IV.

Finally, the Interdepartmental Committee for International Scientific and Technological Relations has until only recently viewed its mandate as lying principally in the context of Canada's scientific relations with developed countries. Although working groups will soon begin preparations for the United Nations Conference on Science and Technology for Development (UNCSAT II), their members do not, as presently constituted, represent the senior level approach considered appropriate to address the broad strategic questions which would result from the dedication of part of the Federal Government's domestic R&D effort towards the solving of major problems facing the developing countries.

RESOURCES

While the development of suitable policy and policy mechanisms is a crucial issue, it is matched by the practical question of where the resources - both financial and staff - to meet an enhanced degree of departmental participation in international assistance are to come from. The question has two major components; problems currently encountered by departments in meeting their present low level commitment, and the much broader considerations evoked by the concept of a sizeable increase in future involvement including the use of the twinning concept.

The funding of present departmental participation in technical assistance activities is, as discussed in Section IV, provided virtually exclusively by CIDA. It covers the bulk of departmental costs - travelling and living expenses, in many cases the salaries of staff involved, as well as equipment used - and on the face of it should, in theory at least, raise few domestic budgetary difficulties. In reality however, departments are faced with certain hidden costs which make such activities unattractive. One Assistant Deputy Minister of a department very much committed to the need for international assistance stated bluntly that even the present level of assistance would not have been undertaken had the request from CIDA not been made in earlier and financially easier times. This reflects a fairly wide-spread view and bodes ill for the continuation of the present level of departmental participation let alone any increase.

A further consideration is the response departments currently feel able to make to direct requests for assistance from developing countries. Not only are these requests likely to increase as the result of an increasing tendency to adopt world approaches to major international problems, (e.g. Fisheries management - Law of the Sea, provision of potable water - Habitat, the establishment of international tropical diseases institutes - WHO, agricultural research - FAO), but they are often manifested as a desire by developing countries for a department tc continue its relationship after the conclusion of a successful project. Yet under present conditions a positive response, even if the department is prepared to make one, is only possible where CIDA can be interested in footing the bill which clearly depends upon the Agency's priorities and available resources at any given time.

Many departmental and indeed CIDA officials interviewed identified man-year considerations as a substantial problem. Investigations suggest however that in most cases CIDA funds are available to cover the salaries of departmental officials seconded abroad or to reimburse departments for staff involved "part-time" on international development projects. In some cases, additional funds are available to enable departments to engage replacement staff. Moreover, a recent Treasury Board letter[1] authorizes departments to omit from their man-year counts those officials seconded on leave with pay to CIDA assignments abroad.

Nevertheless, these mechanisms appear to offer only a partial solution to the difficulties experienced for the following main reasons; First, the experienced staff of most value to developing countries are needed in the departments to manage and execute domestic programs. Their long-term secondment abroad therefore represents a serious loss which normally cannot be offset by the employment of temporary replacements from external sources. Second, no man-month/year credits appear to be available to cover that portion of time devoted by departmental officials based in Canada to directing international assistance projects or to training scientists from developing countries in Canada. Third, no provision appears to be made currently for the establishment of a core of experts within those departments substantially involved which could develop departmental experience in international assistance including the adaption of pertinent domestic skills to different environments. The implementation of the twinning concept would substantially exacerbate present man-year problems due to its emphasis on a cooperative approach on training and research in Canada and because of the concomitant involvement of senior departmental officials.

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[1] Treasury Board 740836, 6 April 76

The man-year problem may to the uninvolved reader appear to be over-emphasized but the frequency with which it arose during interviews reflects at least its psychological impact - particularly in the current climate of severe restraint - and suggests the need for further more detailed examination.

The above considerations suggest that the present system restrains rather than encourages the participation of departments in international development and that new administrative approaches will have to be devised if either the use of the concept of twinning or the diversion of some part of the domestic R&D effort towards the needs of the Third World are to be achieved. Among several major questions to be addressed will be the following:

a) By what means are resources of funds and man-years to be channeled to departments? Direct to departmental budgets? Through CIDA? Through a central resource pool similar to current energy R&D arrangements?

b) How are such resources to be fitted into the overall national development assistance program, priorities fixed and assessments made? Who for instance will identify potential twinning partners in the developing countries and decide between contenders?

c) How will the various domestic and international components of departmental participation in a twinning arrangement be funded, through what mechanisms and by whom? What major financial and other control mechanisms will be necessary and how should they be established?

d) Should <u>domestic</u> research aimed at attacking specific problems of developing countries be classified as Official Development Assistance?

<u>PEOPLE</u>

No matter how well thought out the policies or generous the resource allocations the end result depends basically upon the motivation and commitment of those involved. This is particularly true of international assistance work which often demands substantial personal adaptation to unfamiliar work and cultural environments.

Unfortunately, all too often those engaged in development activity, though usually personally highly motivated, do not enjoy the support and recognition deserved for their contribution.

Major problems reported during interviews included adverse effects on career prospects, difficulties of reassimilation on return, lack of recognition by peers for research achievements and non-utilization, on return, of expertise gained.

Traditionally either the very young and junior scientist or the senior official nearing retirement seem to form the bulk of those seconded abroad to participate in international assistance projects. While both categories have much to offer it is suggested that the experienced 'mid-career' scientist represents in many cases the most appropriate staff resource. As things presently stand, however, such specialists accept a foreign assignment at considerable risk to their career development. The 'action' is to be found at the centre of domestic departmental programs and reputations are to be made there not several thousand miles out of sight and mind.

The key to the solution or at least easing of this type of problem lies in an acceptance by departments - and particularly by senior departmental management - of international assistance as an intrinsic part of domestic activities. It will not be easy to encourage valuable staff needed at home to undertake secondments abroad or even to divert a part of their time from domestic priorities. Without this support and encouragement however, coupled with full recognition for personal achievements, many of the best people will remain aloof from efforts to help developing countries help themselves.

CONCLUSIONS

The single crucial roadblock standing squarely in the way of the ability of the science intensive departments and agencies of the Federal Government to either effectively utilize the twinning concept or to substantially enhance their participation in international assistance is the absence of a clear cabinet policy encouraging such involvement.

Until a break is consciously made with the traditional acceptance of 'foreign aid' as being the exclusive prerogative of CIDA and IDRC, senior departmental management cannot be expected to become involved to any great extent. Yet in the absence of such involvement the high level departmental and interdepartmental planning and professional matching of the scientific potential of the Federal Government with the needs of developing countries will not be made, nor sufficient resources found and priorities established.

Via the international element of their activities departments are becoming increasingly aware of the growing international development crisis. They are however restrained from responding by the present environment of severe financial

restraint which not only concentrates efforts on domestic priorities but additionally consumes those 'spare' resources which in the past might at a pinch have been made available.

While a new policy initiative is therefore an essential precursor to an effective response it will have to be complemented by consideration of how necessary resources are to be provided and the administrative mechanisms through which these can be applied and controlled. For what is involved is not just an additional increment to traditional technical assistance programs but a radical change in approach where international scientific assistance becomes an important extension of domestic research activities.

SECTION VI - TWINNING WITHIN THE FEDERAL GOVERNMENT CONTEXT ADDITIONAL BENEFITS AND POTENTIAL

INTRODUCTION

Those special attributes which make twinning a potentially powerful tool for the transfer of technology to developing countries are fully discussed in Section III. As is pointed out in the same section, the advantages accruing to both developing and developed institutions involved can - if a careful choice is made - be substantial.

Apart from its intrinsic value however the concept of twinning as applied to the Federal Government context is considered to offer other additional potential benefits. Some of these are of a direct nature such as the possibilities of enhancing, albeit in a modest way, the domestic programs of departments[1] involved and Canada's international image in the development field. Others of a more indirect nature include its likely influence on the assumption by departments of a higher profile in international assistance.

These considerations are touched upon in this section, the approach being to deal with the more specific departmental issues and then to move on into the wider context of possible industrial and political benefits.

THE DEPARTMENTAL CONTEXT

Pressures exerted by the growing international focus on scientific assistance to the Third World, the call from CIDA for greater departmental involvement and the increasing tendency for some departments to be drawn into this area as a direct extension of domestic programs, all point to the need for early and serious consideration to be given to new policies and mechanisms under which such participation can be facilitated. The adoption of twinning arrangements, even on a 'pilot scheme' basis, would represent the kind of long-term commitment of departmental resources which could not be made without recourse to the very policy and administrative considerations presently called for. Powerful in its own right, twinning could thus additionally act as a catalyst to bring senior departmental, CIDA and Treasury Board management together in a joint attack on the broader issues raised by a potentially closer departmental participation in technical assistance.

Within participating departments themselves the same long-term characteristic of twinning would require the inclusion of such linkages as part of departmental planning and programming cycles with a concomitant involvement of senior management. The

[1] 'Department' will be used to describe the science intensive departments and agencies of the Federal Government.

potential of twinning to heighten the awareness and better understanding of the needs of developing countries within departments has been mentioned earlier. An additional benefit offered however is the possibility of senior staff making short visits within the overall framework of such arrangements armed with the knowledge of the problems to be jointly addressed which the long-term association with the developing partner would provide. A way is thus offered of alleviating a major current problem of making scarce expertise available at minimum cost to domestic priorities. Similar possibilities are presented to ease the career problems experienced by those who currently have to 'leave their departments' to participate in assistance work abroad.

Much emphasis is rightly being placed by developing countries on the importance of a partnership approach to R&D problems of a common interest. In practice however experience provided by Canada's scientific agreements with industrialized nations suggests that truly common interests are not easy to find and that the familiar exclusive concentration of efforts on domestic activities strongly inhibits departmental contributions to what is often regarded as a diversion of badly needed resources to meet ends of a mainly political nature. The key factors here are considered to be the will of departments to get involved and their right to initiate at the outset only those activities which they - as the experts - perceive as being of value to the execution of their mandates.

The will, as illustrated by the concern expressed during many interviews, is certainly there, the means however are equally certainly lacking under present circumstances. The encouragement of departments to utilize twinning arrangements chosen by them and the availability of resources clearly identified for such arrangements would, it is suggested, be one step in the right direction.

To date very little in the way of cooperative research of mutual benefit is being undertaken with developing countries. This is not considered to reflect the absence of mutually beneficial research possibilities but rather the almost purely 'responsive to CIDA requests' role to which departments are presently reduced,[2] coupled with a still wide-spread (and largely incorrect) belief that neither the scientists nor the different environments of the Third World have much value to offer to Canada. The trick is to facilitate the entry into the field of far more of the right kind of departmental experts who alone are best qualified to judge the potential represented by a given set of circumstances.

An attempt to list research fields in which a degree of mutual benefit can be clearly identified would be outside the aim

[2] Although some moves are already being made by certain departments to provide the Agency with expert advice in the shape of liaison officers seconded to the Special Advisors Branch.

of this study and presumptive on the part of its author. A few illustrative examples provided during interviews may however be of interest. They include in the agricultural area genetic and hybridization research aimed at producing more productive and disease resistant crops; in medicine the acquisition of expertise in tropical diseases to which the much travelled Canadian is increasingly exposed; in resource management different environments available for experiment and the further development of Canadian equipment; in fisheries the investigation of species suitable for the further development of aquaculture in Canada. The extent and variety of possibilities is only limited by the imagination and initiative of the individual scientist concerned and the availability of resources to foster an interest. There is no lack of either of the former within the scientific community of the Federal Government and twinning could - in small part at least - provide some of the latter.

INDUSTRIAL BENEFITS

The aim of twinning is to provide a more effective response to the scientific needs of developing countries and not to encourage industrial development in Canada. Nevertheless there will be some occasions where the two are mutually compatible and these possibilities should not be ignored. It is not suggested that even the large scale use of twinning would contribute noticeably to industrial development in the broadest sense. There are however certain specialized areas of Canadian competence - aerial resource survey systems being one example - where a struggling Canadian industry providing a needed service to the Nation could be strengthened by the possibility of adapting its systems to developing areas and exploiting the larger market which they represent. The developing and domestic birds could thus be dispatched by the same twinning stone.

In the same vein, increased business could accrue to firms supplying equipment for use in twinning arrangements not only directly but through the exposure to potential clients, to new applications, and to information on wider prospective export markets. The international credibility represented by the use of such firms by Canadian government agencies should also be recognized. Even when 'aid' is untied - which seems likely in the near future - developing country nationals understandably turn to colleagues in the developed countries with whom they have a working arrangement for advice on where the best equipment and systems are to be purchased.

Twinning does not necessarily require that only departmental resources are to be used. There will be opportunities to contract out certain elements to provincial, university and/or industrial sources under the "make-or-buy" policy; perhaps even portions of those domestic activities from which departmental

resources could be more effectively diverted to international assistance projects. There already exist examples where such external sources are currently being used by departments engaged in development work[3] and at least one instance of such activity being contracted out under make-or-buy.[4]

Looking to the longer term, Canada as a major trading nation depends to nc little degree upon an expanding and stable world trading community. Recently there has been a marked deterioration in the National balance of trade resulting in 1975 in a substantial deficit. While continuing to seek broader relationships with the developed world - the European Community, Japan and others - the long-term prospects offered particularly by the more advanced developing countries should therefore not be ignored. Many of these in addition to offering future markets are producers of certain raw materials which are expected to become in short supply in the years ahead. On both ccunts it is clearly in Canada's best interest to forge or enhance close relationships - twinning could in its own modest way aid this process.

POLITICAL ASPECTS

Their deteriorating situation and the failure of the industrialized nations to respond adequately have over the past three years generated anew mood among the developing countries. In international deliberations this has been translated into a much more aggressive and cohesive stance and a determinatic̈n to bargain more effectively with the governments of the developed countries. The more advanced of the developing countries are those most likely to cause political difficulties and yet the emphasis in the development strategies of many industrialized nations - including Canada - is turning towards the needs of the very poorest. Fortunately, the advanced developing countries are those most advantageously equipped to benefit from the 'new' forms of assistance of which scientific and technological cooperation and twinning form part. The ingredients for alleviating the situation and adopting a positive response are thus at hand should the developed countries wish to grasp them.

Within Canada itself there is, as pointed out in the Speech from the Throne given on the 12 October 1976, an increasing awareness that Canada "cannot live in dignity as a nation while other people in less fortunate lands live in a state of deprivation and hopelessness." Involved, informed and active church and citizen groups have existed for many years. Their ranks have been swelled by the recent establishment of a "North-South Institute" whose first stated objective is to carry out a systematic examination of Government agencies, programs and priorities in the field of international development. The time therefore seems ripe for the Government to examine the

[3] CDA and EMR

[4] N.H.W.

possibilities of exploiting the substantial latent potential of its scientific community for meeting the needs of the Third World and to closer involve this important segment of the population in its development strategy.

The ripples of this broad groundswell of concern in the international assistance area are being felt in the scientific field in the shape of heightened activities in major international fora. These activities will be brought to a climax by the United Nations Conference on Science and Technology for Development (UNCSAT II) scheduled for early 1979.[5] The potential value of this major international initiative lies not so much in the actual Conference itself as in the preparatory work which will be undertaken first at national then at regional levels over the next two years. This work will determine what concrete measures will be taken to respond to the scientific and technological needs of the developing countries and set the scene for either a new level of mutually beneficial cooperation between the developed and the developing nations of the world or increased confrontation and instability. It will, additionally, highlight those amongst the developed countries who are prepared to contribute in practical terms as opposed to paying lip service. For these reasons its impact on Canada's current reputation as an enlightened and effective participant in international development could be substantial.

A major item on the proposed agenda of UNCAST II is the question of new forms of international cooperation in the application of science and technology, (Appendix C, page76). It is suggested that the introduction, even on a pilot basis, of the concept of twinning within the scientific element of the Federal Government would represent a highly effective and visible Canadian response to the Third World's request that new mechanisms be found and enhanced levels of scientific assistance to be made.

CONCLUSIONS

While the main benefits of twinning lie in its potential for transferring the scientific expertise of an institution in a developed country to a counterpart in a developing country or region there are other ancilliary benefits which could accrue both to the scientific community of the Federal Government and to other national interests.

The application of the concept to the science intensive elements of the Government itself would focus attention on the establishment of those policies and mechanisms badly needed to facilitate and encourage their more effective participation in international assistance - a participation sought by CIDA and being increasingly recognized as a need by the departments

[5] UN General Assembly resolution 3506 (xxx), para. 2.

themselves. The concomitant involvement of senior departmental management could alleviate many of the resource and career problems presently encountered.

Twinning relationships need not and should not be viewed in the traditional donor-recipient context but approached with the aim of jointly attacking scientific problems of common interest. Research of value to both partners can be identified providing the will exists and the right departmental experts are involved. The possibilities presented by the different environments and substantial scientific capability of the more advanced developing countries could be recognized and grasped.

Like many technical assistance activities twinning could offer the advantages of contacts, wider exposure and a broader international market base to Canadian firms providing appropriate services, equipment or expertise. The potential of contracting out services required either as part of a twinning relationship or to replace departmental resources committed to such a relationship should not be ignored.

In a far wider sense the adoption of twinning would represent a constructive and highly visible National response to the scientific requirements of the Third World at a time when international attention is being focussed on the need for innovative and concrete measures to be undertaken in this field.

SECTION VII - THE RESPONSE OF OTHER INDUSTRIALIZED NATIONS

INTRODUCTION

The challenge of S&T for development is not posed to Canada alone but is shared by other industrialized nations. The policies formulated by these countries as part of their national response, concepts applied - including twinning - and mechanisms adopted are thus of some interest. Time and resources however did not permit anything more than a very rough and ready survey of some of the major developed countries to be attempted - primarily with the assistance of Canada's science counsellor network abroad.

Because appeals for information had to be made early in the study when the definition of the ideal R&D twinning arrangement was still under formation the traditional difficulties encountered when dealing with 'what was meant by twinning' were experienced. These resulted in an emphasis being placed in replies upon the general approaches towards R&D assistance and institutional methods adopted rather than upon identifying the use of twinning per se. Where twinning was identified it was more in the context of a recent approach by certain governments - along the lines of this report - to use the concept as a tool in the narrow area of involving their own government S&T organizations in international assistance.

Nevertheless while bearing carefully in mind the fact that different domestic environments will affect national emphases and approaches, the information gleaned is considered pertinent both to this study and perhaps more to the further interdepartmental activity which it is hoped will ensue. For these reasons a separate review of the S&T cooperation activities between selected OECD[1] member nations and developing countries has been prepared and is presented in Volume II to the reader seeking more detailed information. This section merely extracts and highlights some of the more interesting facts.

THE OLD COLONIAL POWERS

The influence of history is nowhere more apparent than in the area of international assistance. In many instances a history of colonialization works to the detriment of the image of the ex colonial power, raising in the minds of the developing countries the spectre of continued influence and paternalism under the guise of development assistance. These same old colonial ties however, by a quirk of fate, have in many cases become ready-made institutional linkages in the S&T area providing both an understanding of development needs and the

[1] Organization for Economic Cooperation and Development

experience of working on problems of concern to the developing world.

The United Kingdom, (UK), France and the Netherlands are prime examples of this historial influence. Each possesses scientific institutions established many years ago to deal specifically with the development of their colonies, particularly in the fields of agricultural and tropical medicine. Each additionally enjcys a long established practice whereby many national research centres, (government and private), are involved, to varying degrees, in international assistance work as an extension of domestic programs.

Coordination of the many research elements of the naticnal development assistance programs of the UK, France and Netherlands is exercised in several ways; in the UK by means of a system of research committees, panels and boards under the overall auspices of the Ministry of Overseas Development; in France mainly through such major internationally aligned research organizations as ORSTOM,[2] GERDAT[3] and the Pasteur Institutes - though a national focus in the shape of a Coordinating Committee for Overseas Research (CCROM) is under consideration; and in the Netherlands by a National Council on Research for Underdeveloped Countries. A common thread running thrcugh all is the involvement cf senior management of the major pertinent scientific organizations in the planning and execution of the national technical assistance programs.

Although bilateral and multilateral institutional linkages undoubtedly exist in many shapes and forms within the overall international assistance programs of these nations[4] these represent a natural extension of associations of many years standing rather than new concepts to meet new needs. In one case however - that of the Netherlands Central Organization for Applied Scientific Research, (TNO) - the use of the twinning concept is being currently specifically emphasized in the context of the transfer of technology to developing countries. Nine such linkages are presently underway and several more are in varying stages of consideration. Overall planning and coordination for these is provided by TNO's very active Bureau for International Projects.

UNITED STATES, (US)

As witnessed by the several major speeches given by Secretary of State Kissinger during recent United Nations meetings,[5] the US is broadening its policy towards the developing countries with emphasis being placed on the role of technology transfer leading to industrialization. A recent manifestation of this policy stance is the national conference called in November 1976 to launch the US contribution to UNCSAT 11[6] for which,

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2 Office de la Recherche Scientifique & Technique. A large organization, (about 1300 personnel in France plus 1300 'local officers' throughout its 35 missions in developing countries), mainly concerned with fundamental research related to tropical plants and animal production.

incidentally, a location within the US is being offered. A further wider result is the current re-examination of domestic mechanisms for supporting international technical assistance now underway. Of particular interest to this study is the consideration being given to proposing new legislation aimed at permitting Federal Government agencies to become more involved in this area.

The short visit made during the study to both the US State Department and to the US Agency for International Development (AID) did not reveal a deliberate policy of employing the twinning concept in the developmental field. (Although interest was expressed in the Canadian study). Some use of twinning in its widest sense is made - particularly by AID's Office of Science and Technology in the university area - and it forms part of the many assistance programs undertaken by the National Science Foundation on behalf of AID. Except for the Bureau of Standards, however, which has linkages with many developing countries the concept does not appear to be used by the science-oriented federal departments. This situation may well alter if the legislative changes mentioned above are adopted.

SWEDEN

In many ways the position of Sweden in the international assistance field is analogous to that of Canada. Both have achieved an advanced degree of industrialization and have for many years been seen to be strongly committed to international development. Neither have colonial backgrounds. Unfortunately very little information was able to be gathered in the time available on the details of Sweden's assistance mechanisms and its use of twinning.

One area of direct interest to the study was however identified. This is the Swedish Agency for Research Cooperation with Developing Countries (SAREC) established in 1975 as the result of a recommendation by a special Royal Commission. (Details in Volume II).

SAREC shares with the Canadian IDRC an emphasis on R&D programs which strengthen the indigenous scientific capabilities and infra-structures of the developing countries. Its mandate however appears to be far broader in that it acts as a central coordinating authority for much of the Swedish domestic R&D effort dedicated to international assistance. To this end it has close and formal links with domestic research centres and councils.

Like CIDA, the Swedish International Development Authority (SIDA), appears to be consolidating its main efforts towards meeting the needs of the very poorest developing countries. The

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3 Groupement d'études et de recherches pour le développement de l'agronomie tropicale.

4 Bilateral Institutional Links in Science and Technology, UNESCO, 1969.

establishment of SAREC, which reports direct to SIDA, thus represents a means of mobilizing domestic R&D expertise to meet a major secondary development need without diverting SIDA resources and attention from its major strategic thrust.

FEDERAL REPUBLIC OF GERMANY, (FRG)

The existence of a large, financially powerful Federal Ministry for Research and Technology (BMFT - recent annual budgets running at some $1.6 Billion), has permitted the FRG to take a rather different apprcach to responding to the S&T needs of the Third World than the other industrialized countries reviewed.

Following the adoption by the Government in 1974 of a series of new principles and strategies for international technical assistance, a formal agreement was struck between BMFT and the FRG's Ministry of Economic Cooperation (BMZ)[7] under which the former assumed responsibility for the planning and execution of the R&D element of the nation's technical assistance program.

The agreement appears to have carefully tailored to meet the main demands of the developing countries in the scientific research and technology application area. It provides for the development of new technologies specifically suited to local environments, the adaptation of techniques already developed in the FRG and the further development of traditional local technologies. Research and development projects undertaken under the agreement can be carried out either in the develcping country, in the FRG, or in both.

An interesting facet is the split of funding. As a general guide the BMZ is to provide the bulk of the funds in support of assistance projects with the science ministry assuming the costs of the 'domestic' R&D portion including full staff and material expenses where institutionally supported centres are involved.

Because the science ministry contracts out much of its research to German industry the close involvement of this sector - with all the associated direct and indirect benefits - is automatically assured.

JAPAN

Japan is of particular interest to this study because of a fairly recent emphasis on the direct involvement of several Government ministries in the execution of its technical assistance program - an involvement which is expected to spread during the next few years to cthers.

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5 One of which including the US proposal for the establishment of an International Industrilization Institute.

6 United Nations Conference on Science and Technology for Development, Spring 1979.

7 Signed in April 1976.

Major examples of this process are the Tropical Agricultural Research Centre (TARC) and the Office of International Research and Development Cooperation.

TARC was established in 1970 by the Japanese Ministry of Agriculture and Forestry with the objective of assisting the development of tropic agricultural technology by carrying out research both in the Centre and in developing countries. Its main implementation strategy consists of the use of joint cooperative research programs with scientists of institutions in tropical and sub-tropical countries.[8] All funding is provided by the Ministry of Agriculture and Forestry. 39 research projects with developing countries and international research centres have been initiated since the Centre's establishment and responsibility assumed for a further 22 research projects underway at its inception.

The Japanese Ministry of International Trade and Industry is responsible for the development of mining as well as industrial technologies. In 1973 it established, within its Agency for Industrial Science and Technology, an Office of International Research and Development Cooperation responsible for international R&D cooperation with developing countries in the mining and industrial fields. Like TARC, the Office relies upon the mechanism of joint cooperative research programs tc carry out its mandate. Research must however be carried out both in Japan and a developing country and be aimed exclusively at meeting the latter's needs. More than a dozen such projects have been initiated to date and a detailed description of 9 are available to those interested.[9] Though called 'projects' these arrangements match very closely the 'ideal R&D twinning arrangement' defined in this study.

CONCLUSIONS

It would be ill-advised - though admittedly tempting - to draw, from the superficial review made, firm conclusions on the use of twinning in the international assistance programs of the nations surveyed. Nevertheless it can justly be claimed that the concept is currently being applied in the general context of governmental S&T organizations by at least two nations - Japan and the Netherlands. Its benefits are acknowledged in the 'Project Reports' of the former and were confirmed during an interview with a senior official of the government of the latter. It is considered likely that further detailed examination would identify its use by others.

The survey however does point to other matters of concern to this study. It is clear, for instance, that most nations reviewed are taking seriously the challenge which has emerged over the last few years in the R&D element of international

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8 TARC - General Information Brochure 1975.

9 Office of International Research and Development Cooperation - Progress Report of ITIT Projects, Volume I, March 1976.

technical assistance. The new strategies adopted in this area by Sweden, the FRG and Japan are cases to point. This suggests that Canada should not be satisfied to rest on the laurels gained by the establishment of the IDRC but should consider the potential of other initiatives aimed at improving even further the National response.

A further point emerging is the existence, in each and every nation considered, of one or more mechanisms established to focus appropriate domestic S&T resources on the international development problem. These differ in extent and form, but all involve senior representatives of national scientific communities in the strategic planning and coordination of development programs - if not in their actual execution. Many of these are of fairly recent origin, (Sweden, Japan, FRG, France, the Netherlands), and appear to emphasize the growing awareness of the substantial potential represented by domestic R&D capabilities and the concomitant need for a properly orchestrated national approach to their exploitation on behalf of the developing countries. As pointed out in Sections III and IV, no such instrument presently exists in Canada.

SECTION VIII - CONCLUSIONS AND RECOMMENDATIONS

GENERAL

This study was initiated as one small part of a Canadian response to the spectre of the dramatic failure of the attempts by the industrialized nations of the world to break the vicious circle of poverty, deprivation and despair to which the majority of the world's population is reduced. A break from the traditional forms of international assistance - with its overtones of patronage - is being sought by the developing countries in the direction of new strategies and mechanisms emphasizing a partnership approach towards the goal of self-reliance. In this new thrust the key role of science and technology as an essential element in the establishment of an indigenous industrial capability has been recognized.

Three fundamental demands are being made by the developing countries as far as science and technology is concerned. They provide the context into which the study fits and no apology is made for repeating them here. They are, simplistically stated:

a) A substantially enhanced level of technical assistance, in its widest sense;

b) The realignment of a part of the domestic R&D effort of developed countries towards the solving of major socio-economic problems faced by the developing countries; and

c) An implicit appeal for joint collaborative research to be undertaken.

Canada, through the IDRC, is making an effective, substantial and innovative response to the first major demand. Neither the IDRC however nor the substantial technical assistance program of CIDA answer, nor are designed to answer, the other two; a situation exacerbated by the Government's new strategy under which the bulk of CIDA's efforts will be directed in the future towards attempting to meet the basic requirements of the very poor developing countries. New strategies and mechanisms aimed at exploiting other sources will therefore have to be considered.

S&T RESOURCES OF THE FEDERAL GOVERNMENT

A major surprise encountered during the study was the very low level of involvement in international assistance by the major science-oriented departments of the Federal Government itself - 'peripheral' is as good a description as any. Taken together these organizations represent the most powerful single source of

scientific expertise in the Nation - a source moreover lying directly under the hand of the Government. Furthermore much of this expertise lies squarely in those areas of most potential value to the developing countries.

That this substantial resource has not been exploited to date is attributable to one major factor - the fact that departmental mandates do not include international assistance as part and parcel of domestic activities. Unless and until this state of affairs is changed departmental involvement will remain conditioned by the availability of those few resources which can, at a pinch, be diverted from pressing domestic priorities to respond to appeals from CIDA for assistance. Without a new policy direction and while the present climate of financial restraint continues not only will departmental participation fail to rise to meet the new challenges of international development but, on the contrary, will very likely be reduced from even the currently low level.

Within this context the concept of twinning scientific institutions of the Federal Government together with selected counterparts in the Third World is considered to offer many advantages. A proven means of transferring knowledge and experience between participating organizations it has for many years been extensively used in international assistance programs particularly in the university sector. In the rather special form proposed by this study it would superimpose upon the more general benefits offered by a sustained institutional linkage the possibility of adopting the critical joint collaborative attack on problems susceptible to a scientific solution so eagerly sought by the developing countries. Furthermore many of the basic characteristics of twinning - the commitment of an institution rather than some of its experts, the better understanding as an institution of the needs of the developing partner, the resulting opportunities for identifying mutually beneficial activities - are directly responsive to stated wishes of the developing countries.

Powerful in its own right the concept of twinning is also considered to offer substantial potential secondary or indirect benefits when applied in the Federal Government departmental context. The chief of these is the catalytic effect which its introduction even on a 'pilot scheme' scale would have on the establishment of policies and mechanisms needed to facilitate the entrance - in their own right - of departments into the international technical assistance arena. The problems of enlarging departmental mandates, sources of finance and manpower are common to both and their solutions equally applicable. In addition the involvement of senior departmental management demanded by the long-term commitment of resources to twinning arrangements would expose these key officials more directly to

the problems of developing countries and bring a level of expertise to bear on the strategic considerations of Canada's assistance program more commensurate with the substantial National investment now being made.

While the main benefits of twinning lie in its potential for enhancing the level of departmental response to the needs of developing countries, opportunities are also offered in certain industrial areas - such as resource survey - where Canadian equipment and expertise can be developed and applied to meet the requirements of wider export markets. The full exploitation of these and other possibilities, such as mutually beneficial R&D, will depend largely upon careful choice and planning. They do however exist.

Finally in the broader political context the use of twinning in the Federal Government R&D context would, it is suggested, be a highly visible and practical response in a major technical assistance area currently receiving a great deal of international attention - attention which will soon attract substantial National domestic interest as preparations for the forthcoming United National Conference on Science and Technology for Development gathers momentum.

A really effective Canadian response to all three major categories of scientific needs as expressed by the Third World is not considered possible without the full and active participation of the science intensive departments and agencies of the Federal Government. The desire for such involvement is believed to be growing within the departments themselves and is coupled with an appeal to this end by CIDA. The concept of twinning, as defined in this study, is considered to represent not only a powerful mechanism for the transfer of scientific expertise in its own right but also a 'cause celebre' which could focus departmental and interdepartmental attention on the problems currently inhibiting the effective application of Canada's single largest scientific resource to the benefit of developing countries. The feasibility of its use within this content is suggested by the three 'near' twinning arrangements which together represent a sizeable proportion of the current involvement of science-oriented departments in international technical assistance. Its full potential however will not be able to be exploited until the necessary policies and administrative mechanisms are established. It is therefore strongly recommended that:

1. Interdepartmental action be initiated to further examine the potential and benefits of, and modus operandi for, twinning scientific institutions of the Federal Government to selected counterparts within developing countries or regions with a view to recommending its early adoption on a pilot basis.

2. A concomitant interdepartmental review be undertaken of the present involvement of science and technology intensive departments and agencies of the Federal Government in the National technical assistance program with the aim of recommending measures to enhance the contribution made.

OTHER SECTORS

For reasons outlined in Section I this study was deliberately restricted to a quick 'first look' at the potential offered by the twinning concept in the context of the science and technology element of the Federal Government alone. This element however is complemented by broadly similar resources in the university, provincial and private sectors; resources moreover which are able to offer different and additional types of expertise and technology equally valuable and pertinent to the needs of the Third World. No examination of the potential of twinning will therefore be complete until the possibilities offered by these sectors have also been addressed.

The teaching and research potential of the Canadian university sector has been well appreciated and extensively used by both CIDA and to a lesser extent the IDRC. These efforts, which include the use of 'twinning' arrangements of various types and complexities, are carried out under the auspices of CIDA's Higher Education Cooperation Plan and are complemented by high level planning and advice provided by an advisory council on which the Agency and representatives of the Association of Universities and Colleges of Canada are represented. A review of the progress made under this system is currently underway and should provide valuable background to the interdepartmental activities recommended earlier.

While the 'science departments' of the Federal Government and the universities can offer much of direct and substantial value to the developing countries their contribution is probably weakest in the area of the application of research to the actual production of needed goods and services in a given developing country itself. This is the last and critical step in the whole R&D cycle without which the fruits of research will not be harvested. To this area the industrial research institutes of the provinces and the research elements of Canadian industry have a great deal to bring - for their emphasis lies squarely at the intersection of research and its application to manufacturing processes and products. During the study several instances of twinning between this type of institution and its regional or developing country counterpart came to light. (e.g. The New Brunswick Productivity Council and the Caribbean Industrial Research Institute). However their very nature usually precludes the participation of such organizations unless external funding

is available and it is considered worthwhile investigating the potential and mechanisms of further government support aimed at obtaining their closer involvement in international assistance via twinning arrangements. It is therefore recommended that:

3. Consideration be given to a feasibility study of the concept of twinning Canadian provincial and industrial research institutions with counterparts in selected developing countries and regions.

OTHER DEVELOPED NATIONS

Time did not permit anything more than a fleeting examination of the policies and mechanisms currently used by other developed countries to respond to the scientific needs and demands of the Third World - including their use of the twinning concept. Even this rough and ready approach however produced ideas and information of value and suggests that further more detailed study would be worth undertaking in parallel with interdepartmental activities in this area if the latter is subsequently authorized. In this event it is recommended that:

4. Consideration be given to a more extensive study of the technical assistance policies and mechanisms of other developed nations with particular reference to their use of the twinning concept and mechanisms adopted to involve their scientific and technological communities in the international development field.

THE CHALLENGE

Progress towards meeting some of the majcr needs of the Third World in the area of science and technology and thus helping create a more equitable world order depends to no little degree upon whether the Canadian Government succeeds in mobilizing the opinion and support of its own scientific community. It is hoped that this study - in its own small way - will contribute towards this process.

APPENDIX A

IDRC-Supported Research Undertaken by Canadian Federal Government Agencies

Source: IDRC

1. Agency	Project title	Date approved	Grant	Duration
Dept. of Environment	Aerial forest survey (Surinam)	Nov. 1972	15,000	

Description: To assist the Forest Management Institute in carrying out tests on a radar altimeter, for use in aerial photography to complete forest and other resource inventories.

2. Agency	Project title	Date approved	Grant	Duration
Dept. of Agriculture	Osmotic dehydration of food	March 1971	6,000	

Description: To develop at the Food Research Institute an improved and inexpensive system of dehydration by osmosis, using sugar or salt as the plasmolyzing agents, and applying the process to tropical fruit and fish.

3. Agency	Project title	Date approved	Grant	Duration
Prairie Regional Laboratory of the NRC, Saskatoon	Sorghum/maize hybrid	1975	104,000	2 yrs.

Description: To carry out research to determine the feasibility of creating a viable fertile hybrid, which would combine the desirable characteristics of maize and sorghum, through tissue culture.

The PRL has pioneered the development of techniques of cell-fusion for hybridization. Thus these techniques are being put to good use focussing on the sorghum/maize programme - besides assistaing PRL in the continued refinement of its methods, it is also possible that this hybrid or a variation, might be utilizable in Canada.

4. Agency	Project title	Date approved	Grant	Duration
Prairie Regional Laboratory of the NRC, Saskatoon	Food legume processing (PRL)	Oct. 1973	26,000	2 yrs.

Description: To conduct research on the milling of food legumes and cereals in support of current milling research being conducted in Nigeria.

Here work is continuing on modifying Canadian milling patents and technology for developing country use. Adaptations are being made to threshers from Hill Engineering of Thunder. It is possible that if, for example, appropriately modified threshers work in Nigeria, that country may order a large number of such threshers.

5. Agency	Project title	Date approved	Grant	Duration
Prairie Regional Laboratory of the NRC, Saskatoon	Plant development of cassava (PRL), Phase I	June 1972	35,800	
	Phase II	March 1974	32,000	

Description: To develop tissue culture techniques for the reproduction of cassava plants from somatic cells; and, in a second phase, to extend the meristem culture technique, develop procedures for producing disease-free cassava plants and to determine their genetic stability.

6. Agency	Project title	Date approved	Grant	Duration
Prairie Regional Laboratory of the NRC, Saskatoon	Food legume processing (PRL), Phase II	Nov. 1975	44,000	2 yrs.

Description: To continue the evaluation of simple grain milling equipment and to study the effect of mechanical decortication on the nutritional quality of Nigerian grains and legumes.

In none of these projects did the Canadian institution make the first approach to IDRC for support. Requests arose from institutions in developing countries, that e.g. PRL, with its international reputation for excellence, be involved, either in the development of research or techniques which can eventually be taken over by institutions in the developing world.

APPENDIX B

THE PARTICIPATION OF FEDERAL "SCIENCE AND TECHNOLOGY ORIENTED" DEPARTMENTS IN CIDA FUNDED TECHNICAL ASSISTANCE PROJECTS (1975/76)

Source: Finance and Administration Branch, CIDA.

Federal Department	Assistance Project	Expenditures (1975/76) $
Agriculture	RNDRPEST CONTROL 62-362-00202	29,196.36
Agriculture	Wheat Teams 62-902-00076	250,101.30
Agriculture	Drylands Agric. 64-270-00503	2,269.80
Agriculture	Cons. Agric. 64-270-00410	873.35
Agriculture	Publ Soil Analysis 64-600-00103	7,166.39
Agriculture	Soil Surveyers 64-600-00304	39,032.88
Agriculture	Dryland Cult. 64-468-00104	206,087.54
Agriculture	C ENG BETAIL 66-116-00309	334.96
Agriculture	Aide Alimentaire 68-444-00411	1,596.16
	SUB-TOTAL	536,658.74
Energy, Mines & Resources	Geothermal Power (Feasibility Study) 61-253-00504	446.54
Energy, Mines & Resources	Air Min Survey 61-440-00115	6,193.00
Energy, Mines &	Aerial Survey 61-926-00102	7,272.05

Energy, Mines & Resources	UBLS Expansion Programs 62-201-00052	2,299.91
Energy, Mines & Resources	Geological Survey 62-362-00102	9,521.00
Energy, Mines & Resources	Forest Persl 62-524-00051	7.50
Energy, Mines & Resources	Topo Mapping 3rd Project 62-902-00139	28,815.00
Energy, Mines & Resources	Aerial Survey 64-170-00309	3,416.00
Energy, Mines & Resources	Aero Mag. Survey 64-714-00222	2,567.35
Energy, Mines & Resources	Prospection Geophysique 66-232-00618	592.69
Energy, Mines & Resources	Dev LIP GOUR 66-380-00205	4,136.25
Energy, Mines & Resources	Nat. Cadastral Survey 66-660-01410	22,055.00
Energy, Mines & Resources	GOIAS Survey 68-204-00204	34,008.32
Energy, Mines & Resources	Dev. Capacities Teledetect 68-730-00412	2,175.92
Energy, Mines & Resources	Airborne Geo. Survey 36-500-00082	12,148.32
	SUB-TOTAL	135,654.85
Environment Canada	Castries Fish Plant 61-868-00403	8,674.39
Environment Canada	Meteorology Dept. 62-340-00108	4,497.68
Environment Canada	Rangeland Monitoring 62-524-00305	3,872.37
Environment Canada	River Sys. St. 62-702-00320	2,085.70
Environment Canada	Water Res. Sector Loan 64-472-00503	5,757.80

Environment Canada	Fisheries Manag. Info System 64-530-00501	2,087.08
Environment Canada	Fisheries Institute 64-906-00094	105,527.29
Environment Canada	EC Nat Pêcherie 66-116-00085	3,780.04
Environment Canada	Const. Naval 66-116-00304	11,340.18
Environment Canada	Releve océanographique 66-808-00501	810,005.04
Environment Canada	Pêche artisanale 66-808-00504	7,560.08
Environment Canada	IND Pêche 68-310-00404	3,038.27
Environment Canada	Cerper Pilot 68-730-00219	25,970.13
	SUB-TOTAL	994,196.05
National Health & Welfare	Aménagement rural 66-500-00301	27,129.51
National Health & Welfare	ICAITI 68-432-00202	18,394.04
	SUB-TOTAL	45,523.55
National Research Council	Scientific & Technical 68-204-00301	11,842.80
	SUB-TOTAL	11,842.80
Statistics Canada	WNS CONSTN 61-208-00401	9.00
Statistics Canada	Jamaica Dept. of Stat. 61-504-00070	16,001.75
Statistics Canada	Subvention Programmes 68-286-00405	2,606.57
Statistics Canada	Prog. échange coop celade 68-540-00502	505.00
	SUB-TOTAL	19,167.32
Transportation	Seawell Airport 61-176-00081	874.59

Transportation	Ports Adviser to CUB 61-252-00506	15,161.51
Transportation	Technical Advisor Harbour 61-253-00401	18,396.69
Transportation	Tech Asst Airports-MOT 61-253-00414	1,964.44
Transportation	TIMEHRI ILS 61-440-00302	277.87
Transportation	UBLS Expansion Program 62-201-00052	15,383.36
Transportation	Air Comn 64-472-00112	10,745.69
Transportation	EC Nat. Pêcherie 66-116-00085	1,632.01
	SUB-TOTAL	64,436.16
	TOTAL	1,807,479.47

APPENDIX C

THE UNITED NATIONS CONFERENCE ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT, (UNCSAT II), SPRING 1979

MAIN OBJECTIVES AND DRAFT AGENDA

MAIN OBJECTIVES[1]

1. To adopt concrete decisions on ways and means of applying science and technology in establishing a new international economic order, as a strategy aimed at economic and social development within a time frame.

2. To strengthen the technological capacity of developing countries so as to enable them to apply science and technology to their own development.

3. To adopt effective means for the utilization of scientific and technological potentials in the solution of problems of development of national, regional and global significance, especially for the benefit of developing countries.

4. To provide instruments of cooperation to developing countries in the utilization of science and technology for solving socio-economic problems that cannot be solved by individual action, in accordance with national priorities.

DRAFT AGENDA

1. Science and technology for development:

   a) The choice and transfer of technology for development;

   b) Elimination of obstacles to the better utilization of knowledge and capabilities in science and technology for the development of all countries, particularly for their use in developing countries;

   c) Methods of integrating science and technology in economic and social development;

   d) New science and technology for overcoming obstacles to development.

2. Institutional arrangements and new forms of international cooperation in the application of science and technology:

   a) The building up and expansion of institutional systems in developing countries for science and technology;

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[1] As recommended by the Economic and Social Council in its resolution 2028(LXI), paragraph 2.

b) Research and development in the industrialized countries in regard to problems of importance to developing countries;

c) Mechanisms for the exchange of scientific and technological information and experiences significant to development;

d) The strengthening of international cooperation among all countries and the design of concrete new forms of international cooperation in the fields of science and technology for development;

e) The promotion of cooperation among developing countries and the role of developed countries in such cooperation.

3. Utilization of the existing United Nations system and other international organizations:

Utilization of the existing United Nations system and other international organizations to implement the objectives set out above in a coordinated and integrated manner.

4. Science and technology and the future.

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

Program Projects Approved to June 14, 1975

(cumulative total in $000)

Region of Activity	Program Divisions					
	AFNS	IS	PHS	SSHR	Total	% of total
Africa	5,273	1,237	2,853	1,055	10,418	20.1
Asia	9,059	1,411	1,977	5,618	18,065	34.8
Carribean & Latin America	4,274	687	3,384	1,529	9,874	19.1
Global	238	1,150	1,244	6,401	9,033	17.4
Canada	1,229	1,340	74	1,836	4,479	8.6
Total	20,073	5,825	9,532	16,439	51,869	
% of total	38.6	11.2	18.4	31.8		100

AFNS: Agriculture, Food & Nutrition Sciences

IS: Information Sciences

PHS: Population & Health Sciences

SSHR: Social Sciences & Human Resources

Source: Projects 1975, IDRC, (page vii)

TABLE I

TABLE II

IDRC - EXPENDITURES IN THE NATURAL SCIENCES FY 1975/76

Research and Experimental Development

		$ Cdn (millions)
- In-house R&D	:	0
- R&D contracts	:	0
- R&D grants		
- Industry	:	0.317
- Universities	:	0.143
- Other Canadian	:	0.163
- Foreign	:	8.442

Related Scientific Activities

- Data collection		
- Foreign	:	0.672
- Scientific information		
- Industry	:	0.017
- Universities	:	0.016
- Foreign	:	0.809
- Testing and standardization		
- Foreign	:	0.161

Administration of Extra-Mural Programs

- R&D intra-mural	:	1.876
- Related scientific activities	:	0.347

TOTAL: 12.963

Source: Tabulated from IDRC's response to the Statistics Canada 1975/76 survey 'Federal Government Activities in the Natural Sciences'.

TABLE III

The Three Major Areas of CIDA's International Assistance
($ millions)

		FY 1972/73	FY 1974/75
1.	Bilateral Economic Assistance**	183.21	291.75
2.	International Food Aid	96.03	158.45
3.	Loans & Advances & International Financial Institutions	107.06	137.66
	Total (A)	$386.30 M	$587.86 M
	Total Assistance Budget (B)	$507.31 M	$760.01 M
	(A) as % of (B)	76%	77%

Source: Tabulated from data in CIDA's Annual Review 1974-75, p. 93.

** Includes largely capital assistance.

CIDA's Official Development Assistance Disbursements by Technical Assistance ** Programs

Years	Bilateral Technical Assistance			Multilateral Technical Assistance			Total Technical Assistance	
	Technical Assistance	% of Total Bilateral	% of Total Assistance	Technical Assistance	% of Total Multilateral	% of Total Assistance	Total Tech. Assistance	% of Total Assistance
1972-73	$39.67m	12%	7.8%	$0.81m	0.5%	0.1%	$40.48m	7.9%
1974-75	$51.93m	10.3%	6.8%	$3.54m	1.8%	0.5%	$55.47m	7.3%

Source: Tabulated from data in CIDA Annual Review, 1974-75.- p.93

** The term 'Technical Assistance' is defined here as used by CIDA. It excludes funding of International Development Research Centre, Non-Governmental Organizations and Canadian scholarships which are included by CIDA in their "Other Programs" category. However the term technical assistance broadly covers here the provision of scientific & technical advisors and teachers to LDCs, and providing LDC's trainees in Canada and the third countries for S&T related institution-building activities.

TABLE V

PARTICIPATION OF FEDERAL "SCIENCE DEPARTMENTS"* IN CIDA'S TECHNICAL ASSISTANCE PROGRAM, (1975/76)

DEPARTMENT	CIDA PROJECTS** ($000)	INTRAMURAL S&T EXPENDITURES ($000,000)	PERCENTAGE
Agriculture	536.7	112.9	0.48
EMR	135.7	83.4	0.16
Environment	994.2	266.3	0.37
NHW	45.5	24.5	0.19
NRC	11.8	87.4	0.01
Stat.Can.	18.6	117.7	0.02
MOT	64.4	7.5	0.86
TOTAL	1,806.9	699.7	0.26

1. CIDA's total technical assistance program 1975/76: $54,320,000
   Percentage involvement of "science departments": 3.3%

2. Total Federal Government expenditures on intramural S&T (Natural Sciences), 1975/76 : $941,600,000

   Percentage represented by involvement of "science departments in CIDA projects" : 0.19%

Note: *DND and AECL NOT included.

**Figures rounded off to nearest hundred.

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