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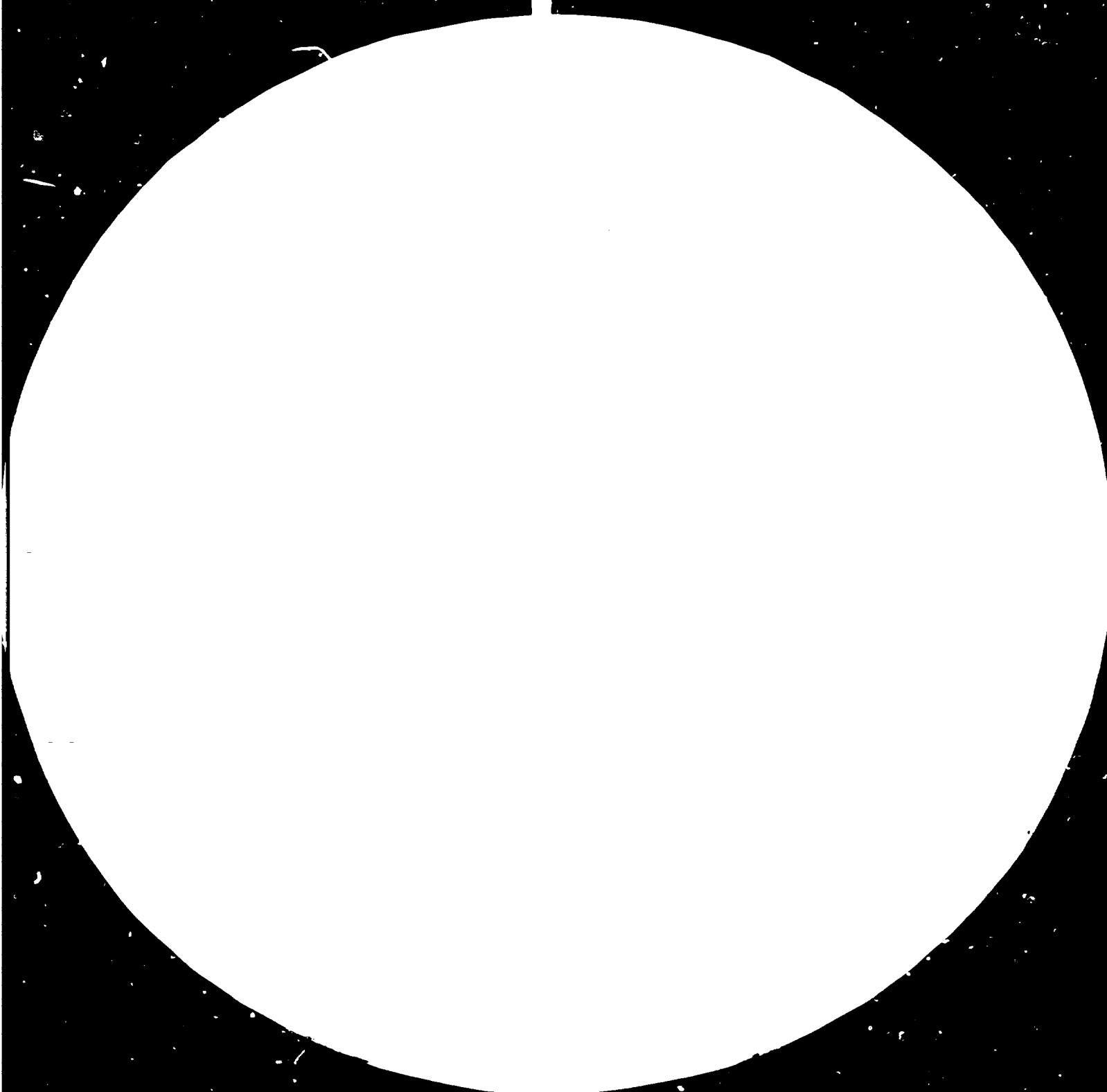

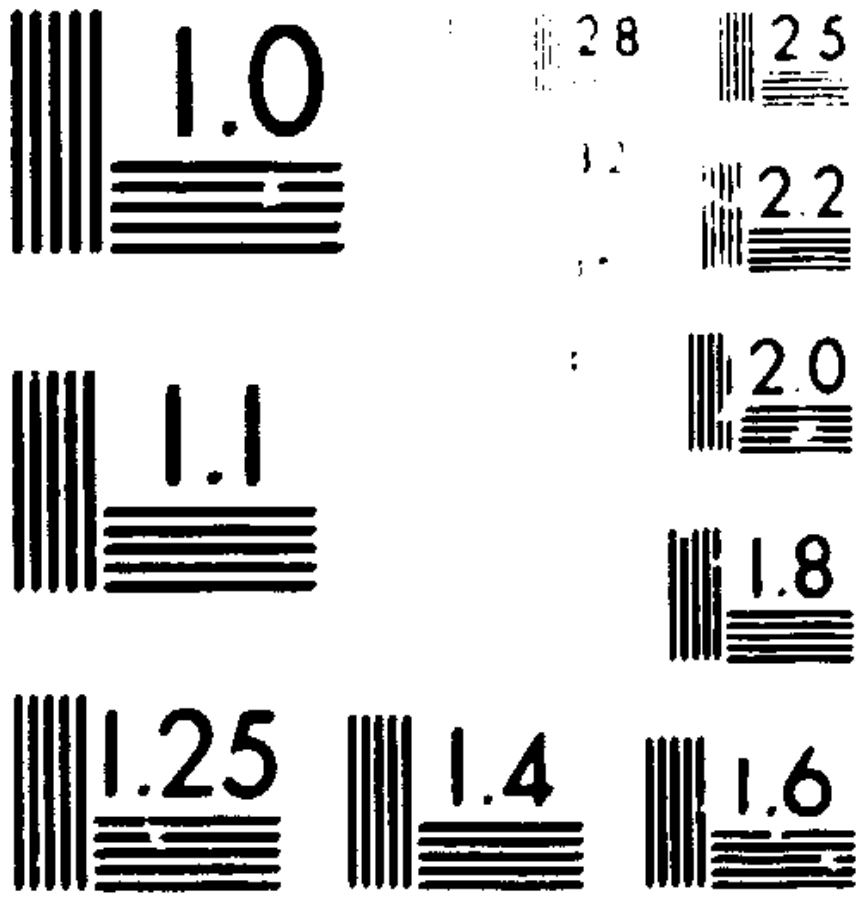
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TECHNOLOGY TRANSFER PROBLEMS AND DEVELOPMENTS IN GUYANA*

Proceedings of a National Seminar on
Technology Transfer Management

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Preface

The Technology Transfer Unit of the National Science Research Council of Guyana, in collaboration with the United Nations Industrial Development Organization (UNIDO), sponsored a National Seminar on Technology Transfer Management and Industrial Development in Georgetown, Guyana, from 16-21 February 1981. The purpose of the Seminar was:

1. To create awareness of technology transfer problems and opportunities among both decision-makers and the general public;
2. To pave the way for setting up institutions to facilitate technology policy formulation and implementation;
3. To serve as a model for wider use in adapted forms in other Caribbean countries.

The Seminar was attended by senior officials of the Civil Service, public corporations, co-operatives and private firms. Representatives from the Guyana Trades Union Congress, the Caribbean Community Secretariat and the Guyana Consumers' Association, among others, also attended.

These edited proceedings are a collection of selected papers presented at the National Seminar. The breakdown of the volume is as follows:

The Introduction gives the opening addresses; Part one deals with the Industrial Development and Management in Guyana; Part two covers the Role of Technology Transfer in Industrial and National Development; Part three focuses on Technology Transfer case studies in Guyana; Part four is on Aspects of Technology Transfer Management; and finally Part five looks at Regional Aspects of Technology Transfer Management.

The contributors are drawn largely from practitioners in the Government, public corporations, and science and technology research institutes in Guyana. It is hoped that policy-makers in other developing countries will benefit from these presentations.

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ORGANIZATIONS

BIMAP	Barbados Institute of Management and Productivity
BIRPI	United Nations Bureau for the Protection of Intellectual Property
BNSI	Barbados National Standards Institute
CARDI	Caribbean Agricultural Research and Development Institute
CARICAD	Caribbean Centre for Development Administration
CARIFTA	Caribbean Free Trade Association
CARICOM	Caribbean Community
CARIRI	Caribbean Industrial Research Institute
CCMRC	Commonwealth Caribbean Medical Research Council
CCMSC	Caribbean Common Market Standards Council
CDB	Caribbean Development Bank
CIDA	Canadian International Development Agency
CTCS	Caribbean Technological Consultancy Service
GNBS	Guyana National Bureau of Standards
IAST	The Institute of Applied Science and Technology
IAU	International Association of Universities
IEC	International Electrotechnical Commission
ICPE	International Centre for Public Enterprises in Developing Countries
IDB	The Institute for Development Studies
INTIB	Technological Information Exchange System (of UNIDO)
JBS	Jamaica Bureau of Standards
NSRC	National Science Research Council
OAMPI	African and Malagasy Industrial Property Office
OPEC	Organization of Petroleum Exporting Countries
PAHO	Pan American Health Organization
TEU	Technology and Energy Unit, Caribbean Development Bank
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Programme
UNIFSTD	United Nations Fund for Science and Technology for Development
WIPO	World Intellectual Property Organization

INTRODUCTION

Opening remarks - Mr. Desmond Hoyte, Vice-President,
Economic Planning and Finance

The Seminar was formally opened by Mr. Desmond Hoyte, Member of the Central Executive Committee of Guyana's People's National Congress and Vice-President for Economic Planning and Finance.

Developing the theme that an environment in which initiative, creativity and innovation can flourish is an absolute precondition for technological development and advance, Mr. Hoyte underlined the dependence of that environment on the political milieu: "The political structure can stimulate or destroy technological development."

This was amply demonstrated by Guyana's own experience as a colony, during which time thriving cotton and coffee industries were suppressed in the interests of sugar. Outside sugar interests also destroyed prosperous village economies and with them the local technologies that supported productive village activity.

The association between the sugar industry and local commercial and manufacturing interests was such that profits on both sides were maximized at the expense of local technological capacity. The sugar estates, for example, substituted punts made from steel, as a result of which the art of making cane punts virtually died out. With it went the opportunity to develop a wood boat industry that would have stimulated a wood-processing technology, marine engineering and related skills.

This was but one of many examples where imported replaced indigenous materials leading to destruction of skills and decline of trades based on local products. The important point, however is that the political dimension must let the people apply their ingenuity and skills to the development of technology best suited to their needs, resources and environment.

Technology will, of course, have to be imported from time to time - but what kind of technology? How can dependency reminiscent of the colonial era be avoided or minimized? Some developing countries import technology that is so sophisticated their engineers and technicians do not understand it, cannot manage it and cannot maintain it. Guyana itself made a different kind of mistake in switching from wood-burning power generation to oil-burning. "We have an abundance of wood; we do not have oil. We fell into the trap of modernity" pointed out Mr. Hoyte.

The source of much technology, the transnational corporations, presents another problem. "Studies of their modus operandi and recent public disclosures reveal that their operations sometimes conflict with the interests of developing countries". Mr. Hoyte questioned, however, the interpretation that developing countries exist in a state of technological dispossession. "There are still many options open to developing countries to protect themselves, secure their interests and advance their development objectives".

Four such options are:

(a) whether indigenous technology might not be equally effective;

(b) whether a simpler more manageable type of technology might not be equally as useful as sophisticated, advanced technology;

(c) whether to insist on an imported technology that means less not more dependence on imported raw materials;

(d) whether the required technology is available from a developing country.

What Guyana has done in this respect includes formulation of a national policy for acquisition of appropriate technology and development of indigenous technology, setting up of a Technology Policy Unit to deal with and advise on the acquisition of imported technology - especially that for small and medium-sized private firms, foundation of the Institute of Applied Science and Technology at the University of Guyana and instituting a system of annual awards for scientific and technological achievement.

* * *

Address - Mr. R. Rainford, Deputy Secretary-General,
Caribbean Community

Mr. Roderick G. Rainford, Deputy Secretary-General of the Caribbean Community focused the attention of the meeting on the needs for third world countries to develop sufficient technological capacity within themselves. Two particular dangers in the field of technology transfer, he pointed out, concern decision-making by the "educated third world man" and the fact that most of the technology currently being transferred is harnessed to the purposes of western society.

Educated third world man finds himself "ensnared in an historical centre-periphery relationship" and in consequence tends to adopt as his own the centre's "ahistorical belief in the permanence of this relationship." A pressing question for research, urged Mr. Rainford, is whether third world countries "are being under-developed by the training and education of their elites. The answer is for us to master and not be mastered by these training experiences."

In line with this, achieving the basic goal of creating technological capacity in developing countries would automatically take care of the issues involved in technology transfer and problems of appropriate technology. Technically advanced countries, noted Mr. Rainford, do not reflect an obsessive preoccupation with these issues. "A country that has achieved technological capacity," he said, "is automatically able to effect transfer of technology to itself and engage in the adaptation of imported technology." Moreover, exclusive focus on technology transfer in formal terms can conceivably lead to a long drawn out process of technological relations between the centre and the periphery, without the periphery developing, even in the long run, any meaningful technological capacity.

Warning against technology policies in developing countries that focus too exclusively on formal technology transfer, Mr. Rainford said that technological developments and innovations taking place in the World Centres embody particular social and economic configurations and a particular world view and image of reality. "The transfer of technology from these World Centres to the countries of the periphery accordingly implies a transmission not only of knowledge of techniques, but also of entire modes of material and social organization for human existence, and there may not always be a 'fit' between this and what is 'warranted' by the objective conditions and circumstances of the receiving countries. In other words, there is the ever present danger of developing countries becoming caught up in the patterns of technology transfer which are but yet another dimension for giving effect to well known general tendencies to reconstruct the world in the image of western human and material organization."

Rejecting the barren notion of "catching up with the West," Mr. Rainford painted a picture of new technological capacity in the third world harnessed in the service of an alternative civilization. In contrast are examples of technology developed for cocoa, rubber and cane sugar, all tropical resources harnessed to the purposes of western society. At the same time, technology being developed for industrialized countries clusters more and more around the syndrome of increasingly large scale-production and automation based on an entrenched pattern of consumption of goods and services often irrelevant to and considerably in excess of the ceiling of rational and basic human needs, involving a depletion of non-renewable resources and creating a destructive impact on the eco-system of the earth. "It is to this very system of activity that numerous third world countries have found their wagons hitched," warned Mr. Rainford.

The model for technological development in the third world should find expression in five directions:

1. A commitment to principles of satisfying basic human needs such as food, shelter, clothing, transport, health, education, leisure and creative self-expression;

2. Developing technologies for scales of production appropriate to the many small, mini- and micro-states in the world today, i.e. rejecting the idea of minimum scale plant and the inexorable trend for it to increase in size;

3. Gearing the structure and composition of third world production to the opportunities existing in each country's own environment;

4. Shaping techniques of agricultural engineering and plants adequate to the special problems of the tropical environment, i.e. soil types, climate and patterns of plant disease;

5. Emphasis on technologies for exploiting renewable sources and those that conserve rather than destroy the environment.

Finally it is important to pay attention to the dynamics of creating technological capacity, Mr. Rainford pointed out. In industrialized countries this had either been the result of unco-ordinated individual effort or of organized innovation within large corporations. "The process will have to be different for today's developing countries," he noted. The private sector still has a critical role to play, but from the outset technological development is an aim of direct concern and responsibility of the Government. Governments are forced to play a primary role in promoting the development of technological capacity. Either way the driving force has to be ultimately indigenous: "External agencies cannot deliver technological capacity to a developing country; they can only contribute to the achievement of technological capacity once the country gets its own indigenous momentum going."

Fields for Government action are many; developments should be mutually reinforcing on several levels and directions:

appropriately conceived science education programmes in schools;
centres of advanced technical and scientific education;
opportunities for scientific and technical training;
institutes and centres for R and D;
formal and informal management training,

specialized technical libraries;

R and D promotion at enterprise level;

specialized technical associations;

application of the principles of "appropriate" technology, effective transfer, absorption and diffusion into the merging technological community.

Scarcity of resources in this connection suggests considerable scope for co-operation among developing countries, especially for risk sharing in R and D where there is common resource endowment. While Europe is co-operating on space research, Mr. Rainford concluded, developing countries could investigate processes for complete coconut and fibre utilization.

* * *

Address - Mr. William H. Tanaka
Head, Development and Transfer of Technology Branch, UNIDO

Mr. William H. Tanaka, Head, Development and Transfer of Technology Branch, UNIDO, conveyed the best wishes of Dr. Khane, the Executive Director, for the success of the Seminar. Recalling the recommendations of the Second General Conference of UNIDO that the share of developing countries be increased to at least 25 per cent of the total world industrial production by the year 2000, Mr. Tanaka stressed that the industrialization process must be drastically accelerated if these target figures are to be achieved. In August 1979 the United Nations Conference on Science and Technology for Development held at Vienna, Austria, adopted the Vienna Programme of Action and urged the need to strengthen the technological capabilities of the developing countries. The Third UNIDO General Conference adopted in February 1980 the New Delhi Declaration which emphasized the relevance of such strengthened technological capabilities to the development of industrial production and achievement of self-reliance.

Emphasizing the strengthening of technological capabilities it should not be forgotten, Mr. Tanaka stressed, that technology transfer is not an end in itself but a means to promote industrialization. UNIDO recognized four main elements of great importance to be pursued in a systematic manner: development of human resources; building up of institutional infra-structures; preparation of an overall framework of activities on the basis of a set of technological policies, plans and programmes, and an efficient information system. Among these elements, practical and realistic activities must be initiated in a well co-ordinated manner; according to the priorities of the national economic and industrial development plans; without losing sight of the overall and total impact of the individual activities on the achievement of the national objectives and targets.

Mr. Tanaka gave significant emphasis to the great potential that the country possesses. the possibilities of mobilizing these potentials towards promoting the industrial development and subsequently the socio-economic conditions for the interest and benefit of the people. He also noted a few of the great number of practical activities already in the pipeline such as: mini-hydro generation; formulation and packaging of agricultural chemicals and pesticides; engineering consultancy services; application of computer technology, and the project proposal for a Caribbean Technical Consultancy.

Stressing the importance of identifying the priority areas, Mr. Tanaka referred to the need to form the basis of guidelines and recommendations for submission to the Government for the formulation of policies and programmes of action. UNIDO would co-operate and collaborate, within the limited resources available, in carrying out activities in this field.

PART ONE

INDUSTRIAL DEVELOPMENT AND
MANAGEMENT IN GUYANA

INDUSTRIAL MANAGEMENT CHALLENGES IN GUYANA

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Thelma Joseph

Director, Guyana Management Development and Training Centre

INTRODUCTION

Guyana, like most developing countries, feels that the means of closing the gap between being developed and underdeveloped is to improve and increase its rate of technology development. Whether this reason is apt is not the main concern, since the fact is that the use of transferred technology is being pursued in an effort to aid development.

In its economic development plan, the Government has outlined its intention to push the manufacturing and industrial sectors within the framework of its political philosophy. It means, therefore, that its technological development approach must also reflect adherence to this philosophy. It is in this context that the discussion focuses on industrial management challenges in transferring technology which must take cognizance of the existing economic, social, cultural and political conditions.

There is no clearly articulated technology policy for Guyana, but the intention of the Government can be assumed from its expectation of the role given to the public enterprise in the execution of its economic and social development programmes, and from its education policy, the importance given to science and technology on the curricula of the schools.

The instruments for transfer and development of technology would have to be examined in order to relate the actions that Industrial Management should undertake to better facilitate transferred technology.

The establishment of the necessary technological infrastructure calls for Government to recognize the active role it has in stimulating technological improvement within an international environment today where it has been realized that:

(i) the technological gap between the technological leader and follower is wider;

(ii) the organization of the international market for technology is quite systematized:

(iii) the direction of the developed countries' consumption technology varies from the developing countries.

As expressed by a leading Caribbean economist, the experience of developing countries shows that technology transfer is more in the form of a technology sale involving an absence of proprietory rights and of effective knowledge. Also transferred technology is often too capital intensive, too scaled up for the small sized domestic markets and based too much on imported inputs. However, it is still demanded by developing countries, Guyana being no exception. It calls for the type of technology transferred to be questioned, the source of the technology inputs to be broader, i.e., not to stick to Western/advanced technology but to look for countries whose situation is not dissimilar. This means that the management of the transfer of technology would have to be more professional.

It calls for more suitable and appropriate technology to be transferred and the necessary administrative machinery instituted to ensure that this takes place.

It also means that the present divergence between domestic resources and production would be narrowed. Finally, transferred technology should not discourage the development of an indigenous technological capacity.

In light of the theme of this seminar, the paper proposes to look at the changes taking place in Guyana and what these would mean to Industrial Management if they are expected to take up the challenges necessary to aid Guyana's development through the transfer of technology.

ECONOMIC, SOCIAL, POLITICAL AND CULTURAL IMPACT

Guyana's economy has been dependent on bauxite, sugar and rice production as the main contributors to GNP. The attainment of political independence in 1966 and Republican State in 1970 are major achievements. The Government, in its attempt at extricating the economy from its backward state, embarked on a programme of economic and social transformation. The development of the agricultural sector was among the priorities in terms of diversifying the agricultural base. Expansion of industry and manufacturing sectors is being pushed in an attempt to diversify the economic base.

A socialist ideology was adopted which aimed at the institutionalizing of equal opportunities to all citizens. It meant that workers' participation in the decision-making process of the economy and enterprises had to be developed.

Culturally, the development plans had to recognize the six peoples of Guyana (Amerindians, Africans, Indians, Chinese, Portuguese and other Europeans) and their origins and the legacy of a plantation system (stratified labour force) and crown colony systems.

In the 1970s, the growth of public enterprises as the main instrument for execution of economic and social development programmes developed. Nationalization, government entrepreneurship and majority ownership and control were the means used to acquire the enterprises.

Today, the public corporations control the operations of the majority of enterprises.

Guyana's economy suffered a setback in 1976 when its foreign reserves fell drastically after a large expenditure on capital works, with no corresponding rise in export earnings. This necessitated a change in our importation pattern and a demand for increase in products for export.

Guyana's policy on foreign investment also changed in the 1970s and this affected the inflow of direct foreign capital which put a squeeze on the economy, to support all the development projects that had been implemented. However, indirect foreign inflow was allowed through aid programmes and Technical Assistance.

TECHNOLOGICAL ENVIRONMENT

Mention can be made of the characteristic features of technological development of Guyana:

(a) it is based heavily on transfer of advanced Western technology;

(b) recently it has begun to seek transfer of technology from other non-Western sources, namely China, the German Democratic Republic (such technology may reflect social transformation) and Japan.

This technology transfer takes the form of:

Books and Articles (with vital information kept by the supplier to preserve monopoly).

Scholarships granted to locals (who return as salesmen of their Western production and cannot adapt learnings to local environment).

Movement of skilled personnel from the Developed Technology supplying country as Experts (these personnel are, most times, culturally disoriented and are not always of the best).

Aid and Technical Assistance (which is very often tied through the sale of patents, licences and contracts or "know-how" agreements).

Guyana, again, like most developing countries, lacks the persons with the technical skills to:

assess technology,

adapt technology, and

improve technology.

It means, therefore, that this is a feature lacking in our technological development process which has to be corrected through development of skilled manpower and increased Research and Development Facilities.

The development of domestic technology has not been on a commercial scale but is being encouraged.

MANAGEMENT ENVIRONMENT

At this point, mention should be made of the existing management environment in Guyana which can affect the actual administering of the technology in the enterprises. Here, reference is being made to:

the migration of management capability and skilled labour;

the competition among industrial enterprises for the limited available managerial resource, especially to manage new projects;

poor decision-making capacity which is a spin off of the limited data base facilities:

the lack of proper manpower planning activities in enterprises;

limited training and development of staff - both at managerial and at technical levels;

low productivity levels which may be due to:

(a) motivation level of workers;

(b) inadequate compensation;

(c) limited upward mobility;

(d) attitude of malaise in the work force;

lack of objective appraisal system in organizations;

non-functioning monitoring systems.

Industrial Management must take responsibility for providing training and development of their staff within their organizational development plans. Setting up Functional Appraisal systems which would require objective task analysis would be one of the challenges to management in this situation.

ADMINISTRATIVE ARRANGEMENTS FOR TRANSFER AND DEVELOPMENT OF TECHNOLOGY

In the Administrative Arrangement for Transferred Technology in Guyana, the Ministry of Economic Development is the link between the Government and the Suppliers of Technology.

It means, therefore, that the personnel of the Ministry must be in consultation with the enterprise which is the recipient of the technology in order to attain the best possible terms of agreement.

The Monitoring Committee of the State Planning Secretariat, a Central Planning arm of the Government, evaluates the performance of the enterprise with a view to assessing the return on investment and effectiveness of the technology.

In looking at the transfer of technology cycle and enumerating the challenges to Industrial Management at each stage would give a rounded picture of the situation.

1. Introduction to Transfer and Development of Technology

In the process of introducing transferred technology, the first and crucial step is in the identification and selection of appropriate technology.

At a recent workshop on "Management of Transfer and Development of Technology in Public Enterprises in Developing Countries", the keynote address referred to:

> "The adoption by developing countries of foreign technology devised in a wholly different environment, serving totally different goals and using different inputs was one of the basic reasons for the overall dependency of developing countries and the shaping of developmental patterns not in accordance with the basic needs and developmental objectives of developing countries." 1/

The conditions, therefore, under which the transfer is to occur, must be clearly spelt out and the persons who are negotiating the terms of the transfer for the developing country must ensure that the country gets what it wants and needs.

Industrial Management is challenged through their role in advising Government on the direction of technological development to be selective in their choice of technology suppliers; to convince suppliers to adopt a more positive role in technology transfers to countries like Guyana by sharing essential knowledge, and ensuring information dissemination.

The necessity for functioning information systems to support decision making activities is vital. Consequently, it means that Industrial Management would have to build a general technological and informational base - acquire specific technological knowledge to facilitate effective choice between competing/alternative technologies; and information on specific activities and performance of the various enterprises in production, sales, finance and purchasing.

Communication within organizations is an area that needs to be considered. Persons to be affected directly or indirectly by technology transfer must be kept informed.

1/ International Workshop on Management of Transfer and Development of Technology in Public Enterprises in Developing Countries held in Ljubljana, 19-24 June 1978, page 9.

Industrial Management should be looking for appropriate technology. The challenge is to set criteria upon which choice of appropriate technology should be based. Generally, it is expected that such criteria must recognize:

transferred technology within our social considerations, e.g. surplus labour that exists;

skills development against perpetual dependence on external assistance;

costs and marketability of the output so that we can be competitive on international markets;

utilization of local inputs;

economic development strategy.

2. Operations of Transferred Technology

The transfer of Industrial Technology can affect the country's level of dependency on the suppliers of the technology.

Machinery and equipment purchased to activate the technological process have inherent follow-up activities vis-à-vis servicing, repairs and parts replacement. Since technology suppliers in their effort to maintain control of their technology only sell to the developing country instructions for use and not knowledge of the full operation, they seek to tie the recipient to them for those follow-up activities.

In Guyana, this is observed, e.g., our communications industry, the telecommunications equipment is returned to the suppliers for servicing since that facility was not provided for locally. This means that employees are not fully utilized during this time. As a result, it could be said that the operation of the transferred technology affects:

(i) Production — since this is held up whenever one of the follow-up activities is to be done by the supplier of the technology;

(ii) Industrial Relations — in situations where the reaction of the Union and their workers to the implementation of the new machinery or equipment is negative since it is seen in terms of its effect on their job security;

this causes also alienation of workers, especially senior workers who are not exposed to training for the new technology;

development of negative coping mechanisms by supervisors of the newly trained persons who are to operate the technology, if the supervisor himself has not been trained;

(iii) Finance Management — when suitable accounting systems, costing systems and adequate financial analysis of operations are not done to reflect the actual costs involved in the operations;

(iv) Sales — the propensity to sell to external markets means that the output must be competitive in both domestic and regional markets, therefore, prices (which must cover cost of production) must be relative to those existing in the foreign markets.

In summary, it means then that in managing the operations, Industrial Management must be aware of the technology and its effect on the Personnel, market competition and other functions of the enterprises.

STRATEGY FOR INDUSTRIAL MANAGEMENT IN TRANSFER AND DEVELOPMENT OF TECHNOLOGY

In order to meet the Industrial Management challenges enunciated, Management of Public Enterprises would have to:

ensure that there is a clearly articulated technological policy which gives guidelines to:

(a) the introduction of transferred technology;

(b) the adaptation of transferred technology;

(c) the development of domestic and innovative technology;

(d) the training of skilled manpower;

have clear criteria listed for selective technology transfer;

develop a strong negotiating team with experts in the particular line of technology that is being sought;

develop a proper technological and information base - Management Information Systems will have to be set up in each enterprise;

include provisions for infrastructure facilities and inputs to ensure effective implementation of the technology in the transfer package;

set up the communication network to introduce transferred technology to the persons affected;

develop proper Research and Development facilities - here the Government and the Technology Transfer Unit (TTU) have parts to play. Government, in terms of releasing the necessary foreign exchange for purchasing equipment, etc., and TTU, to constantly remind Industrial Management, through seminars, etc., of their role in transfer of technology.

SUMMARY

The paper attempted to discuss transferred technology with reference to Guyana, highlighting the process and instruments of transferred technology and the challenges that face Industrial Management if they are to meaningfully assist in the development of technology.

The brief reference to the economic, social, technological development and management conditions in Guyana was to emphasize the necessity to transfer technology in keeping with the environment existing in the recipient country.

The introduction of transferred technology and the operation of the technology which are the two main aspects of the transfer process were discussed in an attempt to highlight some of the pitfalls and, later, develop a strategy to avoid them.

The strategy outlined recognizes the need for an articulated technological policy by the Government; the strengthening of the negotiating teams; developing criteria for selection of transferred technology; well-developed Research and Development facilities and, of course, availability of necessary information systems and funds to facilitate the Research and Development process.

Industrial Management challenges arise within each of these activities and the leadership is being called upon to recognize its role and managerial responsibilities so that transferred technology would be appropriate for the development of Guyana.

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INSTITUTIONAL ASPECTS OF INDUSTRIAL DEVELOPMENT AND MANAGEMENT IN GUYANA

O.A. Baptist

Executive Vice-President, Guyana State Corporation

The Development Concept

It needs to be stated at the very outset that Industrial Development in the context of Guyana has to be regarded as but one element, albeit a vital one, in a total process of ensuring balanced and orderly growth, the benefits of which are to be equitably distributed across the whole society. This underlying concept of integrated development of the total society in itself necessarily implies putting into place an institutional framework within which such development will be planned and ordered.

But Guyana also embraces the philosophy of self-reliance and in the foregoing context of development this further suggests the existence of institutional mechanisms by which the country can:

(a) enumerate its natural resources and adumbrate policies for the exploitation thereof;

(b) research, identify and refine appropriate indigenous technology to enhance our competitive ability overseas and reduce our inherited high propensity to import;

(c) establish such linkages in the agro-industrial sectors of the economy as would optimize the wealth creative potential of both our natural and human resources.

We cannot however intelligently assess either the validity of our development concepts or the appropriateness of our institutional responses unless we appreciate the circumstances underlying our country's confidence that it possesses the main ingredients necessary to sustain a viable recipe for balanced growth.

The Background

Guyana is gifted with significant natural endowments as represent[illegible]eral deposits, agricultural land, marine and forest resources the output of which [illegible] after minimal processing and enhancement of value. In addition a vast hydropower [illegible] remains virtually untapped.

A population of less than one million with severely limited purchasing power provides no home market base for large-scale manufacturing enterprises.

An inherited distortion in the structure of the economy has perpetuated a high propensity to import inflation while prices for our primary exports remain volatile.

Inappropriate educational emphases in the past have bequeathed us a rich legacy of articulate academics who are equipped to contribute more to the literature rather than the labours of development. Indeed not only has the legacy of technological and managerial capability been poor, we have even inherited certain distorted attitudes towards accomplishments in these fields, which imply that had the same efforts been devoted to the study of law or medicine the individual would have been infinitely more worthy of respect.

If to this scenario we add such symptoms as deteriorating terms of trade, technology dependence, energy dependence and lack of foreign reserves, the magnitude of the development task becomes all too clear.

To start with, the nature of much of our natural resource base implies massive capital inputs beyond our internal capacity to generate. This circumstance in turn suggests foreign participation whether institutional or private and that in turn would commend as a matter of urgency the codification of our many declarations concerning attitudes to foreign investment. Happily urgent consideration is being given to this particular exercise.

Our minuscule home market and the high capital cost of manufacturing plant combine to dictate an export orientation for much of the output of our industrial activity.

These realities present significant challenges as well as opportunities. The challenges are posed by the necessity to meet competitive price and quality standards using indigenous resources and technology as far as possible. The opportunities exist to forge linkages in the economy, substitute imported inputs, provide employment, raise living standards and earn the foreign exchange required to fuel the further expansion of the economy.

In the context of a high resource base, small population, limited technological skills and the determination as far as possible to be self-reliant and to bring about economic independence and social justice, what then are the options? Firstly, we must set about the exploitation of our natural resources in partnership, where appropriate with overseas capital and expertise, on terms which protect the birthright of current and future generations of Guyana. Next we must so integrate the efforts of the population into our development objectives that economic justice is secured through the active participation of the people in the development of the State's redistributional activities. Man can never derive self-respect from what he has been given, only from what he has earned.

Thirdly, if we are to achieve more than verbal self-reliance we must invest in research and technical and managerial training on a scale unprecedented in our history.

Institutional Response

In the light of the foregoing it may be appropriate now to review the responses so far to the need to institutionalize the concepts and policies which ought to be put in place if industrial and management development are to be smoothly integrated into the progress of the whole society.

Development like any other process has to be planned and managed, and since planning and management of necessity interact continuously it would be undesirable to endorse any approach which isolated the "planners" from the so-called "executing agencies". Our State Planning Commission has therefore been conceived not as a "new economic and political Czar, but as the machinery meshed and co-operating with other agencies to ensure the realistic conceptualization and efficient execution of National Plans in the economic, social and political sectors". Its main function is co-ordinative in that it is intended from the vantage point of a broad overview to establish priorities, develop policy responses, ensure that we live within our means and generally to foster and protect the concept of balanced development.

It may as a subsidiary function initiate projects but the primary responsibility in this area still rests with public and private sector agencies. We are not seeking to institutionalize initiative.

The main sources of inspiration for the conceptualization of new industrial development projects therefore are:

the Policy Ministers responsible to the Cabinet for resource development and industrial activity in the various sectors of the economy;

the Public Corporations and Private Sector Companies from whose boardrooms most of the investment ideas emanate.

In addition, the Ministry of Economic Development and Planning plays a pivotal role in terms of project evaluation, determination of investment criteria and co-ordination of the substantial involvement of offshore lending and technical assistance agencies in the country's development programmes.

Planning mechanisms alone will not ensure that worthwhile ideas go forward to fruition and in an effort to ensure that strictly commercial considerations do not overshadow development priorities, the Guyana Government has taken entry into important supportive fields of financial activity. The Agricultural and Industrial Bank, the National Co-operative Bank, the Co-operative Insurance Service and the Mortgage Finance Bank attest to a determination to facilitate balanced growth and to widen financial management capabilities across the society. The National Insurance Scheme is now firmly established and is providing Social Security as well as generating substantial sums for investment.

It can thus be surmised that we have gone a fair way towards setting up an institutional framework which can underpin and co-ordinate the myriad complexities involved in any thrust for balanced development. If therefore resources exist and supportive institutions are already in place, why, it might be asked, is the process so long drawn out. The answers are as necessarily complex as the problem but in accordance with my brief it is possible to advance one or two comments related to technology and management.

Technological Development

In spite of an oft articulated commitment to the development of indigenous technology it is distressing to note how limited is our investment in research with the possible exception of the sugar industry and even where such traditions do exist their emphases are self-contained and do not pervade the rest of the industrial economy. The setting up of a National Science Research institution is a most welcome if indeed belated response to this yawning gap in our efforts to identify indigenous resources and technology and integrate them into our industrial development thrust. This entity however, is inadequately staffed and funded. Extensive research needs to be carried out before we can identify the commercial potential of many of our vegetable and mineral resources. Much refinement of possibilities already identified is also needed if we are to match competitive standards prevailing in overseas markets. Let us squarely confront the fact that our investment in research needs to be massively increased if appropriate technology is not to remain a phrase. Industrial organizations should be required to pay a levy each year to help finance research infrastructure and the National Science Research Council should gear itself to undertake on a "paid for" project basis much more commercially oriented research.

Even today whilst caught up in a world experiencing a rapid acceleration in the pace of change, most of our industrial entities continue to neglect research and product development. The attitude often is that the original technology came from the North and any refinements must necessarily emanate from the same source. Very few have budgetary

allocations for research and the function is completely without representation in the management hierarchy of almost all industrial organizations. We cannot hope to compete on the international market without continuous product development and it is time this fact was given practical recognition.

But even if all the shortcomings mentioned earlier were to be remedied overnight we still face a further crippling constraint. There are too few technologists to usher in the technological revolution. Our investment in institutions to produce technically trained people has been pitifully inadequate. Here again there is an argument in favour of productive entities being levied on to contribute towards the cost of technical training facilities (unless of course they maintain their own training establishments of approved standard). The main inputs however should emanate from the Central Government and from favourably disposed international agencies. We cannot create an impact on our massive natural resources if the relevant corps of human resources is non-existent.

This lament leads us, logically, to survey another very serious constraint to rapid industrial development.

The Managerial Dimension

In order to manage development we must first of all develop management. This recitation of the obvious would be unnecessary if the country had in place an institutional framework sufficient to the task of producing an adequacy of managerial talent orientated towards the practical aspects of their function. Unfortunately much more needs to be done in this respect. Management disciplines are offered at the University of Guyana, and the Management Development Centre, still seriously understaffed, is attempting to stretch very limited resources to embrace seminars and courses covering an ever widening range of topics. However both these institutions are geared to impart techniques and these may also be culled from management literature. We need to be able to give instruction in the processes of management so that persons endowed with academic qualifications can master the art of getting things done through other people. At present the term "management" is for the most part regarded as an indicator of hierarchical status rather than signifying results. This conceptual distortion of the managerial role leads to an individualistic rather than a team approach to management with resultant failures in co-ordination arising out of a competitive rather than a co-operative approach to the tasks at hand. There is a need to emphasize more forms of instruction based on case studies which illustrate the team approach to problem-solving and the co-ordinative motivational responsibilities of the management function. I would seriously advocate the development of a modified version of the M.B.A. type business management programme with a practical bias as a prerequisite for entry into the higher managerial ranks of academically sound persons of limited managerial experience. Such a project would hopefully attract institutional financing since it could impact dramatically on the ever present problem of finding local counterparts to understudy overseas expertise made available under Technical Assistance programmes.

Let us look a little more closely at the composition of the Public Sector Managerial environment. We have a Cabinet comprised of Ministers responsible for the policy direction of Corporations or functions within their sector of responsibility. They are not in charge of the management of Corporations but are expected to answer for the consequences of managerial failures. This classic separation of functions can only work if:

(a) Ministers derive their specific objectives from a long-term National plan approved by the Cabinet and for which resources have been identified;

(b) The objectives of the Corporations or executing agencies are fully integrated into the sector objectives for which the Ministers are responsible;

(c) The Ministers gear their Ministries to shed the attitudes of being remote from and over and above the grim practicalities of trying to serve the society and generate an adequate surplus at the same time.

There is in Japan a closer identification with the national economic interest between a private sector economy and the State than exists in many ex-British colonial territories which now boast planned economies. We cannot afford a Public Service housed in towering ivory. It must see its task as the facilitating of legitimate economic activity even at the expense of bending or changing many rules which have possibly outlived the context of their birth. Although obvious, it has taken a long time for this to be recognized. Until we get this perception right, the relationship between planners and executing agencies may continue to reflect certain "conflict" symptoms and managerial initiative is likely to suffer.

In addition, the whole society is suffering a kind of "transition stress" as the pace of change exceeds the absorptive capacity of many. Mixed signals at the political level still leave for urgent clarification terms such as "functional superiority" and trade union suspicions of the motivations behind the institutionalization of worker participation coupled with an equivocal stance towards the concept of participative management in some quarters combine to produce a managerial environment which presents fantastic opportunities as well as sizable risks.

Inevitably the tasks and burdens of development must be shouldered by the Guyanese. The problems are immense but so too is the promise. It is not merely a question of resources and institutions. Do we have the will? Do we have the imagination to wrest continuing prosperity from our richly endowed environment? In the final analysis these are the real questions.

PART TWO

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ROLE OF TECHNOLOGY TRANSFER IN
NATIONAL AND INDUSTRIAL DEVELOPMENT

TECHNOLOGY TRANSFER AND INDUSTRIAL DEVELOPMENT

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INTRODUCTION

Since the objective of this seminar is to look at the question of technology transfer management and industrial development, it is necessary to look at the question of technology transfer in the recent industrial development experience of developing countries. The explicit purpose of this paper is to provide such an examination.

(i) Definition of Terms

In order to do so, some working definitions are called for. Technology may simply be regarded as know-how, necessary for the productive functioning of an enterprise. In other words, knowledge about production methods, processes, techniques, etc. The term includes hardware (factories, machines, equipment, laboratories, etc.) and software (knowledge, experience, education and training). Economists sometimes draw a distinction between production technology i.e. technology used for production, and consumption technology i.e. technology embodied in consumption, such as consumer goods generated by production technology.

The history of measuring the importance of technology to development is fairly recent in origin. Most economic textbooks still insist that it is "exogenous" and by this off-hand treatment, effectively dismiss it from any meaningful analysis. The American economist Solow, in quantifying the effect of technology economic growth in the United States of America found that it accounted for some 89 per cent of the growth in that economy between 1909-1949. 1/ A study by Denison as to the importance of technology to development, also reached similar conclusions. 2/ Recent statistical evidence from the Union of Soviet Socialist Republics has shown that technology has accounted for over 75 per cent of real growth in that economy. 3/ If that is so, prima facie, technology is of special relevance to developing countries. This is so because such economies are anxious to bring about self-sustained growth and development. Thus, from a welfare economics point of view, the social value of technology would seem greatest here.

1/ R. Solow "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, Vol. 39, 1957.

2/ E. Denison Accounting for U.S. Economic Growth 1929-1969 (Washington: Brookings Institution 1974).

3/ See USSR Report in National Science and Technology Policies in Europe and North America (Paris: UNESCO 1979) p. 385.

(ii) Technology Transfer

The relevance of "technology transfer" to developing countries stems largely from the fact that such countries often lack an indigenous capacity to generate the technology they need. For example, available data for 1973 show the following: developed countries accounted for 87.4 per cent of R + D scientists and engineers and developing countries 12.6 per cent. 4/ In terms of global expenditures i. technological innovations, developed countries at the same time accounted for 97 per cent of these, developing countries 3 per cent. 5/ In terms of global exports of technology intensive goods, developing countries in 1976 accounted for only 3.4 per cent of these and developed countries 96 per cent. At the same time, developing countries imported some 90 per cent of basic capital goods from developed economies. 6/ Thus, the technology resource gap problem is clearly evident. Given the need to accelerate development then, foreign technology tends to play a leading role in the development efforts of most third world economies. Most of this foreign technology emanates from Western industrialized countries.

The main vehicles for the transfer of technology to developing countries are:

1. Foreign direct investment including joint ventures;
2. Licensing arrangements including patents and trademarks;
3. Imports of goods and services (embodied technology). These incidentally constitute the major portion of direct costs for technology transfer. In 1968, for example, out of $25.7 billion (US) expended by developing countries for foreign technology, imports of machinery and equipment constituted $18 billion (US) or 72 per cent; 7/
4. Technical assistance such as those affecting bilateral and multilateral arrangements.

(iii) The Role of Industrialization in Development

Since we propose to link technology to industrialization, we do well by briefly looking at the role of industrialization in development. Most processes of economic development are marked by a changing complexity in the structure of production away from primary production specialization.

For developing countries then, some of the potential benefits of industrialization are as follows:

1. Increase in processing of primary products i.e. agro-industrial activity, mining and the like, thereby creating local value added;
2. Stimulation of linkage effects in the macro-economic structure and adding greater structural depth to economic activity because of 1;
3. Economic growth, as a result of additions to real output of goods and services;

4/ UNIDO Industry 2000: New Perspectives (New York. United Nations, 1979) p. 81.

5/ Ibid.

6/ Ibid.

7/ UNCTAD TD/B/AC II/10/Rev. 2, March 1975, p. 28.

4. Creation of employment opportunities;

5. Increase in export earnings capacity when industrialization is geared to satisfying overseas demand;

6. Reduction of imports by producing goods formerly imported. That is to say, benefits allied to import substitution;

7. As a result of 1, 2 and 5, the reduction of economic vulnerability by reducing undue dependency on primary exports which face a volatile world market.

Because of some of the foregoing, industrialization can be regarded as central to economic transformation.

Further, a recent study argues that "industrial growth can expand occupational choice of the population of a country, promote greater equality in social as well as economic terms, promote national pride, national self-reliance and national independence for countries which were, until recently, colonies of Northern powers". 8/

(iv) 'Two Sector Models' and Industrialization

The theoretical foundations of the foregoing, optimism, concerning the role of industrialization in development, were born out of the dual sector models of economic development, which were popularized to an important extent by Caribbean economist Arthur Lewis. 9/ Within the dual sector framework, an economy is made up largely of two sectors - a subsistence sector and a modern sector. The subsistence sector is akin to agriculture in the main. It is characterized by the following: surplus labour and therefore high rates of disguised unemployment, low levels of productivity, primitive technology, low rates of capital accumulation and a high incidence of poverty. There is also little marketable surplus generated by this sector. The modern sector conversely, is made up mainly of manufacturing activity. It is noted for modern technology, relatively high ruling wage rates, productivity is quite high, there is a progressive expansion of capital and technological change to provide the foundations for the economic dynamism of this sector. Economic development is seen as a gradual withdrawal of surplus labour from a relatively inefficient agricultural sector to the modern sector which provides the catalyst for development and transformation by its very self-expansive nature. This dynamism also helps to improve labour resource utilization and efficiency in agriculture, since "dead labour" so to speak, is thrown off the back of this sector. In this scheme of analysis then, industrial activity and its partner in arms, modern technology, are central to development.

(v) Industrial Development Policy - Further Remarks

The 1950s saw attempts by developing countries to charter new horizons for development based on a modern sector policy bias. This was partly influenced by the dualist model, just looked at (or subsequent versions of it) which has an intuitive appeal to development analysis

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8/ UNIDO Industry 2000: New Perspectives ..... op. cit.

9/ See Arthur Lewis "Economic Development with Unlimited Supplies of Labour", The Manchester School, May 1954, p. 139-191. See also, C. Fei and G. Ranis, Development of the Labour Surplus Economy (Homewood 1964) for further extensions.

because of its simplicity, secondly because of its apparent realism, thirdly because it seems to provide a mechanical panacea for underdevelopment. Indeed, it is true that development thinking as a whole came under its sway. Industrialization and modern technology were after all, the necessary ingredients to rid poor countries of Hla Myint's 'low level equilibrium trap'.

To the economic historian, casual observations seemed to strike home the point. After all, this was the path followed by metropolitan countries. They were synonymously industrialized countries, and simultaneously constituted in Rostow's language, the quintessential stage of "self-sustained development". 10/ Also, agricultural specialization, because of low price and income elasticity of demand, and its overall sluggish nature, seemed to offer to many developing countries limited scope for rapid economic development.

Further, reasoned some economists, savings (because of its importance to investment) constituted the key transformational link between agriculture and industry. 11/ Poor countries, it was argued, saved little and because of this, could not generate adequate investment capital for stimulating economic activity in the modern sector. Low levels of savings resulted from low levels of income and Engels Law (which postulated that at low levels of income, the marginal propensity to save was low, meaning little room was left for savings). Low levels of real income were in turn induced by low levels of productivity. In this "vicious circle world" (which became associated with Nurkes) massive injections of capital were considered necessary to bring about industrial development in poor countries. Given the internal savings constraint just referred to, such capital it was further reasoned, had to come from overseas; that is to say, from developed economies. The grand era of industrialization via foreign capital was thus born from the 1950s onwards.

(vi) The Industrialization Experience, Developing Countries and Technology Transfer Issues: Some Reservations

Ultimately, most policy measures are based on some form of theory, for it is theory that gives some stature as to what such measures are likely to accomplish in real terms, under particular assumptions. Policy prescriptions may be based on good theory or bad theory.

One of the major shortcomings borne out by industrialization experience, is to be found in relation to the question of technology transfer. An elaboration is necessary. Such industrialization attempts can be broken down into two groups, import substitution and export promotion. Import substitution industrialization was primarily geared to satisfying the needs of the home market; in particular, light manufacturing goods such as textiles, beverages, food and the like. The easy phase of import substitution refers largely to light manufacturing activity given the nature of the domestic market. For one, with adequate protection, domestic demand in most developing countries is such that a ready market exists for a range of consumer goods normally imported. Sooner or later, however, as evidence seems to confirm, the domestic market becomes a limiting factor for import substitution industrialization and exports have

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10/ See W. Rostow, The Stages of Economic Growth (2nd ed.) (London: Cambridge University Press 1971).

11/ See R. Nurkes, Problems of Capital Formation in Under-developed Countries (Oxford: Blackwell 1953).

to be resorted to in order to push the process of industrialization further. 12/ But producing for a heavily protected domestic market and a keenly competitive foreign one is not the same. And often, evidence seems to show that the jump from the domestic to the international market, especially for indigenous third world firms, is not that automatic if they are able to be competitive at international prices. Also, various tariffs and non-tariff barriers to trade show themselves as a limiting factor. Further, the import substitution experience in the capital goods or technology intensive sector in developing countries has been less spectacular than in the light manufacturing sector, already referred to. The strategy became quite popular in Latin America in the 1950s and 1960s and is also common to the Caribbean experience.

Be that as it may, formal attempts at regional integration by many developing countries in Asia, Latin America, the Caribbean and Africa provided larger regional markets by which transnationals, through subsidiaries or through licensing arrangements, anxious to jump tariff walls, were able to benefit from import substitution possibilities at the regional level.

In the case of the Caribbean, export-led industrialization gained much currency given the small nature of the domestic market, the limited resource base to be found in some countries, and the attempts to reduce undue reliance on plantation agriculture. Barbados, Jamaica, Trinidad, Puerto Rico, and recently Haiti, are examples of such economies, which, with varying degrees of emphasis, resorted to this strategy. Taiwan, Hong Kong, Singapore, and South Korea, are examples of other developing countries, which have been making considerable headway with this type of industrialization strategy, characterized by elaborate export processing zones. These countries' hopes for industrialization were in their ability to exploit relatively abundant supplies of cheap labour or natural resources, within the existing sphere of international division of labour. Two broad features are detectable in the literature - traditional types using largely unskilled labour, and modern high technology types such as electronics, computers, engineering and precision instruments and the like, where skilled labour inputs are of growing importance. For example, the experience of a number of export processing zones in Asia lends evidential support to this.

In the meantime, the two approaches to industrialization - import substitution and export-led - although conceptually dissimilar, had two main features in common: the establishment of lavish incentives schemes to attract foreign investment, largely transnational corporations, and the uncritical acceptance of imported technology as part of the industrial ation strategy. In cases where import substitution did not rely on foreign investment, but stressed the active participation of the indigenous capitalist sector, developing countries still had to depend sigrificantly on foreign technology to lubricate the industrialization process. In many instances too, most basic inputs - raw materials, intermediate products, machinery and equipment - were supplied from abroad. In the case of transnationals, this was done through their vertically integrated world production network.

To be sure, between 1960 to 1977 developing countries' share in the world value added of manufacture rose from 6.9 per cent to 9 per cent (see table 1). Between 1960-1965, the annual growth rate of world manufacturing value added for developing countries was 6 per cent; between 1970-1975 it was 8.7 per cent; in 1976 it was 8.5 per cent and in 1977 it represented 10.4 per cent.

12/ See H. Bruton "The import substitution strategy of economic development: A survey", Pakistan Development Review, Summer 1970.

TABLE 1

World value added to manufacture

	1960	1965	1970	1975	1977
Share of developing countries in world manufacturing value added	6.9	6.9	7.3	8.6	9.0

Source: UNIDO Industry 2000: New Perspectives (New York, United Nations 1979) p. 88.

As table 2 shows, the corresponding averages for developed market economy countries at the same time were 6.7 per cent, 3.2 per cent, 9 per cent and 4.1 per cent.

TABLE 2

Growth rates of world manufacturing value added

Annual percentage changes

Year	Developing countries	Developed market economies
1960-65	6.7	6.7
1970-75	8.7	3.2
1976	8.5	9.0
1977	10.4	4.1

Source: UNIDO Industry 2000: New Perspectives (New York, United Nations 1979) p. 89.

Thus, judging from the data, developing countries as a group have been able to increase progressively their involvement in the world division of labour as it affects manufacturing activity. For some countries, such as Mexico, Brazil, Taiwan, Singapore, Hong Kong - sometimes referred to as rapidly industrializing countries - involvement has been more significant than the weighted average of developing countries as a whole, just cited. For other countries, such as land-locked economies in Africa, this involvement has tended to be below the average, cited in table 2. It is difficult to generalize about the impact of the industrialization experience in developing countries, given the unevenness of the rates of industrialization, varying emphasis of industrialization policies, and different resource configurations facing them.

When allowance is made for the preceding point however, the benefits of industrialization seem to have failed to live up to theoretical expectations in a significant number of cases.

As a result of considerable research which has taken place over the impact of technology transfer in recent attempts at industrialization by developing countries, some of the main problems identified in the literature are as follows:

1. Increased economic dependency on foreign technology suppliers which militates against the self-reliant development;

2. Forms of economic control by technology suppliers;

3. Tying of technology inputs and the use of restrictive business practices. This has limited the prospects for developing indigenous technology. Often "tie in clauses" prohibit the use of alternative technology as part of the technology package. This also prevents developing countries from resorting to cheaper technology substitutes or complements from abroad when these are available in the international market;

4. Because of 3, the linkage potential in developing countries has been kept to a minimum so that the application of imported technology has failed to make an impact in terms of structural transformation;

5. Relatively high price for technology provided from abroad, largely because of the oligopolistic nature of the world technology market on the one hand, and weak bargaining position of technology buyers from developing countries on the other. This has resulted in balance of payments difficulties;

6. Imported technology tends to be capital-intensive and has failed to make an impact on problems of unemployment in developing countries. The capital-intensive bias of such technology is a function of the 'factor configuration' facing developed countries themselves as suppliers of technology. Therefore, the technology they export hardly satisfies the factor supply situation in developing countries, which more often than not, demands the use of labour-intensive techniques;

7. It has failed, in a number of instances, to make an impact on the development of new industrial skills in developing countries. In the main, technological know-how associated with industrialization has been retained by transnationals;

8. Further, limited technological research on industrial activity is encouraged by technology suppliers in developing countries. According to one estimate, over 96 per cent of R + D conducted by transnationals takes place in developed countries;

9. Because of the nature of the distortions which tend to occur in the factor market imported technology has tended to aggravate income distribution and therefore economic inequality in developing countries. For example, the use of a capital-intensive technique means that the share of income going to the owners of capital is greater than that going to labour;

10. Consumption technology has tended to favour income needs of relatively well-to-do social classes to the neglect of basic needs of the rest of the population. From this point of view, it can be said that consumption technology is inappropriate to the socio-economic conditions of developing countries;

11. Transfer pricing between parents and subsidiaries of transnationals has tended to result in tax evasion for maximization of global profits of such firms. For example, by under- and over-invoicing of inputs supplied to or from overseas networks.

Thus, the dynamics of technology transfer can be said to have been a main cause in the limited impact of industrialization in developing countries. It has also been an important contradiction to normally acceptable goals of development policy in a wide cross-section of countries.

It seems fair to conclude that the industrialization experience of many developing countries, given the lack of a concerted technological strategy, has fallen gravely short of expectations.

The Lima Declaration has set a target of increasing the share of developing countries in world industrial output by 25 per cent in the year 2000. From the evidence before us, that target is unlikely to make any meaningful impact on third world development, unless a radical redressing of technological distortions, just looked at, takes place.

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GUIDELINES FOR TECHNOLOGY TRANSFER MANAGEMENT IN GUYANA'S INDUSTRIAL DEVELOPMENT

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There must be few, if any, countries in the world with more potential opportunities than Guyana for industrial investment projects. And I have never seen a developing country whose people are more able to take advantage of their possibilities. So it is not surprising that many opportunities are already being converted into projects. One may look at the GUYSTAC operations and at the recent GAIBANK report to see how much activity there is ongoing.

Now, it is clear that technology transfer - in one form or another - represents a major part of the heavy ongoing investment in manufacturing activities. But since technology transfer is a means and not an end in itself, it is by now conventional wisdom that technology transfer must be "managed". But managed for what purpose? Well, the purpose is surely to achieve development objectives, and there is a set of national industrial development policy objectives which varies somewhat from country to country, and from time to time. Some of the policy objectives which currently appear to receive a high degree of positive reinforcement in Guyana are as follows:

Increase production of consumer, intermediate and capital goods;

Generate foreign exchange earnings and/or savings (i.e. increase manufactured exports and local value added);

Provide additional employment;

Build technological and managerial self-reliance ("capacity");

Provide opportunities and incentives and rewards for individual and group achievement;

Mobilize full use of national resources through co-operation among public, private and co-operative sectors.

Some people, in considering the subject of this paper, may ask for an indication of what exactly is meant by the term Technology Transfer Management, which is not yet really in very widespread use. It may be defined as "a system by which technology is acquired, generated, assessed, selected, adapted, applied, disseminated and promoted, in accordance with rational principles of resource allocation involving socio-political and cultural, as well as economic criteria". This definition does not give much direct help to managers and decision-makers. So I propose to offer seven guidelines which may be useful in evolving an increasingly effective Technology Transfer Management system in Guyana.

But first, it should be acknowledged that Technology Transfer Management must still be considered a "frontier area". In other words, I know of no country which is likely to be held up as a model for a comprehensive Technology Transfer Management system. Not even Mexico, which certainly has long and creditable experience in this field. Thus, there is room for some flexibility and certainly a need for innovation in approaching the subject here in Guyana.

Guideline No. I: Mainstream position

Technology Transfer Management belongs in the mainstream of development. And where is the mainstream? Wherever the skills, money and decision-making power are located. Partly among public institutions and partly in the private sector. As a negative illustration, consider the Institute for Development Studies (IDS), located on the campus of an East African University. Some years ago the IDS published penetrating analyses, but its papers seemed to be blithely ignored by the officials who granted licences and incentives. IDS was not in the mainstream.

Guideline No. II: Promotional role

Technology Transfer Management has a positive promotional role, not just a restrictive screening and compliance function. The system can help identify project opportunities and constructively influence project design; it is not basically a go/no-go checkpoint. Useful tools for this purpose are fiscal incentives and technical help as well as recognition and awards.

Guideline No. III: National profitability

There is a place in the system for a down-to-earth form of national profitability analysis. As an example, consider the trade-offs involved in choosing between the production of liquid and powdered detergent. And what about the choice between powdered and ground coffee? And how many different drug formulations should ultimately be manufactured?

Guideline No. IV: Motivation and creativity

A viable Technology Transfer Management system must be concerned with motivation and practical results, not just rhetoric. Vital to success is the widespread willingness of individuals to apply creativity and energy in ways compatible with common goals. Incentives and recognition (such as publicity) for achievement are essential elements. It is also of interest to note that there is sometimes a thin line between the (preferred) perception that a politician's action, affecting a specific project, is in line with his statutory policy-making responsibility, or a perception that it may constitute a demoralizing exercise of political interference.

Guideline No. V: "Training for remaining"

Technology Transfer Management success requires that promising skilled people be challenged by on-the-job training and by progressively increasing authority and responsibility in accordance with their expanding capabilities and interests. The principal alternatives are emigration and so-called "burnouts". Thus, it is appropriate to use a system of action-learning which helps ensure that such people feel truly involved in Guyanese opportunities for personal growth and satisfaction. One readily available technique is to set up multidisciplinary action-learning teams to deal with current project-related tasks. Examples of possible topics might

be one or another aspect of the mini-hydro programme or the pesticide formulation and packaging scheme or perhaps the prospects for energy conservation at a particular manufacturing plant. There are many more possible topics and a pilot programme could be started with little effort.

Guideline No. VI: Short- versus long-term R + D

Technology Transfer Management must reflect an allocation policy governing the allowable time and expense before a particular technology can be used commercially. An off-the-shelf technology may or may not be preferable to one that requires moderate adaptation, while the advantage of generating an indigenous technique may appear worth the risk of possible disappointment. The allowable time horizon may arbitrarily be kept short, especially if confidence in ultimate success is weak.

Guideline No. VII: Systems approach

The final Technology Transfer Management guideline simply reiterates the need for a system of interrelated measures which do combine to yield acceptable results. For example, training and incentives may be ineffective if the "mainstream" guideline is ignored. And the system will not work unless excessive brain-drain can be averted. The key question of respective institutional roles will be dealt with at length in a later session. But it is a basic empirical truth that the leadership of a few individuals ultimately produces results, and is at least as important as the clear division of responsibilities. And, again, the media can contribute vitally to stimulating success by publicizing plans and progress.

In summary, it is clear that very considerable resources are being expended to inject technology into new and existing productive activities in Guyana. Successful technology transfer is therefore both a crucial challenge and a rich opportunity.

Development of effective Technology Transfer Management is essential to help ensure the required pay-off in production, jobs, and foreign exchange gains.

UNIDO has become associated with the development process in Guyana in various ways. For example, on my first visit here in September 1979, one of the first people I met was Mr. Baptist, Executive Vice-President of the Guyana State Corporation. In a short time it was agreed in principle, that UNIDO should co-operate with GUYSTAC to establish a consultancy unit to deal with all manner of capacity utilization problems and eventually to become involved in identification, preparation and promotion of new projects. One year later (September 1980) a UNIDO team-leader started work with a dynamic Guyanese team. Much progress has been made on the technology transfer problem through the efforts of this team.

Now I feel that the Technology Workshop set up during the week of this Seminar will come up with some very practical ideas for specific action programmes - not for UNIDO particularly, but for initiative to be taken locally, maybe in partnership with agencies such as UNIDO.

Some Action Possibilities

1. One good example is the challenge Mr. Baptist posed concerning management training. He proposed use of local case studies and problem-solving teams, as a means of stimulating people and building self-reliance. It might be suggested that GUYSTAC set up a pilot programme of this nature, using an outside facilitator if necessary. Funds can be drawn from the UNDP/UNIDO Consultancy Budget. The pilot programme should be done in co-operation with Selma Joseph, and afterwards the Guyana Management Centre would possibly want to continue it, so as not to divert the attention of the consultancy team from its other duties.

2. Mr. Trotz was also among my first contacts in Guyana. We conceived an industrial technology project, eventually assigned to UNESCO for execution. The idea of commercialization of indigenous technology could be boosted, and suggestions for a programme could be provided with the help of UNIDO's Development and Transfer of Technology Branch.

3. Mr. Long and I drafted a multi-faceted project some time ago. We could start on part of that project, if funds are available, tied to project identification and preparation, for example.

4. Mr. Tanaka and I expect to discuss the proposed Caribbean Technological Consultancy Service (CTCS) with Mr. Demas at the Caribbean Development Bank (CDB) in the very near future. Guyana can participate in and benefit from the CTCS at a very modest cost.

5. Finally, maybe in a year or so, we can all reassemble and review progress achieved towards the evolution of a fully operational Technology Transfer Management process. The group's action recommendations are eagerly awaited.

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NATIONAL INSTITUTIONAL ASPECTS - THE CASE FOR SYSTEMATIC MECHANISM FOR CO-ORDINATION AND MANAGEMENT OF TECHNOLOGY TRANSFER

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At the very beginning of this Seminar, reference was made to the four main elements strengthening technological capabilities and capacities. These were:

(i) Technological capabilities - or human resources development;

(ii) Technological capacities - or institutional infrastructure development;

(iii) Technology policies and programmes based upon the national strategy and priority objectives, in order to provide a framework for implementing the various activities in a co-ordinated and integrated manner;

(iv) An efficient information system.

An effective transfer of technology cannot be ensured without these three main elements being in a satisfactory state of art.

Technology transfer is an extremely complex matter, involving a whole spectrum of action. In order to simplify the thinking, we have divided this spectrum into a series of steps. Insofar as technology transfer for industry is concerned, these steps are:

(i) Identification and selection of appropriate technology;
(ii) Negotiation and acquisition of its foreign technology;
(iii) Adaptation of the acquired technology;
(iv) Absorption of the technology;
(v) Development of the technology, including indigenous technologies.

To manage effectively the technology transfer process, the technological capability - human resources - in the country concerning each of these steps has to be strengthened. It also applies to the technological capacities; that is the institutional infrastructure in the country has to be created or strengthened so that each of these steps can be duly covered.

Based upon the information on the situation in Guyana, which is admittedly of a very limited nature, we would like to put forward some thoughts, as a basis for a "brain-storming". It may be that some of these ideas could essentially be put into a reality. We should also, at this point of time, classify our basic viewpoint as to "an institution".

Frequently, despite the fact that some sort of an institution, or an organization, or an office already exists in the country, a new project is designed and put into operation because the existing one is not properly functioning, or because it is of a different source of finance or under another jurisdictional authority, etc. This is a clear-cut duplication of work and a complete waste of resources. Furthermore, it only adds to confusion, rivalry and inefficiency. A better solution would be to strengthen the capability of the existing institution so that it can improve its activities and satisfactorily discharge its intended duties and tasks.

One more matter which should be clearly understood is that when we speak about an institute or a centre, it should not be considered in the form of a new building, a new office, a new physical entity. It is always recommendable to give due thought to the scope of duties and tasks as against the available resources and size of operation anticipated, to avoid an exaggerated planning resulting in superfluous capacity and high investment costs. The needs should be considered in terms of "a function". A function can be carried out by a one-man operation also. When a need is identified, and implementation decided upon, it is better to start off as a small unit or a section of an existing entity that has some relevance to the substance of the works, and then gradually expand and enlarge the unit in parallel to the experience acquired, the available resources, and the increase of the scope of the tasks assigned to it. From the implementation point of view also, this will be simpler in that it is always somewhat easier to expand successful operations rather than start up anew some operations.

Following is a list of potential institutions - that is functions or services - which could come into consideration in Guyana.

Types of Technological Institutions

One of the main elements, i.e. technology policies and programmes, requires institutions to implement them. They provide a measure of continuity and collective interaction of experience and in due course, become repositories of technical capabilities. At the same time, they can only be as good as the policies and programmes they help to implement, and only as good as the technological capabilities or manpower available to implement the work.

Institution building can be quite expensive, and can also raise a host of co-ordination problems. On the other hand, the problems of technology development, transfer and management are too numerous for a single institution to tackle, except perhaps for the purpose of monitoring.

Bearing these facts in mind, let us see what kind of institutions do come into consideration on general terms. (It is not intended to be complete.)

Ministry of Science and Technology;

National Council/Committee for Science and Technology;

Project formulation and evaluation centres;

Industrial and technological information centres;

Industrial research institutions - single or multi-sectoral;

Technology development centres;

Consultancy and engineering services;

Extension service centres for medium and small industries;

Technology regulating offices;

Investment promotion services;

Standardization and quality control offices;

Institutions for technological education and training;

Industrial design development centres;

Productivity offices;

Management development institutes including training centres, etc. - an endless list including, for instance, co-operatives about which we have already heard.

The institutions may be for promotional, regulative or service purposes, and, as agreed upon previously, may be considered in terms of functions or services rather than institutions per se. When assessing the institutions, it should be on the basis of their output with particular reference to their contribution to the national requirements for which they were established, and not judged by the number of persons employed or by the expenditures incurred. As regards national institutions, the place of the respective institutions in the governmental set-up, their involvement in decision-making for industrial and technological development, and their contacts with the industries and the public are critical factors in assessing their effectiveness.

In the context of the technology transfer spectrum on the one hand, and the types of technological institutions we have just reviewed, and apart from technological education and training institutions, there are three basic types of institutional functions that have to be covered:

1. Technology development strategy + policy formulation and monitoring at the macro-level as well as technology selection, screening and evaluation at the micro-level.

   These functions have to reside in a government department or agency, suitably in a set-up that can influence decision-making.

2. Technological information, evaluation and consultancy assistance to the industries and entrepreneurs.

   These functions should be so organized to have effective relations with government, financial institutions and industry.

3. Technology development, adaptation and commercialization with facilities for consultancy and extension work.

   These functions have to be exercised by research institutions or technology development centres (applied research centres), and may be single or multi-sectoral depending on the priorities and requirements.

Having reviewed the several situations of the needs of institutional functions and services, let us look into the case of Guyana.

Governmental Set-up

In view of the high priority given to the subject of science and technology, many countries have established ministries or agencies for science and technology, be they developing or developed countries. Again, many countries have created national advisory councils or committees on science and technology, composed of representatives from all sectors and areas having relevance to the over-all problems of science and technology, with the objective of providing advice to the government on the complex problems to be catered for by them. The Technology Transfer Unit could be considered as a first step towards such a set-up, and there is no doubt about what heavy tasks and responsibilities lie ahead.

The main objectives of organizations and agencies within the government set-up would be to provide clear-cut guidelines and to ensure a concerted and co-ordinated action in the total field of technology transfer and management, while the practical implementation of the work should be entrusted to other organs, institutions and services. One exception, however, would be the technology regulatory offices which should be charged with the task of monitoring acquired technologies from abroad and screen new proposals on the basis of a systematic assessment of its relevance and contribution to the national economy. UNIDO's TIES programme is to promote co-operation among such offices in developing countries with the aim of assisting their positive development and satisfactory performance.

Information Services

We have heard so often about the important role which systematic information services has to play in the process of technology transfer and management. It covers each step of the technology transfer spectrum. To identify and to select a technology, one needs information on what is available, and who has it, which one suits better the purpose i.e. appropriate technology, etc. It also provides needed information and data to successfully negotiate and acquire the technology from the potential technology supplier. It is also very important in the R + D work, that is the adaptation and development of the technology. It is necessary to keep up to date with the technological, economical, environmental and other aspects of the acquired technology. The information service, or centre, will have to be organized so that it can satisfy the needs of the nation and the industries and particularly of the priority sectors of development. Does Guyana have such a service, that can comply with the requirements? Can it be strengthened and expanded to comply with the needs and serve the purpose? What about its regional or inter-regional linkages? Is it effectively functioning as a partner in a network? UNIDO's INTIB (Industrial and Technological Information Bank) has created a network on a world-wide basis, and could link its system with that of Guyana. In case a new centre is to be created, appropriate assistance could be provided, subject, of course, to the availability of required funds.

An important point is that the information service should be an active and dynamic one, and not a sleeping set-up, in the sense of a mere collection and stacking up of numerous books, journals, reports, etc. onto the shelves.

Industrial Research Centres, Technology Development Centres

Again, there is no need to emphasize the important role which such centres or institutes have to play. Apart from the traditional function of undertaking R + D activities, which itself should be oriented strictly to the priority sectors and areas of the development strategy and goals, essential technological functions, such as extension services, pilot plants and commercialization of technologies and successful R + D results, should also be performed.

The Institute of Applied Science and Technology (IAST) is already performing a part or more of these anticipated and required tasks. It is a matter of assessing the scope of needs from the national needs' viewpoint, and matching resource allocations to enable IAST to carry out the work. Eventually, one could assume that separate single-purpose institutions could spring out of the present organizational set-up to ensure more concentrated and intensive work in that particular area. It would nevertheless be desirable if they remained under the same direction, or umbrella, to facilitate easier interchange of the capacities and capabilities.

Consultancy and Engineering Services

It would not be an exaggeration to say that a large portion of the self-reliance and technological independency lies in the availability of effective and efficient consultancy and engineering capabilities. It is this phase of work that converts technology into a powerful weapon of production.

GUYSTAC has already initiated action in this respect, and UNIDO is very pleased to be participating in such efforts, through the project established by GUYSTAC, with co-operation of Mr. W.P. Millager, SIDFA (Caribbean), and funded by UNDP.

The initiative of GUYSTAC should be fully supported and expanded, pulling together the available local capabilities in the country, to serve comprehensively Guyana Pharmaceutical, GUYNEC, etc., and to stimulate availability of such services for both public and private enterprises.

Standardization and Quality Control Office/Bureau

An important basic element of industrialization developing healthily is standardization and quality control of the products. The relevance and importance to technology transfer is a vast task and should be given serious consideration, since the later the actions are taken, the more difficult it will become to harness this already complicated subject.

Others

I understand that there already exist many institutions, services and facilities in Guyana. The work of the Management Development Centre, and the efforts made by the University of Guyana in manpower-building at the education level, are very impressive. An Industrial Training Centre is also in operation.

The problem, if any, therefore should be to:

(a) Find the places where the respective institutions, centres and services fit in, within the over-all technological development strategy and policy of Guyana;

(b) Make a clear-cut identification of their duties, tasks and responsibilities, or in other words, the role they are to play in the over-all picture of development in Guyana;

(c) Ensure a synchronized and co-ordinated action between and among the various elements and components, in an integrated manner so that their performances and outputs can contribute to the maximum extent of promoting and sustaining the efforts of national development through technology transfer, development and management.

In summing up, Mr. Tanaka complimented the efforts being put into this most important element of a sound and successful economic and industrial development process in the country; the strengthening of technological capacities and capabilities. It is a long-term and laborious process to be followed up with patience. But there are also numerous areas which are of a short-term nature and which could be started up immediately. The basic step has been taken in the form of the setting up of the Technology Transfer Unit. As was mentioned, there is much brainpower in Guyana. And the experience is also there, as we have witnessed throughout the whole period of this Seminar, and particularly as we have heard from Mr. Harold Davis of GUYSUCO.

The problem is how to harness these elements and direct them towards bringing positive impacts to the over-all development process in the country. This Seminar could be a significant step towards technological self-reliance. Having had the pleasure of co-sponsoring this event, we feel deeply involved in the successful follow-up of what we have spent our time on in this room. It would also, however, require close involvement of each one of the participants and their personal engagement in bringing together a collective force to ensure that "Action of Follow-up" so that the "words" so cheap as they may be, can be converted into a valuable stage of results to the satisfaction of each one of us of having achieved something.

PART THREE

TECHNOLOGY TRANSFER ISSUES IN GUYANA (CASES)

AN OVERVIEW

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Broad Outline

The traditional form of foreign direct investment in Guyana was plantation agriculture. This was later complemented by mineral resource investments. The second half of the twentieth century saw the emergence of contractual arrangements involving foreign firms with local partnership largely in manufacturing activities. For example, joint ventures, licensing, and know-how agreements, and the like. Legal differences notwithstanding, the key similarity between traditional forms of foreign direct investment and contractual arrangements is direct control over the nature and form of technology transfer on the part of the foreign technology supplier. More often than not, these tend to be transnational corporations, operating in oligopolistic or monopoly type markets. A United Nations survey on the market behaviour of transnationals, for instance, has confirmed the growing strategic importance of manufacturing and service sector activities to the global spread of such corporations. During the 1970s, Government nationalized transnationals engaged in sugar and bauxite operations. Thus, it is estimated that the State has direct control over 80 per cent of the economy. This has meant a declining role of foreign direct investment and private investment as a whole. However, given the traditional importance of foreign capital in the Guyanese economy, it is necessary to deal with it, in this paper. Table 1 shows the increasing role of the State in overall investment activity. In 1961, this was G$43 million compared to G$62.3 million (private). In 1979, public investment had risen to G$250 million compared to private investment of G$60 million. And between 1970-1976 for example, US direct investment in Guyana dropped from US$40 million to US$22 million.

Traded goods are really technology embodied in output of one sort or another, pieces of know-how, use of skills, the transformation of various inputs as a result of technical process, and the like.

Two broad components can be roughly identified: consumer goods and capital goods (including intermediate ones). One of the characteristics of small economies such as Guyana is undue dependency on imports and indeed foreign trade. Imports are required to fill the immense gap which exists between aggregate domestic demand and domestic supply. A basic structural explanation for this gap is the underdevelopment of the transformation capacity of such economies. Lack of finance capital, know-how, skills, entrepreneurship, and the like, are sometimes attributed to this.

Whatever the justification for this may be, the main point to observe presently, is that economies which are basic producers of raw materials for export, are unable to directly satisfy domestic demand to any important extent unless a major transformation of the input-output matrix takes place. Thus, it is not surprising that a significant portion of Guyana's

consumption needs and capital requirements are obtained from abroad. In this context, a capital goods sector, which is crucial to structural transformation, is hardly existent. This state of affairs is revealed in the structure of imports and exports in tables 2 and 3. From this, it will be seen that Guyana imports mainly technology intensive goods, and tends to export those with a low technological content - mainly primary goods.

As in the case of foreign direct investment, scant evidence seems to suggest that much of the technology traded in consumer and capital goods affecting Guyana is obtained directly or indirectly through transnationals. This arises from the fact that such corporations are significant traders of technology in the international economy. This though, is not unconnected to their role as important generators of technology. Some economists have indeed identified technology as a major strategic factor in competitive rivalry affecting transnationals. In 1979, for example, Guyana imported some 56 per cent of its imports from Western economies where such corporations predominate. This remains so even though Government has been diversifying its trade relations in an effort to reduce traditional reliance on North America and Europe. Further, much of the Caribbean Community (CARICOM) trade is directly or indirectly mediated through such corporations. This, howevever, remains to be quantified. In 1979, some 20 per cent of Guyana's imports were from this source.

The importance of technical assistance, meanwhile, arose as a result of the need to fill certain resource gaps which were evident in Guyana and elsewhere. To an important extent, this was devoted to social overhead capital (drainage and irrigation, transport, education, health, power, telecommunications, communications, skilled manpower and the like). Quite recently, such assistance is rendered to direct productive activity (textile, clay brick, leather, to name a few), and socialist economies are increasingly active in the area. Previously, much of this assistance emanated from the United Kingdom of Great Britain and Northern Ireland, the United States of America and Canada.

Technological Underdevelopment, International Specialization and Guyana

If then, Guyana is dependent on the industrialized North for the technology it uses, it must be because Guyana lacks a capacity to generate technology to satisfy its development needs. This lack of a domestic technological capability is sometimes regarded as technological underdevelopment. It is necessary to put this in a historical and structural perspective.

Before the advent of European colonization, what we now know as Guyana was technologically developed in the sense that Amerindian tribesmen used indigenous technology to transform their largely pre-capitalist socio-economic formations. This is a classic case of technological self-reliance. Fishing, hunting and planting and other forms of economic activity were conducted largely by the use of acquired skills and instruments of production (capital) which were developed by man in his so-called primitive state and were appropriate to his needs and mode of life.

The technology was certainly not as sophisticated as today's modern technology, given the state of our present knowledge. Local technology used not only to produce but to live (for example, construction, household utensils including those for cooking, furniture, medicinal purposes, etc.). An all-embracing technological infrastructure had developed. By a curious irony, such an infrastructure is lacking in Guyana in today's twentieth century world.

TABLE 1

Investment activity
(G$ million)

PRODUCTS	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Public Investment 1/	42.6	56.2	66.3	73.8	114.0	155.0	250.0	355.0	230.0	194.0	250.0
Private Investment 2/	62.3	67.8	39.1	47.3	44.0	65.0	70.0	70.0	60.0	47.0	60.0

1/ Includes investment of public enterprises from 1966.

2/ Including stock changes.

Source: Bank of Guyana Annual Report, 1979.

TABLE 2

Imports by major economic classification
(G$ million)

Year	Total Consumer	CONSUMER GOODS		INTERMEDIATE GOODS				CAPITAL GOODS	Total Imports
		NON-DURABLE GOODS							
		Total Non-Durable	Food for Households	Total Intermediate goods	Fuel and Lubricants	Food for Industry	Chemicals	Total Capital Goods	
1974 1/	108.0	69.3	44.1	311.0	103.5	40.8	37.8	143.0	567.0
1975	131.6	81.2	48.2	414.1	135.0	51.8	46.5	260.6	810.6
1976	165.3	98.9	56.8	450.2	137.5	68.2	46.8	303.0	927.4
1977	142.9	100.4	64.9	411.0	160.4	51.4	38.8	226.4	804.3
1978	130.9	97.4	62.6	421.1	169.9	48.8	42.6	153.6	711.1
1979 2/	142.0	n.a.	n.a.	497.0	230.0	64.0	39.0	141.0	785.0

1/ New Series.

2/ Estimates.

Source: Bank of Guyana Annual Report, 1979.

TABLE 3

Exports - main activities
(G$ million)

PERIOD	AGRICULTURE		MINERAL	TOTAL EXPORTS
	Sugar	Rice	BAUXITE/ ALUMINA	
			Total Bauxite Alumina	
1974	284.8	49.0	198.2	600.0
1975	413.1	84.8	271.9	858.0
1976 1/	258.7	73.6	288.8	711.3
1977 1/	185.7	66.8	331.0	661.2
1978	234.6	96.0	332.0	753.8
1979 1/	226.3	80.8	327.4	737.5

1/ Provisional.

Source: Bank of Guyana Annual Report, 1979.

Any explanation of technological underdevelopment in Guyana must begin with colonialism as a mode of production and as a mode of international division of labour. A convenient reference point is the so-called plantation system. This system ultimately saw the advent of external ownership and control over economic resources including technology, a new mode of production marked by international exchange and the rising importance of surplus value appropriation. Slave labour was introduced on a mass scale initially. Plantations originally began as individual family farms but became organizational and technologically complex over the years. They were, by the end of the nineteenth century, to become synonymous with one of the leading transnationals of the day - Booker McConnell. Forced labour was later substituted by wage labour with the abolition of slavery so that labour power became a marketable commodity subject to the dictates of plantation "capital".

The plantations were instrumental in introducing modern production techniques from metropolitan Britain as oligopolistic competition in the world sugar market, and cost reducing strategies, amongst other things, became critical for international production. Cost reducing strategies, prima facie, would serve to enhance surplus value and sharpen the competitive cutting edge of respective transnational firms. Thus, the technological requirements of plantation agriculture were fashioned largely by such firms. It is true that the system was partly labour intensive for cane cutting, by way of illustration, but processing, refinement, etc. were to an important extent capital intensive operations.

In terms of the above, the point to observe, is that local labour was used mainly in rudimentary activities, namely "soft" technology areas, but not in key areas (for instance, production, engineering, research and development) where relevant skills and know-how of sugar manufacture were crucial. This perversity was even more so the case in capital goods technology related to the sugar industry (e.g. equipment, machinery, spare parts, engineer design, etc.). Primary production specialization therefore induced a type of technological specialization where the periphery was colonial Guyana and the centre metropolitan Britain.

The foregoing picture applied with equal force to the natural resource sector of Guyana. For example, bauxite which traditionally was owned and controlled by transnationals. Here too, a type of technological specialization was induced whereby a local capability for technological mastery of these raw materials for processing, and other activities were virtually non-existent and were not promoted. On the other hand, the mastery that developed was retained by transnationals. Patent laws, the organizational structure of the industries, and monopoly control, amongst others, all ensured that the diffusion of this know-how to Guyana was against the corporate interests of transnational capital.

Further, the demand induced by foreign technology, for labour use in both plantation agriculture and mining (also in several Caribbean economies) meant that artisan and ot. indigenous technology which existed were either destroyed or stultified. Labour used for "primary accumulation" being effectually absorbed into the so-called modern sector. Booker McConnell and bauxite companies (Reynolds and Alcan), meanwhile were important traders in both consumer and capital goods. The commercialization of traders' technology embodied in these, also dealt a blow to the indigenous potential for producing basic consumer goods. In the absence of this technological competition embodied in foreign trade, it seems clear, given the resource potential, that Guyana would have been more self-sufficient in many consumption items such as foods, building and construction materials, consumer durables, and the like. It also limited the development of production technology.

In spite of major attempts during the 1970s to transform the Guyanese economy, the country remains fundamentally dependent on foreign technology and locked into a vicious circle of technological dependency on overseas technology suppliers.

The foregoing historical background showed how this dependency was both structurally and colonially induced. Further, the economic structure within which this dependency is a central feature, has been a standard explanation of the process of underdevelopment worldwide.

Some Contemporary Issues

It is necessary to make observations on some of our findings concerning the contemporary technological dynamics of Guyana.

In an examination of over 70 firms in the country, with varying sizes, the following is evident.

(a) Well over 80 per cent of the technology used in the country is imported. Over 90 per cent of the patents and trademarks in the economy of Guyana are dominated by foreign technology; the industrial property system being biased against indigenous technological interests.

(b) Dependency on overseas raw materials and intermediate inputs is importantly determined by the technology used including machinery and conditions stipulating use of such technology.

(c) Current problems of production and productivity in the country are importantly influenced by the functioning of imported technology. On a weighted average basis, it is conceivable that with a proper technology transfer policy, the real output in the country can increase itself significantly across the board, with existing stocks of capital. This is because most of the factors responsible for existing rates of under-utilization of plant capacity in the country are technologically induced. In some instances, some 80 per cent capacity under-utilization has been traced to technological factors.

(d) The main problem facing foreign technology in the country, apart from direct costs for acquisition of technology and terms of payment, is its improper absorption and assimilation into the mainstream of macro-economic activity. In this sense the appropriateness of such technology to development as a whole, is brought into question. This, in turn, is importantly determined by the types of choices technology buyers in Guyana have made in the first instance.

(e) Training and education are not fully geared to solving the problems of absorption and assimilation of imported technology and for the development of indigenous technology for which much potential seems to exist in the country. Nor is it fully geared to develop indigenous technology to its fullest.

(f) We have found immense technological potential of a wide range of products in the capital goods sector, but importantly in the consumption goods sector. Also, in terms of technological service capability (construction, engineering, design, etc.) much capability exists as well.

(g) However, many constraints, ranging from the unavailability of skills, finance, the supply of certain types of inputs, management, non-development of certain intermediate substitutes in the country, exist which limit this capability.

(h) In terms of Research and Development limited amounts of this is spent in the country and considerable duplication of efforts exist. And little co-ordination of activity exists where such duplication is present. Total R + D is way below the stipulated United Nations target of 1 per cent of GNP. Additionally, weak linkages exist between R + D and the productive structure of the country. And R + D does not, on the whole, seem geared to adaptation of imported technology thereby making them more efficient from the point of view of assimilation and absorption.

(i) There seems to be much innovative work taking place in the country which goes unrecorded with the country benefiting to a small extent, in terms of diffusion of these "indigenous technologies". In other words, little technological continuity exists here.

Some Problems facing Technology Buyers

Some of the problems faced by technology recipients in the country are:

(i) Lack of capacity to prepare a project properly, i.e. from preliminary study to the economic and technological feasibility study and to engineering ramifications of this.

(ii) Lack of proper information of the sources of alternative technologies worldwide and comparative prices in terms of sales.

(iii) Management ability in terms of functioning of technology under given socio-economic conditions is lacking or limited.

(iv) Specific kinds of skilled personnel to work technology efficiently is sometimes not available.

(v) There is, in many instances, a lack of knowledge and skilled ability to purchase other inputs such as raw materials, components, equipment, or to examine substitution possibilities. Also of relevance is inadequate domestic technological infrastructure such as servicing, maintenance, spare parts replacement possibilities, substitution possibilities for use of indigenous raw materials and other inputs, ever present foreign exchange constraints, and the like.

Some Conflict Areas

Some of the problem areas of technology transfer are:

Conflicts in terms of growth and productivity

Conflicts in terms of the promotion of indigenous technology, self-reliance and participation of Guyanese in technological development

Non-development of indigenous resources

Conflicts in terms of economic transformation given the above

Conflicts in terms of balance of payments

Conflicts in terms of Guyanese welfare

Conflicts in terms of basic needs

Conflicts in terms of effectiveness of planning

Conflicts in terms of employment creation.

The case is clear for proper technology transfer management from the point of view of firms operating in the country, and from the point of view of development policy as a whole. In this respect, it can be argued that the problems identified have been partially induced by the non-existence of a concerted technology policy framework.

THE PATENT SYSTEM

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Introduction

Due to the historical development of the international division of labour very few developing countries produce modern capital goods. The sophisticated high-level technology is concentrated in the developed countries. Moreover most of the developing countries lack a clear cut scientific policy and the means of producing the skilled manpower for their developmental needs. When they do produce the skilled manpower they lose the majority of that skilled manpower to the developed countries. Also barriers are placed as regards access to information as regards specific processes. The situation is such that the developing countries have to import technology on a large scale, pay heavily for access to technology and so continue to be perpetually dependent on the technology of the developed countries. The international patent system is one of the means by which the developed countries control the rate of transfer of technology to the developing countries. A report prepared jointly by the United Nations Department of Economic and Social Affairs, the United Nations Conference on Trade and Development (UNCTAD) secretariat and the International Bureau of the World Intellectual Property Organization (WIPO) (1) shows that

> "84 per cent of all valid patents in developing countries are foreign owned and most of them are in the hands of corporations based in five developed market economy countries, about 90 to 95 per cent of these foreign patents are unused."

Easier access to technical knowledge and selective choice of technologies can improve living standards. The international patent system as operated acts to a distinct disadvantage to the developing countries as the UNCTAD reports show. This paper briefly examines the system in relation to the laws of Guyana, the Patents and Designs Act.

The Paris Convention

The Paris Convention for the protection of industrial property was adopted in 1883 and was revised as late as 1967. Guyana does not belong to the Convention also Barbados and Jamaica. An UNCTAD report (2) deals with the structure of the Convention and points out that:

(a) The Convention does not contain any general commitment to the importance of the public interest nor any specific statement regarding the economic development objectives of the developing countries;

(b) Argues that if the Convention is to be revised then an explicit statement would have to be introduced

> "underlining the importance of making the international patent system responsive to the development objectives of developing countries and emphasizing the need for the system to be adapted in ways consistent with the realization of those objectives."

(c) The developing countries have only played a minor role in the revisions of the Convention which does not recognize their distinct situation. The spread of national patent laws is related to development of the industrial revolution and the colonial domination of most of the developing countries until recent times;

(d) Since the Paris Convention provides for non-discrimination in international trade in industrial property, it is of significance for those countries which are either relatively large exporters of industrial property, relatively large importers, or both.

Table 1 shows the spread of national patent legislation, 1873 to 1973 and indicates that legislation has only been recent in the developing countries coinciding with the beginning of the decolonialization period.

TABLE 1 (1)

The spread of national patent legislation, 1873 to 1973: number of countries having patent laws in given years

GROUP OF COUNTRIES	1873	1884	1900	1911	1925	1934	1958	1967	1973
Developed market-economy countries	9	11	16	17	19	20	20	20	20
Socialist countries of Eastern Europe	1	2	3	4	7	7	8	8	8
Southern European countries	2	3	3	3	4	4	4	4	4
Developing countries	10	13	23	28	42	44	60	83	85
of which:									
Africa	1	2	4	4	10	11	16	35	37
Asia	1	1	2	3	7	8	16	19	19
Latin America	8	9	15	19	22	22	24	25	25
Others	0	1	2	2	3	3	4	4	4
Other States	0	0	0	1	1	2	3	3	3
TOTAL WORLD	22	29	45	53	73	77	95	116	120

Table 2 emphasizes this point and shows that membership of the Paris Union increased with the independence for developing countries.

TABLE 2 (1)

Increase of Paris Union membership by groups of countries: number of members in given years

GROUPS OF COUNTRIES	1884	1900	1911	1925	1934	1958	1967	1973
Developed market-economy countries	6	11	13	18	19	19	20	20
Socialist countries of Eastern Europe			2	6	6	6	7	7
Southern European countries	2	2	2	4	4	4	4	4

TABLE 2 (cont'd)

GROUP OF COUNTRIES	1884	1900	1911	1925	1934	1958	1967	1973
Developing countries	5	3	5	9	9	15	42	44
of which								
Africa	1	1	1	2	2	3	23	23
Asia				2	2	6	8	9
Latin America	4	2	4	4	4	5	8	9
Others				1	1	1	3	3
Other States					1	3	5	5
TOTAL WORLD	13	16	22	37	39	47	78	80

The core of the patent system is that exclusive rights are granted to inventors by different national laws and special legal machinery is set up for this purpose. A model law for developing countries has been prepared by the United International Bureau for the Protection of Intellectual Property (BIRPI) in 1964.(1) The model law provides:

The patent shall confer upon its registered owner the right to preclude third parties from the following acts:

(a) When the patent has been granted in respect of a product:

(i) making, importing, offering for sale, selling, and using, the product;

(ii) stocking such product for the purposes of offering for sale, selling, or using;

(b) When the patent has been granted in respect of a process:

(i) applying the process;

(ii) doing any of the acts referred to in (a) above in respect to a product obtained directly by means of the process.

The Guyana Law

The Guyana law governing patents is the Patent and Designs Act of 1937 which was amended by several acts and as recently as 1972.

The Guyana Act like other laws is for the protection of inventions. Patents were devised to provide a reward for the inventor, and give individual inducement to inventors to encourage inventive activity and increase the knowledge of society as a whole. At present the patent system is of very little benefit to Guyana in development terms, this is due to many reasons including:

(a) Patents are obtained to protect, or monopolize, the flow of imports to the countries concerned. This is because in many instances the patent is held by a private company or transnational which insists on direct investment or partnership in the venture by the developing

country. Studies have shown that the owners of patents or technology dictate terms as to where raw materials for the developing country's projects or proposed industries should come from. This generally leads to over pricing.

The UNCTAD study (1) states in paragraph 377 of its report:

> "The degree of overpricing in the charges for these imports protected by patents from competition in the developing countries could be substantial."

The point is further emphasized by paragraph 378.

In those cases where a patent is used as the basis for a licensing contract the empirical work conducted in various countries indicates that such contracts often contain restrictive clauses which themselves lead to a heavy burden of indirect costs. The existence of limiting clauses in such contracts may be summarized (1) as follows:

> "Export restrictions are a prominent feature of licensing arrangements. Given the international production and marketing strategies of the transnational corporations holding many patents, they wish to maximize their profits through appropriate control over the locations of their production and over the possibilities for inter-country sales of products. In those instances where such sales across national frontiers would create difficulties for the corporation, a limitation on exports is a logical concomitant of its over-all strategy."

(b) Prevention of the use of the patent for productive purposes so that the market of the patent-granting country is reserved for the benefit of the patent-holder;

(c) The majority of patents in Guyana are owned by foreigners and multinational corporations and are unused.

In the case of (b) the Guyana Government or private local industry may have carried out feasibility studies to determine whether a patented product could be produced in Guyana. The studies would have revealed that it may be cheaper to import the patented product from elsewhere, moreover the use of local materials, employment, and training of personnel goes towards the saving of foreign exchange. The foreign patent owners and transnational corporations under the present international patent system derive great benefit at the expense of the developing countries in this area.

Evidence from the Deeds Registry in Guyana indicates that the granting of patents has not led to any foreign investment in Guyana by foreign patent owners. The small number of foreign patents used in production in developing countries is given in Table 3. (1)

TABLE 3 (1)

Patent holdings in developing countries by ownership and use, 1972

Item	No. of patents held in thousands	Distribution %
WORLD DISTRIBUTION		
Developed Countries	3,300	94
Developing Countries	200	6
TOTAL	3,500	100
Distribution in Developing Countries		
Held by nationals	30	16
Held by foreigners	170	84
of which used	10-20	5-10
of which not used	150-160	90-95

Table 4 (1) gives an indication of duration of patents of inventions in selected countries:

TABLE 4

Duration of patents of inventions in selected countries

GROUP OF COUNTRIES	Years			
	1-5	6-10	11-15	16-20
Developed market-economy countries			Italy Japan	Australia Austria Canada Denmark Federal Republic of Germany Finland France Norway Sweden Switzerland United Kingdom of Great Britain and Northern Ireland United States of America
Socialist countries of Eastern Europe			Bulgaria Czechoslovakia Romania USSR	German Democratic Republic Hungary
Southern European countries	Turkey	Spain Turkey	Greece Portugal Spain Turkey	
Developing countries	Argentina Chile China Iran Venezuela	Argentina Chile China Colombia Egypt India Iran Peru Venezuela	Argentina Brazil Chile China Egypt India Iran Iraq Korea (Republic of) Mexico Sri Lanka Syrian Arab Republic Uruguay	Algeria Chile Iran Israel Liberia Malawi OAMPI countries Pakistan Philippines Sudan Tunisia

In Guyana there has been some failure to make use of section thirty-one (31) of the Patent and Designs Act 30 of 1949, where there is provision for prevention of abuse of monopoly rights under a patent. There has not been any known case of anyone applying to the registrar after the expiration of three years from the date of sealing a patent. This could be attributed to the failure of industry to make use of the scientific, technological and design-engineering capabilities that were available before the accelerated brain drain which started a few years ago. The fact that prior to 1971 most industry was owned by multinationals may be the reason, but they certainly had the technological capabilities but not the will to contribute to the development of Guyana.

The bauxite industry is a case in point. The Demerara Bauxite Company (DEMBA) carried out all its research and development at its headquarters in Montreal, Canada. No attempt was made to develop the research capabilities of Guyanese, in fact it was not until after 1971 when the company was nationalized that a research and development unit was set up to serve the needs of the local concern. It is these research and development skills which will enable Guymine in the long run to extend the technology in order to diversify their line product. The strategy of a developing country like Guyana should aim at developing capabilities as part of a strategy of technological self-reliance. Technological self-reliance will give Guyana

(i) Increased knowledge and capability; and

(ii) Develop evaluative skills so that we can be in a better position to bargain and obtain good terms for imported technology.

With the banning of certain products, in 1971, there should have emerged that creativity to make use of local materials etc. to replace imported products. There was not enough local research and development into produce and products using local materials so that domestic needs, incomes and tastes could be satisfied.

Section thirty-one (31) of the Patent and Designs Act also provides for other circumstances for the abuse of monopoly rights under a patent as shown in the appendix under 31 (b), (f).

Although not being a member of the Paris Union, Guyana does legislate on compulsory licences which allow the patentee to be protected from abuses of the invention and derive a reasonable advantage in relation to profits from his invention.

Some countries also specify items that are eligible to be patented. Table 5 (1) summarizes the regulating governing patentability for selected countries:

TABLE 5 (1)

Fields of exclusion from patentability in selected countries

	Field of exclusion	Countries
1.	No specific exclusions	Australia, Federal Republic of Germany, Ireland, Netherlands, New Zealand, United Kingdom of Great Britain and Northern Ireland, Cuba, Jordan, Liberia, Malawi, Philippines, Sri Lanka, Sudan, Zambia.
2.	Food Products	Austria, Canada, Japan, Spain, Switzerland, Brazil, Chile, Colombia, Egypt, India, Korea (Republic of), Kuwait, Tunisia, Venezuela, Yugoslavia, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, USSR.
3.	Plant varieties or kinds of animals, or essential processes for obtaining plants or animals	Denmark, Finland, France, Norway, Sweden, United States of America, Poland, Romania, USSR, Algeria, Colombia, Israel, Nigeria.
4.	Pharmaceutical products	Austria, Canada, Italy, Japan, Spain, Switzerland, Turkey, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, USSR, Argentina, Brazil, Chile, Colombia, Egypt, Ghana, India, Iran, Iraq, Korea (Republic of), Kuwait, Lebanon, Morocco, OAMPI countries, Pakistan, Syrian Arab Republic, Tunisia, Uruguay, Venezuela, Yugoslavia.

(continued)...

TABLE 5 (cont'd)

	Field of exclusion	Countries
5.	Chemical substances	Japan, Switzerland, USSR, Brazil, Chile, China, India, Korea (Republic of), Mexico
6.	Nuclear materials, atomic energy, atomic weapons	Japan, United States of America, Czechoslovakia, Poland, Romania, Brazil, India
7.	Programmes for computer machines	France, Poland
8.	Inventions related to State monopolies	Austria
9.	Items deemed contrary to public or social interest or economic development	Ghana, Iraq, Peru

The relevant section twenty-eight (28) of the Patents and Designs Act dealing with licences of right is given in annex 1. There is evidence that few applications are made for compulsory licences and there may be many reasons for this including:

(a) The public is not aware that section twelve (12) provides for on the acceptance of the completion specification,

> "the Registrar shall advertise the acceptance in the Gazette and the application and specifications, with the drawings, samples and specimens (if any), shall be open to public inspections."

At present the public or the local scientist and engineers are not aware of this section of the law. It is necessary that the "public" be aware of the patents, and see what uses could be made of some inventions appropriate to local conditions. This use of patent documentation will depend to a large extent on the country's know-how although there is compulsory licensing with the local Patents and Designs Act.

(b) Absence of the technological capability to assess patents when received in the patent office. There is not any known case of rejection of a specification when it is sent to the examiner appointed by the Registrar. The National Science Research Council (NSRC) together with IAST should see to it that there is trained personnel to assess patents, local and foreign.

(c) The interests of foreign firms not to use the patent in Guyana for strategic reasons. The international protection of patent rights (Paris Convention), as we have already seen takes into account, primarily the interest of the technology suppliers. It is largely through the transfer of technology that the developed countries seek and do control to a great extent the development process in the developing countries and the existing market system.

Foreign firms therefore do not intend or wish to foster or create potential competitive centres of innovation.

Therefore, unless they can get conditions, through licensing or otherwise, to create and perpetrate a psychological environment of dependence, they are unlikely to use a patent that will give the opposite effect.

(d) The duration or period for which a patentee can retain monopoly privileges is too long, fourteen (14) years in Guyana for example. This needs to be revised in the light of rapid technological advance and it is obvious that the national interest must take priority.

Discussions and Conclusions

The evidence shows that most of the patents granted by the Government of Guyana are owned by foreigners or transnational corporations. This is a reflection of the technological and economic gap between Guyana and the developed country/countries concerned. Also, as indicated earlier because of the absence of knowledge of registered patents locally by the business and scientific community the provisions in the act of the compulsory licensing and monopoly has not been taken advantage of or tested.

The findings of the UNCTAD report (1) as regards the agreements entered into by developing countries concerning use of patents is worth quoting:

> "Even the small number of foreigners' patents which are actually used in production processes in developing countries represents a transfer of technology. In these cases, however, the agreements, entered into by developing countries, concerning use of patents through foreign investments or licensing arrangements frequently contain not only high royalty payments and charges for technical services raising the direct costs of obtaining the technology, but also restrictive practices and in some instances abuses of patent monopolies, either explicitly embodied in the contractual agreements or implicitly followed by subsidiaries and affiliates of transnational corporations, which impose heavy indirect or 'hidden' costs through overcharging for imported inputs. The foreign exchange burden of these costs - much larger than direct costs - applies to all developing countries regardless of whether they have national patent laws, or whether they are members of the Paris Union."

There is need to review the legislation in light of our economic circumstances and the need to develop our indigenous technological capabilities. Unless we develop and improve our scientific and technological infrastructure we will always be recipients of out-dated technologies.

It is apparent that the present legislation in Guyana as it relates to patents is colonialistic in origin and therefore was not structured to meet the socio-economic needs of a developing Guyana. In other words the present patent system enables the patent holders the majority of whom are from developed countries to create monopolies and to control the world market system for imports and distribution of goods.

There is need for institutional support mechanisms to stimulate local patent activity and at the same time to reduce costs associated with an undue dependency on foreign technology initiated through patents. To be able to stimulate local activity our technology infrastructure has to be developed, in a sound science and technology policy and consideration of social and cultural attitudes to technology. It also means dynamic and progressive changes in the education and training system. More emphasis must be placed on science and technical education at the secondary school level. We must train the personnel on a continuous basis to meet this challenge. The education and training of technicians and engineers must be such as to prepare for professional work in design and engineering-research and development. Industrial training and experience must be an integral part of the curricula. At present we are short of engineers, technologists and scientists, trained managers and basically engineers with adequate industrial experience.

We, therefore, urgently need to get down to restructuring the educational system so as to produce and develop our technological infrastructure. Some of the changes recommended by the UNCTAD report (1) include:

> "Introduction of inventor's certificates, granted to applicants of any nationality as in socialist countries of Eastern Europe or in Algeria; exclusion of some products or processes from patentability; a limitation of the duration of patent grant for specific products or processes; in the balance between monopoly rights of patent holders and general public interest, a shift in favour of greater recognition of public interest; strengthening of disclosure requirements; stricter provisions for non-use; strong provisions against abuses in patent licensing agreements."

A bibliography of patents with abstracts for the period 1900 to 1979 is to be published later this year. The draft of this publication is available for perusal and it is hoped that the final publication will help stimulate interest in patents for the economic and technological development of Guyana; and at the same time to activate policy measures in the area.

REFERENCES

1. United Nations Conference on Trade and Development - The role of the patent system in the transferred technology to developing countries. T-TD/B/AC 11/19 REV.1.

2. UNCTAD - The international patent system as instruments of policy for national development - TD/B/C 6/AC 2/3.

Annex 1

Extract from the Patents and Designs Act, Chapter 90:03 Act 4 of 1972.

Title 1

Application for and Grant of Patent

Application:

3. (1) An application for a patent may be made by any person who claims to be the true and first inventor of an invention; whether he is a Commonwealth citizen or not, and whether alone or jointly with any other person.

(2) The application must be made in the prescribed form, and must be left at, or sent by post to, the Registrar in the prescribed manner.

(3) The application must contain a declaration to the effect that the applicant is in possession of an invention, whereof he, or in the case of a joint application one at least of the applicants, claims to be the true and first inventor, end for which he desires to obtain a patent, and must be accompanied by either a provisional or complete specification.

(4) The declaration required by this section may be either a statutory declaration or not, as may be prescribed.

Specifications:

4. (1) A provisional specification must describe the nature of the invention.

(2) A complete specification must particularly describe and ascertain the nature of the invention and the manner in which the same is to be performed.

(3) In the case of any provisional or complete specification where the Registrar deems it desirable he may require that suitable drawings shall be supplied with the specification, or at any time before the acceptance of the same, and such drawings shall be deemed to form part of the said specification.

(4) A specification, whether provisional or complete, must commence with the title, and in the case of a complete specification must end with a distinct statement of the invention claimed.

(5) Where the invention in respect of which an application is made is a chemical invention, then, subject to the prescribed rules, typical samples and specimens shall, if in any particular case the Registrar considers it desirable so to require, be furnished before the acceptance of the complete specification, and the applicant shall be at liberty, where he so desires, and subject to the prescribed rules, so to furnish any typical samples and specimens, unless the Registrar in any particular case considers that it is undesirable that any should be received.

Advertisement on acceptance of complete specification:

On the acceptance of the complete specification the Registrar shall advertise the acceptance in the Gazette and the application and specifications, with the drawings, samples and specimens (if any), shall be open to public inspection.

Term of patent

Term of patent (30 of 1949, 4 of 1972)

21. (1) The term limited in every patent for the duration thereof shall, save as otherwise expressly provided by this Act, be a term beginning on the date of the patent and ending at the expiration of sixteen years from the date (to be entered in the register of patents) on which the specification accepted as a complete specification is treated by the Registrar as having been first left.

(2) Any patent the original term of which had not expired at the date of the commencement of this Act shall have effect as if the term mentioned therein was sixteen years, subject to the following conditions:

(a) any licence existing at that date which has been granted for the term of the patent shall be treated as having been granted for the term as so extended if the licensee so desires;

(b) if the patent would, apart from this section, have expired on or before the commencement of this Act, the patent shall, during the period of extension, be subject to all the provisions of section 28 (except subsection (5) thereof) as if the patent had been endorsed "licences of right".

(3) Where any party to a contract with the patentee or any other person, entered into before the commencement of this Act, is subjected to loss or liability by reason of the extension of the term of any patent under this section, the Court shall have power to determine in what manner and by which parties such loss or liability shall be borne.

(4) A patent shall, notwithstanding anything therein or in this Act, cease at the expiration of the period prescribed for the payment of any prescribed renewal fee, unless the patentee pays the fee within that period or within that period as extended under this subsection.

The period prescribed for the payment of any such fee shall from time to time be extended to such period (not exceeding a period three months longer than the prescribed period) as may be specified in a request in that behalf made by the patentee to the Registrar, if the request is made, and the fee and the prescribed additional fee (which shall not exceed one hundred dollars) are paid, within the period so specified.

(5) If any proceeding is taken in respect of an infringement of the patent committed after a failure to pay any renewal fee within the prescribed period, and before any extension thereof, the Court before which the proceeding is proposed to be taken may, if it thinks fit, refuse to award any damages in respect of such infringement.

Compulsory licences and revocation

Provision as to patents endorsed "licences of right."

28. (1) At any time after the sealing of a patent the Registrar shall, if the patentee so requests, cause the patent to be endorsed with the words "licences of right", and a corresponding entry to be made in the register, and thereupon

(a) any person shall at any time thereafter be entitled as of right to a licence under the patent upon such terms as, in default of agreement, may be settled by the Registrar on the application of either the patentee or the application:

Provided that any licence the terms of which are settled by agreement shall be deemed, unless otherwise expressly provided, to include the terms and conditions specified in paragraphs (c) and (d) as if they had been imposed by the Registrar thereunder in like manner as if the terms had been settled by the Registrar;

(b) in settling the terms of any such licence the Registrar shall be guided by the following considerations:

(i) he shall, on the one hand, endeavour to secure the widest possible user of the invention in Guyana consistent with the patentee deriving a reasonable advantage from his patent rights;

(ii) he shall, on the other hand, endeavour to secure the patentee the maximum advantage consistent with the invention being worked by the licensee at a reasonable profit in Guyana;

(iii) he shall also endeavour to secure equality of advantage among the several licensees, and for this purpose may, on due cause being shown, reduce the royalties or other payments accruing to the patentee under any licence previously granted:

Provided that, in considering the question of equality of advantage, the Registrar shall take into account any work done or outlay incurred by any previous licensee with a view to testing the commercial value of the invention or to securing the working thereof on a commercial scale in Guyana.

(c) any such licence the terms of which are settled by the Registrar may be so framed as to preclude the licensee from importing into Guyana any goods the importation of which, if made by persons other than the patentee or those claiming under him, would be an infringement of the patent, and in such a case the patentee and all licences under the patent shall be deemed to have mutually covenanted against such importation;

(d) every such licensee shall be entitled to call upon a patentee to take proceedings to prevent the infringement of the patent, and if the patentee refuses or neglects to do so within two months after being so called upon, the licensee may institute proceedings for the infringement in his own name as though he were patentee, making the patentee a defendant. A patentee so added as defendant shall not be liable for any costs unless he enters an appearance and takes part in the proceedings. Service on him may be effected by leaving the writ at his address for service given on the register;

(e) if in any action for infringement of a patent so endorsed the infringing defendant is ready and willing to take a licence upon terms to be settled by the Registrar, no injunction against him shall be awarded, and the amount recoverable against him by way of damages (if any) shall not exceed double the amount which would have been recoverable against him as licensee if the licence had been dated prior to the earliest infringement:

Provided that this paragraph shall not apply where the infringement consists of the importation of infringing goods;

(f) the renewal fees payable by the patentee of a patent so endorsed shall, as from the date of the endorsement, be one moiety only of the fees which would otherwise have been payable.

Provisions for prevention of abuse of monopoly rights (30 of 1949)

31. (1) Any person interested may at any time after the expiration of three years from the date of sealing a patent apply to the Registrar alleging in the case of that patent that there has been an abuse of the monopoly rights thereunder and asking for relief under this section.

(2) The monopoly rights under a patent shall be deemed to have been abused in any of the following circumstances:

(a) if the patented invention (being one capable of being worked in Guyana) is not being worked within Guyana on a commercial scale, and no satisfactory reason can be given such non-working:

Provided that, if an application is presented to the Registrar on this ground, and the Registrar is of opinion that the time which has elapsed since the sealing of the patent has by reason of the nature of the invention or for any other cause been insufficient to enable the invention to be worked within Guyana on a commercial scale, the Registrar may make an order adjourning the application for such period as will in his opinion be sufficient for that purpose;

(b) if the working of the invention within Guyana on a commercial scale is being prevented or hindered by the importation from abroad of the patented article by the patentee or persons claiming under him, or by persons directly or indirectly purchasing from him, or by other persons against whom the patentee is not taking or has not taken any proceedings for infringement;

(c) if the demand for the patented article in Guyana is not being met to an adequate extent and on reasonable terms;

(d) if, by reason of the refusal of the patentee to grant a licence or licences upon reasonable terms, the trade or industry of Guyana or the trade of any person or class of persons trading in Guyana, or the establishment of any new trade or industry in Guyana, is prejudiced, and it is in the public interest that a licence or licences should be granted;

(e) if any trade or industry in Guyana, or any person or class of persons engaged therein, is unfairly prejudiced by the conditions attached by the patentee, whether before or after the passing of this Act, to the purchase, hire, licence, or use of the patented article, or to the using or working of the patented process;

Provisions as to unfair exercise of process patent

(f) if it is shown that the existence of the patent, being a patent for an invention relating to a process involving the use of materials not protected by the patent or for an invention relating to a substance produced by such a process, has been utilized by the patentee so as unfairly to prejudice in Guyana the manufacture, use or sale of any such materials:

Provided that, for the purpose of determining whether there has been any abuse of the monopoly rights under a patent, it shall be taken that patents for new inventions are granted not only to encourage invention but to secure that new inventions shall so far as possible be worked on a commercial scale in Guyana without undue delay.

PATENTS AND TRADEMARKS

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Introduction

Developing countries such as Guyana are finding it increasingly necessary to institute national policies and strategies which will reduce their dependence on the international economy and at the same time maximize their national self-reliance. An important feature of the international system is the importation of technology, which in most instances is a transfer of technology from the industrialized to the developing countries. At this period in the development of Guyana, one of the policies being proposed is the promotion and development of indigenous technology and the transfer of appropriate technology. These two objectives may foster the maximization of self-reliance and the minimization of external dependence. This policy has two immediate implications, the first is that the indigenous sector has been neglected or relatively underdeveloped, and the second being that the economy was a recipient of technology which was often inappropriate to the country's particular circumstances.

In order to pursue the policy successfully, there arises the need to monitor and regulate the flow of technology into the country. One regulatory mechanism is the Patents and Trademarks System. It is therefore necessary to evaluate this system since it forms the basis for many technology transfer agreements. This paper discusses the Patents and Trademarks System in terms of its adequacy as a stimulant for the development of indigenous technology and as a regulatory mechanism for the transfer of appropriate technology.

Definition of Terms

A patent can be interpreted as the granting of the sole right to a person or persons, to make, use or sell an invention in the territory where this right has been granted. This right prevents other persons from using, making or selling the invention without the permission of the holder of the patent. 'A patent confers upon its holders an ownership right to a specific product or process for a designated number of years and thereby facilitates collection of a reward for inventive activity." 1/ Royalties are paid for the use of patents. The main role of the Patent System is the provision of adequate information to the public in exchange for monopoly rights which are granted by the State through patent laws. Other supplementary roles include the protection of new inventions, the encouragement of research and innovations and the disclosure of discoveries.

A trademark is more obvious than a patent. It is a means of identification, such as a mark, a letter, word or words used in the course of trade so that the goods to which it is applied may be readily distinguished by the public from similar goods of other traders. Product differentiation is one of the main functions of the trademarks system. The rationale for trademarks has been given as the need to protect and maintain quality control of the product with the mark and to assist in promoting the product. In a recent publication of the United Nations it is stated that:

> "Trademarks are universally recognized as a device used by a producer or distributor to identify the goods he is making or selling, through such identification it is generally possible to distinguish the goods according to their source of origin, that is to distinguish the goods of one enterprise from those of other enterprises." 2/

1/ KAMIEN, MI; SCHWARTZ, N.L. - "Patent Life and Research and Development Rivalry", American Economic Review, Vol. iv, No. 1, March 1974, p. 183.

2/ UNCTAD - The Role of Trademarks in Developing Countries, p. 1.

An Overview of the Patents and Trademarks System in Guyana

The first Patent Act in Guyana was passed in 1902. The legal system is an inheritance of the colonial era, ergo, it is based, to a significant extent, on the British system. Political independence brought no major changes in the system. Since 1902 there have been a number of amendments to the Patent Laws, the first being passed in 1937 and enforced in 1938. Subsequent amendments were made in 1938, 1949, 1956, 1961 and 1972. The first Trademarks Acts in Guyana was passed in 1914. It was however amended in 1928 to facilitate United Kingdom transfers of trademarks. Since 1928, there have been three other amendments, these were in 1952, 1956, and 1972. It was observed that most of the amendments in both the Patents and Trademarks Acts resulted in the main from changes in the British legal system and not from any real desire to make the system more specific to the needs and development patterns of Guyana.

Inventors, wishing to have their inventions and innovations patented in Guyana may obtain patents from the Registrar of Deeds. In addition to those patents which are processed in Guyana, there also operates a system of patent transfers between Guyana and the United Kingdom, whereby patents that are processed and registered in the United Kingdom may be transferred to the Patent Register in Guyana, bypassing the normal procedure. This feature which will be referred to as "UK transfers" is a direct outcome of the colonial relationship between Guyana and Britain and is also applicable to trademarks.

In an effort to divert from the British system, the Patent Acts amendment of 1972 stated that those patents registered in the United Kingdom and transferred to Guyana should be subjected "to all conditions established by the laws of Guyana as if a patent had been issued to him in Guyana under this Act." [3/] This in itself constitutes an inconsistency since Section 58 of the Laws states that "Privileges and rights so granted shall date from the date of the patent in the United Kingdom and shall continue in force only so long as the patent remains in force in the United Kingdom." [4/] In the United Kingdom, patents become lapsed after 20 years. It is important to note that United Kingdom transferred patents are carried in the register for fees that are substantially less than those paid by locally processed patents. United Kingdom transfers pay a total amount of ten dollars whereas locally processed patents pay an initial one hundred dollars along with annual renewal fees as from the end of the fourth year until the patent is lapsed.

To obtain a patent or trademark an application with complete specifications, including illustrations where applicable, is submitted by the proprietor through a patent agent, who also acts on behalf of the trademark as applicant, to the Registrar of Deeds. The specifications are sent to a patent examiner who checks them for novelty and verifies whether or not the invention can be put into practice without infringing the claims of an already existing patent. For United Kingdom transfers, the specifications are not re-examined by the Guyanese Patent Examiner. It has been recognized that developing countries such as Guyana "only rarely have adequate facilities to evaluate the degree of novelty of a proposed patent invention, its industrial applicability or the grounds for nullifying the application". [5/]

3/ Law of Guyana, Chapter 90:03. Section 57.

4/ Ibid. Section 58.

5/ UNIDO - Industry 2000: New Perspectives, United Nations, New York, 1979, p. 40.

To counter this problem, there has been a proposal for an International Patent Examination Centre which will provide information on the results and legal decisions of the initial examination of similar patent applications in other countries.

Unlike a patent which has a validity for 16 years trademarks have unlimited periods for which they are valid: the only requirement for validity is the payment of an annual renewal fee. However if a patent holder still wants his patent to be valid after the sixteenth year, a new application must be made with possible changes. This limited period is one way of preventing obsolescence and an ongoing monopoly.

Patents and Trademarks in Guyana

At the end of August 1980, there were eleven thousand, two hundred and thirty (11,230) trademarks in Guyana. Of these, approximately 95 per cent were owned by foreign suppliers with Guyanese producers accounting for the remaining 5 per cent. This has implications for the original structure of the economy whereby most of the country's manufactures and consumer products were imported and a significant amount of these manufactured imports carried trade marks. Nevertheless, the Guyanese public is provided with hope for changes in these proportions with the implementation of an import substitution policy, concomitant with the restriction of imports. As of present however there has been no significant change in the proportion of foreign owned trademarks as compared to those originating locally.

A similar situation exists in terms of the ownership of patents. The table which follows reinforces this statement.

TABLE 1

Patents in Terms of Country of Origin

Country / Period	United Kingdom Transfers	United Kingdom	United States of America	Guyana	Others	Total	
							%
1903-1920	0	52	58	15	20	145	12.5
1921-1940	26	20	49	14	24	133	11.5
1941-1950	21	4	22	8	9	64	5.5
1951-1960	71	9	36	9	31	156	13.7
1961-1970	223	14	61	8	22	328	28.3
1971-1980	227	3	63	7	29	329	28.5
Total	568	102	289	61	135	1 155	
Per cent	49.2	8.8	25	5.3	11.7	100	

Source: Patents Register, Deeds Registry.

Of the one thousand, one hundred and fifty-five (1,155) patents registered between 1903 and August 1980, one thousand and ninety-four (1,094) or 94.7 per cent belong to inventors who are alien to Guyana. To be more specific, the table reveals that 49.2 per cent of the patents were accounted for by United Kingdom transfers. 25 per cent were from inventors from the United States of America, this country shows a consistent increase in its contribution -

this is due partly to the ownership structure of the multinational corporations that operated in Guyana. The United Kingdom which has a steadily decreasing share, contributed 6.6 per cent for the 1903 to 1980 period; 11.7 per cent came from other countries including Germany, Switzerland and Canada. Next to United Kingdom transfers, United States patents rank second in quantum terms, Guyana, the country where all the patents were registered, accounted for an insignificant 5.3 per cent of the patents, beginning with 15 in 1903-1920 and ending with seven for the period 1971-1980. What appears strange is that even with the restriction on imports and the import substitution policy in the 1970s, when one would have expected increases in the local patentable products and processes, the figure for the relevant period, 1971-1980 is smaller than for any other period.

It may be posited that there are factors mitigating against the development of local technology, factors causing the failure of local persons to generate patents in a significant quantity. One factor advanced for this perpetual lack of local initiative is the ownership structure of the economy. Before the last decade, most of the industries were subsidiaries of firms based in the industrialized countries. These subsidiaries were supplied with technology from the parent company, hence the only factor required by Guyanese in the production process was their labour, there was no need or encouragement for them to invent or innovate. Secondly, there was the lack of an industrial sector. The two main industries were sugar and bauxite which, in addition to being supplied with foreign technology, also had an established production process. Thirdly, and more recently, is the problem of brain drain; many who are capable of inventing are migrating to other countries. The patent system is not stimulating local inventors and indigenous technological activities· rather, it appears to be encouraging foreigners. This contention is concretized by the dominance of patents from the industrialized countries in the patent economy of Guyana. Further, there is a tendency for the influx of patents to increase over the years. Between 1961 and 1980, 651 or 56.8 per cent of the total amount of patents came into the country. Finally, most of the foreign patents remain unworked in Guyana in a situation which corresponds with the evidence found in other developing countries.

Tables 2 and 3 show the sectoral distribution of the patents in terms of foreign and local origin respectively.

Even though the figures in the tables are not an adequate reflection of the industrial structure of the economy, they point to the degree of foreign dominance of patents in the economy. Whereas sugar production and bauxite mining - the most important economic activities in Guyana - account for a relatively low 20.5 per cent of the foreign patents, the pharmaceutical and chemical groups, which until recently have been of limited importance, account for 44.6 per cent of these. Of the 488 patents in these two groups. 326 were registered between 1961 and 1980. On the other hand, the foreign patents for agriculture other than sugar are 4.2 per cent. This low share of foreign patents in the agricultural sector other than sugar is due mainly to the low level of technology and the labour intensive production methods used in this sector. Two noticeable omissions from table 3 are pharmaceuticals and agriculture (general). The deficiency of local patents in these areas can be explained when one considers that pharmaceuticals is a very high technological research-intensive area and the level of research and development in Guyana is still relatively low and even non-existent in some areas; and agricultural activity is carried out on small family plots using labour intensive methods, and innovations, where these occur are not normally registered in the patent office.

TABLE 2

Sectoral Distribution of Patents - Foreign

Sector \ Period	1903-1920	1921-1940	1941-1950	1951-1960	1961-1970	1971-1980	Total	
								%
Sugar	28	20	10	6	23	33	120	10.9
Bauxite	4	10	4	16	51	21	105	9.6
Rice	0	5	0	1	0	0	6	0.5
Agri. (Gen.)	2	1	0	9	15	14	41	3.7
Construction	0	5	6	8	10	10	39	3.5
Mechanical	10	3	0	3	5	1	22	1.9
Chemical	40	33	25	58	128	125	409	37.3
Rubber	6	4	0	0	0	0	10	0.9
Pharmaceuticals	0	1	0	5	37	36	79	7.3
Acoustics	26	2	1	0	0	0	29	2.5
Miscellaneous	14	35	10	41	52	82	234	21.9
Total	130	119	56	147	320	322	1 094	100.0

Source: Patents Register, Deeds Registry.

TABLE 3

Sectoral Distribution of Patents - Local

Sector \ Period	1903-1920	1921-1940	1941-1950	1951-1960	1961-1970	1971-1980	Total	
								%
Sugar	6	0	0	0	0	0	6	9.9
Bauxite	0	0	0	0	0	2	2	3.2
Rice	1	0	1	0	1	1	4	6.4
Construction	0	3	2	3	1	0	9	14.9
Mechanical	0	7	1	2	3	1	14	23.1
Chemical	3	2	0	0	1	2	8	12.0
Miscellaneous	5	2	4	4	2	1	18	29.7
Total	15	14	8	9	8	7	61	100.0

Source: Patents Register, Deeds Registry.

There are some problems associated with the process of obtaining and using patents. The vagueness and complicated nature of some patent specifications along with the limited knowledge of technology possessed by entrepreneurs in developing countries may render these specifications useful only to experts in the industry. This consideration may make it necessary for patents to be accompanied by forms of technical assistance to would-be patentees. In the light of this, it can perhaps be argued that a patent does not always transfer technology, and people are often prevented from really getting the know-how, that is the technology. The patent only gives to the person the right to use the technology. Thus to eliminate this negative feature it has been recommended for example by the United Nations that there be a strengthening of the disclosure requirement, and that the specifications ought to be more comprehensive. In purchasing technology, one should know what is needed, the existing terms and conditions, and all the available designs and alternative techniques. This will ensure better choice for the acquisition of imported technology.

Further it has been recommended that the duration of the patent should be less than what it is at present and that some foods and pharmaceuticals should be excluded from patentability in order to control private monopoly and abuses associated therewith. The grant of some patent agreements and sale of technology are often accompanied by many restrictive practices which preclude the attainment of the self-sufficiency objective. Restrictive practices govern areas such as the quality of the goods produced, the sources of input, and the price of the product. On the restrictive practices of some patent agreements, one author argues that:

> "An important by-product of international patenting laws, which gives to the patent owners considerable rights over the determination of the sale of their invention, is that companies are able to use this monopoly to specify the areas in which the Government and the locally operating enterprise can sell their output as licensee. The contract closely specifies the areas of possible sale and the usual practice is to restrict quite closely the rights of the local enterprise to export the product under licence." 6/

The granting of a patent right therefore has several negative consequences. For instance, it perpetuates and strengthens dependency, especially technological dependency. An economy has to depend on the technology of a particular country for a particular industry which may itself be of a subsidiary of a company in the developed country. Technological dependence extends even after the end of the patented period, since, by the time of expiration, the patented process or product might have become obsolescent and a new round of patenting would begin." 7/ Patents also encourage the importation of processes and products from the developed countries to the developing countries, and prevents both foreign and local competitors from using the knowledge in the patent. Restriction especially with respect to the use of the patented product or process and the source of inputs will adversely affect an economy for developing necessary inter-industry linkages. The development of such linkages is crucial for an economy such as Guyana which is economically underdeveloped.

6/ ODLE, M.A. - Commercialization of Technology in the Caribbean, Institute of Social and Economic Research, University of the West Indies, Trinidad, 1977, p. 96.

7/ Ibid., p. 89.

Conclusion

The Industrial Property System which operates in Guyana, has failed to act as an incentive for indigenous research, invention and innovation. The Patents and Trademarks System, in this connection is structured so as to keep out competitors, especially local ones and give monopoly benefits to their owners who are mainly foreigners. The system also serves to make information expensive to those who require it. When the patent leads to production - and in some cases even if it does not lead to production - it entails many restrictive practices. Because of the many restrictions attached to the use of a patent, it becomes difficult for the economy to achieve any meaningful degree of self-sufficiency especially at the technological level.

The foregoing discussion leads one to conclude that the Patents and Trademarks System as it exists in Guyana is not adequate as a stimulant for the development of indigenous technology and the transfer of appropriate technology. Since these two objectives are important for development, there is need for the revision of the Patents and Trademarks System, for a system which will seek to promote an indigenous technological capability and monitor and regulate the importation of technology so that the development costs of technology transfer with patents and trademarks are minimized.

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EDUCATION AND THE TRANSFER OF TECHNOLOGY AND INDUSTRIALIZATION

11358

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"In our civilization, qualified as variable, the school can no longer play the role it did until quite recent times when human knowledge as well as social and economic conditions underwent but insignificant changes in the course of the lifetime of one generation. Knowledge acquired at school could then be considered a quite sufficient base for social orientation, for participating in universal culture, and for the lifelong practice of a profession. School endeavoured to provide an education complete in itself and permanently up-to-date." 1/

In 1974 the Joint Steering Committee of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Association of Universities undertook an examination of the consequences for universities of the growing acceptance of the need to provide for "lifelong" education. The above statement taken from a contribution to this study by Ryszard Wroczynski, Professor of Education at the University of Warsaw, sums up eloquently the general concern among educators about the limitations of current formal education, and explains the considerable attention being given to new structures and innovative techniques all aimed, for the most part, at countering what has been aptly described as the knowledge explosion.

Knowledge obsolescence is however not the only grounds on which the case for continuing education has been built. In the words of Rene Maheu "in a modern society, lifelong education is just as much the natural culmination of the right to education as a necessity of vocational training made inevitable by the acceleration of scientific and technological progress". 2/ In developing countries where only a minority can ever hope to progress beyond the primary level of schooling, and where there is often a relatively high drop-out rate, the need to provide some form of further education for persons outside the formal school system is crucial. Such persons form a significant proportion of the labour force, and improvement of their knowledge base and upgrading of their skills are essential to the process of modernization.

The terms "lifelong education" and "continuing education" have been used so far as if they were interchangeable, and indeed there is a common tendency to treat them as such. There is however a subtle difference between the two, and it is perhaps useful at this stage to digress for a moment and engage in some terminological clarification. The variations in terminology covering the theory and practice of the genus education and its species adult education are enormous, and as Jones-Quartey has observed "the confusion or embarrassment they cause are a function partly of the history of the ideas and philosophies involved in the development of education, and partly of the number of differing interests whose needs the system has had to meet". 3/ The extent of the variation is illustrated by the following list of terms currently in use:

1/ "Lifelong education and its consequences for the use of university resources": A joint UNESCO/IAU inquiry, 1975.

2/ Address to UNESCO Conference of European Ministers of Education, Bucharest, 1973.

3/ Joint UNESCO/IAU inquiry, 1975.

lifelong education	non-formal education
adult education	recurrent education
further education	extension education
continuing education	vocational education
fundamental education	extra mural education
remedial education	public education
out-of-school education	mass education

The list includes concepts such as lifelong education, continuing education, as well as practices - non-formal education, recurrent education. The distinction between concept and practice is important, since one may accept a concept and yet debate the actual practice through which it is to be realized. Of the conceptual terms we must, in the context of this article, distinguish in particular between lifelong education and continuing education. The generally accepted definition of lifelong education is learning of all types at all levels or stages done by the individual from his cradle to his grave. Continuing education is much more restrictive, and refers to learning that takes place after the learner has become adult, or passed the preliminary stage or stages of the process whether in literate or pre-literate society. In the words of the Venezuelan Victoria Heredia de Hernandez, "continuous (continuing) has a very pronounced temporal element, although we are perfectly aware of the fact that it implies a renewal of one's knowledge; whereas lifelong education is more than a constant training which is renewed, it is an attitude towards training; the time element is present of course, but more in the sense of 'all times', that is to say, permanent". 4/

It must be fairly obvious from the definitions that the aims of lifelong and of continuing education are very nearly coincident. Both are attempts to respond to the challenges of knowledge obsolescence and mass education. Implicit in lifelong education however is a restructuring of the entire educational system, and it is for this reason that some educators regard it as a Utopian vision. For developing countries at any rate lifelong education is just that, and efforts to pursue it can only prove illusory. Less ambitious schemes of continuing education offer considerable benefits, without the same degree of structural changes, and at a fraction of the cost.

In the contemporary world any educational system has to take cognizance of certain realities if it is to satisfy the demands on it for relevance of purpose. Firstly, there is the knowledge explosion, to which reference has already been made. The effect of this is starkly illustrated by the estimate that more than half of what is taught to science and engineering students in their undergraduate years will be out-of-date within ten years. This clearly has implications not only for the taught but also for the teacher, which is why the university which has to be in the forefront of knowledge is often the institution best placed to implement continuing education. The second reality is the frequency with which people change jobs in a modern society. Holloway has argued that the initial undergraduate experience is likely to be of decreasing significance in respect of occupational choices and decisions in later life, and refresher and reorientation courses at intervals during working life will become more common. 5/ The third reality, and this is particularly true of developing countries, is the dynamic nature of society, and the rapidity with which changes occur. The changes may be continuous or discontinuous, requiring a higher refinement of skills or a

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4/ Ibid.

5/ "What kind of graduates do we need?" Science and Engineering Policy Series, O.U.P., 1971.

range of new skills to match new directions. Discontinuities are inevitable, for instance, in the transition from an agrarian to an industrialized society. Lastly, there is the reality, again more applicable to developing than developed countries, of a relatively large unskilled or barely semi-skilled labour force that has to be educated and trained to meet the demands of increasing sophisticated techniques and job requirements.

Within developed countries the value of continuing education, and the need for it to be accorded an important place in the hierarchy of training, are no longer matters of debate. The real debate tends to be about who does what, and about the demarcation of responsibilities between the formal and non-formal systems. Tertiary institutions, industry, and professional associations all play a part in continuing education in developed countries, and their contributions are reinforced by the highly developed mass media. The measure of acceptance of the importance of continuing education is exemplified by the situation in Poland, for instance, where the improvement of knowledge and abilities for certain categories of workers is mandatory by law. The law of 1970 makes obligatory the continuous education of workers who occupy determined posts requiring university or secondary education, and, above all, of persons working in the fields of engineering, technology, and economics. It is not by accident, one imagines, that the fields identified are the very ones that have direct relevance to the processes of industrialization and technology transfer.

In the developing world continuing education has by and large suffered from neglect, partly because the main preoccupation has been with expansion and improvement of the formal education system, but partly also because of the failure to appreciate the limitations of formal education in meeting in particular the immediate requirements of the development process. This is so because the formal system addresses in the main the wrong people, insofar as development is concerned. Michael Aliot put his finger on the problem when, speaking at an International Association of Universities (IAU) seminar in Lome in 1979, he was led to observe that "more than once in this seminar we have had the paradoxical feeling that the universities in the third world are at the same time forming too many and too few cadres. Too many, because almost everywhere there are, or soon will be, young unemployed intellectuals; too few, because almost everywhere responsible posts are being held by men and women who have experience but no university training, and whose useful action is thus limited." 6/ This is really the crux of the problem. The decision-makers, and those responsible in a large part for implementing decisions, are generally overlooked in the formal education system which churns out almost blindly large numbers of persons who are neither. Continuing education offers one way of redressing this balance.

During the 1960s an optimistic, if not simplistic, view prevailed about the transfer of technology, and the relationship between science and technology and development. Thus one finds in the Report of the United Nations Conference on the Application of Science and Technology for the benefit of the less developed areas, the following statement representative of the period. "It is true that modern science and technology have widened the gap between the rich and poor countries, but that is because the advanced countries have been in a better position to use them. Enlisted more widely in the service of the developing countries, science and technology can help them reduce that gap; in particular they provide short cuts to the goals of development and can spare the new countries some of the slow processes of

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6/ "The Role of the University in developing countries: its responsibility toward the natural and cultural environment", IAU, Paris, 1979.

trial and error that the advanced countries had to pass through. The developing countries can take advantage of the rate of technological change since the Second World War which has been much faster than ever in history." 1/ The truism of the last sentence has of course to be juxtaposed against the equally true qualification in the first sentence - "but that is because the advanced countries have been in a better position to use them" -, though in general euphoria at the time such juxtaposition was never made.

It is now generally realized that the transfer of technology and industrialization are not the simple processes they seemed at first sight. A prerequisite for the success of these processes is the receiving country's capacity to select, evaluate, absorb and adapt technology, and hence on the human resource capability to perform these functions. Conventional tertiary education programmes rarely address this specific issue, and the need consequently exists for further education programmes to make up for the deficiency. It is perhaps hardly surprising, in the circumstances, to find a Commonwealth team of industrial specialists advocating for developing countries systems of industrial extension services which parallel those currently applied to agriculture. And it is still less surprising that included among the tasks identified to be undertaken are (i) familiarizing industries within the country with developments and improvements with related techniques, and (ii) training local professionals. Both these tasks, if training is taken to subsume re-training, fall under the umbrella of continuing education.

Continuing education then as a tool in the process of technology transfer and industrialization does not have to be argued. The real issues are continuing education for whom, and how. There are two major categories of clientele to be served by continuing education within the limited context of industrialization and technology transfer - professionals and semi- or sub-professionals on the one hand whose knowledge and skills must be updated, and the unskilled or marginally skilled labour force whose knowledge base has to be improved and skills upgraded to meet the demands of increasing sophistication of techniques and job requirements.

Continuing education serves both to improve one's knowledge in one's particular field or to add a new dimension to it. Thus engineering and social science skills can be supplemented, for instance, with techniques of technology assessment, policy analysis, and technology forecasting. Mechanical engineers can become energy specialists, civil engineers and biologists may be trained as environmentalists, and so on. However, if it is to be more than learning for learning's sake, continuing education in relation to technology transfer, management and development has to be implemented within the framework of a national technology policy. It is within the framework of decisions on what technological software and hardware are to be imported or developed that programmes of continuing education have to be constructed at the professional and technical levels.

At the other end of the spectrum is the need to upgrade the unskilled or semi-skilled labour force, to improve scientific literacy, and to increase awareness of the importance of technology. The last two are essential to attitudinal change. They are necessary, as some authors have argued, to demystify science on the one hand and enhance productive capacity on the other. They are equally important in creating a climate for inventiveness and for the upgrading of indigenous technology.

1/ Quoted from "Technology, Planning and Self-reliant Development", Francisco Sagasti, Praeger, 1979.

Nor should one forget the decision-makers in science and technology. In developing countries these persons often have little or no scientific and technological background, but are constantly taking decisions which have explicit or implicit consequences for the scientific and technological system. Novel as the proposal is, one cannot help feeling that there is much to be said for programmes of continuing education in science and technology for politicians.

With regard to the how of continuing education, one is confronted with a wide range of options and the problem is one of choosing the most appropriate from a socio-cultural and economic standpoint. Methods of continuing education range from simple seminars, workshops, refresher courses and on-the-job training to the use of sophisticated mass media techniques and demonstration effects. Often it is desirable, if not necessary, to employ several different methodologies, although this is not always possible. Thus useful as television is proving as a medium for continuing education, a country may simply not have it or, more commonly, lack the back-up resources to make good use of it.

That professionals and semi-professionals need to keep abreast of knowledge through some form of continuing education is never a matter of debate. The general tendency however has been to regard this as the responsibility of the individual, even when the evidence suggests that continuing education by a process of self-learning is the exception rather than the rule. It is easily forgotten that in the universities where self-learning is perhaps most practised, conscious efforts are taken to encourage it through such mechanisms as study leave, attendance at conferences etc. and by a system of incentives that rewards those who practise it and penalizes those who do not. To leave continuing education entirely up to the individual is to take too great a risk in a matter with so much at stake. Individuals need to be encouraged through leave and time-off facilities, and by means of incentives of various kinds to update their knowledge and skills, and even to acquire new knowledge and skills where this is desirable. And government, universities, industry and professional associations need to view continuing education as an essential ingredient of modernization and take conscious steps to implement it as a matter of policy.

The university has perhaps the pre-eminent role in the continuing education of professionals and semi-professionals. This view is shared by Liveright who, in projecting the shape of the future in American higher education, sees continuing education not as a "peripheral, low-status, expendable activity" but as a "basic, integral, and subsidized part of the University". 8/ His College of Continuing Education is a permanent feature of the university, and its Institute of Occupational and Professional Development is seen as undertaking such activities as:

(i) a wide variety of residential, evening and weekend courses for workers who wish to go beyond the preparatory and on-going job training provided by industry and government;

(ii) a wide variety of seminars, conferences etc. in co-operation with professional associations, to keep professionals abreast of their field;

(iii) industrial, scientific and social service demonstrations and field programmes;

(iv) interpretation of the latest developments in engineering, science and the social sciences to practitioners in the field.

It is somewhat ironic that while thinking of this kind is taking place in developed countries, in developing countries where the problems of industrialization and technology transfer are far more acute, universities still tend to regard continuing education as peripheral. Universities in third world countries should, as a matter of policy, add to the

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8/ "Campus 1980", Ed Alvin Eurich, Dell, 1968.

conventional functions of transmission and expansion of knowledge, the equally important function, in the circumstances of their environment, or diffusion of knowledge.

However, continuing education is not a task for universities only. Other organizations and agencies have a significant role to play. Industry, as well as government, can contribute to training and the upgrading of skills through apprenticeship schemes and on-the-job training programmes. Professional associations can help through the holding of seminars and workshops, and the publication of journals and newsletters. Not least is the role of the mass media. The opportunities for use of the mass media in the process of education and training are tremendous, and one merely has to point to the achievements in the developed world in this area. Unfortunately, the media's potential in this respect is not always appreciated.

It is frequently argued these days that a major obstacle to the application of science and technology to development in third world countries is the low level of scientific literacy of a vast mass of the population. A high proportion of them make up the labour force and are excluded from the formal education system, except perhaps at the very lowest level. It is hardly surprising against this background that one encounters such characteristic features as low productivity, inefficient use of machinery, and poor standards of maintenance. The transfer of new technologies and introduction of innovative techniques are often met with suspicion, if not resistance. Instructions are carried out or followed without any real appreciation of why some things are done or why it is necessary to do them in a certain way. This lack of appreciation occasionally has serious and costly consequences.

In the third world then it is not only professionals and semi-professionals who require continuing education. Some form of further education to raise the level of scientific literacy and consciousness of the working population at large is also essential. In a working paper presented at the International Colloquium on Science, Technology and Society, Vienna 1979, the point was strongly emphasized that if science and technology are to make an attitudinal impact on a country as a whole, mass education of and communication with the population as a whole in science and technology are also tasks of the highest priority. 9/ The paper went on to observe that this was a very neglected dimension of education in most developing countries. "Newspaper, radio and television coverage of science and technology is rudimentary and often derivative of the developed countries, and even where it exists, it covers only specific results of science and technology and not the attitude, the method, the outlook, or the approach of science and technology that should impact on the everyday lives of the common people". Mass education of this kind poses a formidable challenge for the mass media and for all agencies in any way connected with education and training. What is needed is a co-operative onslaught on the problems, making use of a variety of methodologies and strategies. Science museums, exhibitions, and technological demonstrations have as much a place in this form of education as formal courses, on-the-job training, and instruction through the media. The challenge is formidable, but the consequences of ignoring it cannot be contemplated sanguinely.

Much of what has been said in this article by way of diagnosis is not new. The need for professional retraining and the necessity of raising the level of scientific literacy of the mass of the population are generally recognized and accepted elements in the processes of technology transfer and industrialization. If this is the case, then the question has to be asked why is not more being done in third world countries to address these problems. The

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9/ "Mobilizing science and technology for increasing the endogenous capabilities in developing countries", ACAST/COLL/WP. 14, 1979.

answer lies perhaps in the dilemma between education as a tool of development and education as a social benefit. Despite the rhetoric that suggests otherwise, the almost exclusive focus on formal education betrays a leaning towards education as a social benefit. Education for all is interpreted as formal education for all, with the implicit acceptance of the social superiority of formal over non-formal education. A hundred and twenty-four years ago Thoreau made a plea for uncommon schools - "it is time that we had uncommon schools, that we did not leave off our education when we begin to be men and women. It is time that villages were universities, and their elder inhabitants the fellows of universities with leisure". Today, there is still a call for uncommon schools. The only difference is that then it was not too crucial whether the call went unheeded, now we fail to respond only at our peril.

CURRICULUM DEVELOPMENT AND ITS RELATIONSHIP TO TECHNICAL EDUCATION IN GUYANA

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Introduction

Guyana's efforts to grapple with the development of its economy have resulted in greater emphasis being placed recently on the establishment of a manpower base embracing technical skills and industrial know-how. This by implication has direct involvement for the education system which through its technical education programme must be able to produce the necessary skills that will help to promote industrial development. Appraisal missions from the World Bank in 1969 at the request of the Guyana Government have reported inter alia, that if education is to play an important role for Guyana to develop industrially, the urgency for relevance in the curricula of the education system cannot be over-emphasized. 1/ Pointing out that the large unemployment and under-employment problems are of a structural nature, there is need to review the training institutions' programmes and amend them to more relevant manpower production. To this effect there has been a decisive swing to technical education from secondary school onwards to technical institutes and the university.

While there have been successful efforts at curriculum development in academic education there has not been any significant corresponding attempt to organize the curriculum for technical education, rather there have been sporadic efforts to develop courses in technical education on an emergency basis and these for many reasons have not proved very effective. This paper attempts to examine the relationship between curriculum development and technical education and to evaluate its success thus far. Technical education is taken to mean those courses of study which are conducted in the technical institutes and intended to produce skilled manpower for industry. It does not include the programme run by the University of Guyana, Faculty of Technology.

Curriculum Development

Modern schools of thought on education define the curriculum as a regular programme of study at a school, college or university. 2/ A more precise definition of a curriculum in use among educational institutions in Guyana is "an orderly arrangement of subjects, activities and experiences which students pursue for the attainment of a specific goal." This latter definition is given preference here because it makes a clearer distinction from the generalization implicit in the first definition and this is important when one has to differentiate between curriculum and syllabus as is the case in technical education.

The concept curriculum is not used in technical institutes and industrial training centres in Guyana. Everyone speaks about the syllabus. Even among secondary school teachers the programme of study is referred to as the syllabus, and it is closely adhered to.

One reason for this, and surely there are others, is that teachers in Guyana as a whole are not concerned with developing a curriculum. They are more likely to be involved in curriculum study, which is examining closely a course of study with the view to improving it. Curriculum development, on the other hand, involves creating a new curriculum altogether rather

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1/ Appraisal for an Education Project in Guyana, 1969. International Bank for Reconstruction and Development.

2/ Albert, I. Oliver, 1965, Curriculum Development, Dodd, Mead and Co.

than modifying or interpreting an existing curriculum. While there has been the establishment of a Curriculum Unit in the Ministry of Education, and this has been catering to the needs of academic education, no curriculum development for technical education has been attempted by this unit, and courses designed locally in technical education have not surpassed the syllabus stage. Training for the task of curriculum development has to precede performance, and while there have been people sent overseas for courses which could equip them to do a number of things in relation to technical and vocational education, these people have been returning but are not being placed where they can perform. That this is an area of major weakness in the technical education programme in Guyana has been substantiated by the World Bank Appraisal Mission in 1969. 3/

Another reason for this too is that teachers in technical institutions do not consider decisions on curriculum their concern. Guyana because of its colonial past has inherited an educational structure largely determined by that of the United Kingdom. Despite the fact that since 1953 Guyana has been granted internal self-government and finally independence in 1966 the education system relies largely on United Kingdom institutions for its educational accreditation at the school leaving level. While UNESCO advisers have been pointing out the need for local alternatives to G.C.E. only in 1979 were Guyanese students able to write a localized alternative to the London G.C.E. i.e. Caribbean Examination Council (CXC). In this respect general academic education is moving towards local accreditation but for technical education there is no similar provision. Once the final evaluation of an education programme is determined by an expatriate institution and that institution provides prescribed syllabuses it is very difficult to get the teachers to write their own curricula.

Factors Influencing Curriculum Development

It is recognized that technical education exists to provide industry with manpower for technological processes. Therefore the curriculum for technical education should be developed to satisfy the employment prospects within industry and the designing of courses in technical education must be regarded as a partnership between industry and the technical institutions. In Guyana technical education courses are examination oriented and largely dependent on foreign based examinations viz. City and Guilds of London Institute. Efforts to change this situation have resulted in the technical institutions doing both the City and Guilds and local examinations in the same courses by the same students.

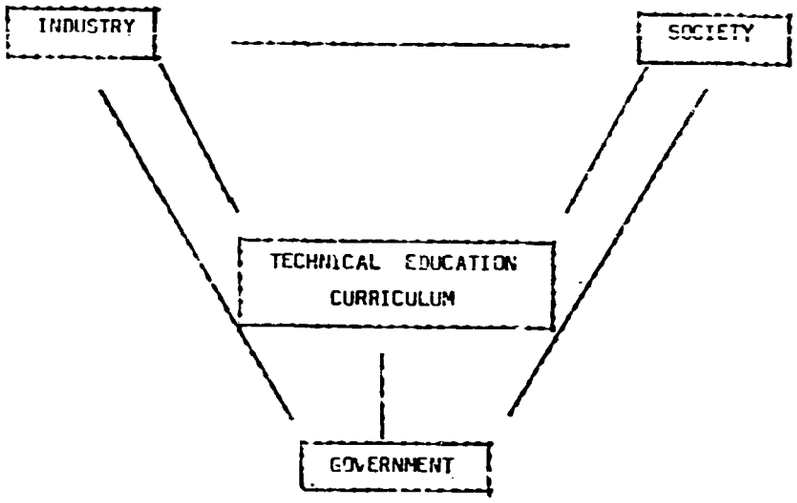
There are no known local curricula as distinct from the City and Guilds syllabus, so the students are put through the City and Guilds courses, they write City and Guilds examinations and then again write local examinations in the same courses, and are told that the institutes consider the local certificate more important than City and Guilds. Yet in the job market, industry and government institutions ask for City and Guilds qualifications and the local certificate is given scant recognition. Another function of the curriculum in technical education is that while preparing the student for work in industry at acceptable standards it must also lay the foundations to enable the student to cope with future changes in technology thus making him amenable to higher training as well as retraining. Close examination of the syllabus used in the technical training institutions reveals that innovations in materials and processes are not included until long after they have become commonplace in industry. In an industrial country a climate of experimentation and innovativeness permeates the society. Guyana is not an industrialized country and must rely on its technical training institutions to initiate new processes and materials through what is contained in the curriculum.

3/ Appraisal for an Education Project in Guyana, 1969. International Bank for Reconstruction and Development.

The dependence on foreign examinations also raises questions of relevance. While it can be argued that technology is universal; that industrial processes are dependent on the application of scientific principles to industry, the question may be asked what is wrong with City and Guilds? Two answers are readily available. First there is no evidence that the institutions which use City and Guilds prescribed courses make organized amendments to relate the courses to local conditions. Industrial principles and practices taught in relation to given materials and milieux require skilful technological transfer to make them adaptive to other situations for which they have been designed. It is not evident that the knowledge of such transfers are existent before the errors are made. Secondly, City and Guilds is only a syllabus, it is not a curriculum. Too often the syllabus is merely topic headings in each subject, and gives no guidance as to the purpose of teaching the subject, the behavioural outcomes expected or the level of the treatment recommended. Because the curriculum is essentially a planned sequence of learning experiences for groups of individuals guided by an institution towards well-defined objectives, an interaction of content, method, and objective is implied. In technical education the content is the most important demand that arises out of the condition and trend of industry. Content and method must inter-relate in order that the objectives may be realized, but in many situations in Guyana these are not clearly determined, or stated, and what goes under the label of curriculum is merely a syllabus with all its inadequacies. In these circumstances teachers find it difficult to understand the precise objectives of the subjects they are required to teach and to relate these to the total objectives of the curriculum as well as to evaluate the outcome of the subjects taught. Further, any attempt of integrating related areas of the curriculum is non-existent because the teachers see these subjects as isolated compartments of knowledge to which outsiders have no place. In a situation of unemployment and under-employment graduates from technical education programmes are often exhorted to set up their own small-scale industries or to establish co-operatives. The possession of a skill and the availability of an initial outlay of capital are not the sole ingredients for a successful business enterprise. Perhaps if these graduates in technical education were taught somewhere in their training basic entrepreneurship this would provide the necessary catalyst to make self-employment a reality. The curriculum would need to take account of this.

Where should the Curriculum come from?

Recognized education practice in curriculum development suggests that the content of technical education cannot be decided by any one source but should emanate from an interaction of industry, society, and government. Industry should indicate what skills are needed by way of job analyses and society through its institutions of training - school, colleges, and universities. These will have to translate these skills into learning experiences and the government must establish the necessary policy to effectuate the functioning of these institutions and legitimize the content by way of its educational institutions. The following diagram illustrates the kind of flow that should exist among the agencies that influence the curriculum.



In Guyana there is little evidence of industry's participation in the technical education curriculum process. On paper there exists a Board of Industrial Training constituted by the Industrial Training Act 1910, and subsequently revised, which could have been the body to represent industry in matters of curriculum for technical education. In fact the list of the duties of the Board states under (h) "to arrange and direct the technical education of apprentices" 4/ and nowhere else is there further elucidation as to what this means. The dangers of this situation can be envisaged if one conceives that each industry operates its own miniature training programme, as it is entitled to do under the Industrial Training Act, without any consensus as to the content of the programme. The fact that the sugar and bauxite industries have established their own training schools and have different periods of apprenticeship illustrates a lack of consensus.

Curriculum Development is a Skilled Job

Developing a curriculum requires specific skills and it must be recognized that such a task cannot be vested in any one person as was indicated in the preceding diagram. One proven approach is to set up a curriculum committee, with representatives from industry, government agencies, the technical institutions, and knowledgeable members of the public, under the guidance of a curriculum expert who is trained in curriculum development and has a wide knowledge of the total education system. In this way, curriculum development in technical education can be an ongoing process.

It is only recently that teachers of technical education have been trained to a respectable level that they can participate in the curriculum process. These, however, are a small number compared with the requirements of the system. The section of the Ministry of Education that represents technical education, although recommended since 1963 5/ and only established in 1974, reflects the inadequacy of the system to cope with the problem of curriculum development. After an unsuccessful attempt to establish a Guyanese engineer as the Assistant Chief Education Officer, Technical, an expatriate expert in technical education was recruited from the United Kingdom. This expert proceeded to service the administrative areas of the system and

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4/ Laws of Guyana, 1973. Industrial Training, Chapter 39:04. Revised edition, published by the Government of Guyana.

5/ UNESCO, 1963. Education Survey Mission to Guyana Report, 1962-63, Georgetown, Government Printery.

nothing was done for the content of technical education. Prior to this, there was one education officer responsible for industrial arts - a lower level of technical education, and this officer was not involved in the programmes of the technical training institutions. It was the principals of the Government Technical Institutes that acted as advisers to the Ministry of Education on matters relating to technical education. If one examines the education qualifications of these principals from 1962 onwards an interesting picture is revealed.

YEAR	EDUCATIONAL QUALIFICATION	PROFESSIONAL TRAINING IN EDUCATION
1962 - 1970	H. N. C. Auto Engineering	Nil
1970 - 1974	H. N. C. lectrical Engineering	4 mths. at Garnett College, London
1974 - 1976	C. N. C. Building	Short course at Huddersfield College of Education.
1976 - 1979	B. Sc. in Land Surveying	Summer Course in Teacher Education.
1979 -	Dip. in Land Surveying	Studying for Dip. Ed. in Administration.

From the above table it is evident that none of the principals possessed the necessary training to function in curriculum development. The present situation at the Ministry of Education is also interesting. The post Assistant Chief Education Officer, Technical has been vacant since October 1979, and that of Senior Education Officer, Technical since 1977. This reflects a marked weakness in the system of one area which should provide the leadership in identifying and developing curriculum in technical education.

Attempts at developing a Technical Education Curriculum

As mentioned earlier the World Bank in its appraisal report [6/] on the second education project had pointed out the need for curriculum development in technical education and as a result an expatriate curriculum expert in technical education was appointed to work with the staff of the two technical institutes in 1978-1979, to develop curricula, but this did not prove effective. The concept curriculum development was clearly misunderstood and what ensued was an attempt at putting some order into the use of the current City and Guilds syllabuses, concentrating on minutiae. The result was a total rejection of any change in the existing system and an outright refusal to co-operate. [7/] Many reasons were responsible for this situation, among which were:

1. The expatriate curriculum expert did not demonstrate that he could have convinced the teachers of the need to change from syllabus to curriculum.
2. Generally the staff had limited professional training and less in the area of curriculum development.

6/ IBRD, 1969. Appraisal for an Education Project in Guyana.

7/ Monize, J. A., Report on Curriculum Development for Technical Education, Ministry of Education, Georgetown, 1980.

3. The organizational climate within the technical institutes did not promote that flexibility that was necessary for change especially when the change was introduced externally. The general impression was one of insecurity within the institutions themselves. Many of the teachers who should have taken the lead in the effort to develop a curriculum were holding acting appointments and in this sense were not decision-takers.

4. There was also a marked absence of that professional ethic which enables one to become involved in the development of an institution for its own sake. Rather the general thinking was how much was there to be gained personally. Here was a situation where the participants were exacting a price to learn something, that would have enhanced their professional development, as if they were already skilled in it.

5. Implementation of innovations must be supported by a legitimizing body. It was felt that the Ministry of Education did not act as that legitimizing body. There is little doubt that if within the organization of the Ministry of Education there was an over-seeing authority to give clear directions to the staff of the technical institutes, committing them to complete assignments relating to the project and exacting accountability for lapses, the result would have been different. Change implementation thrives on an informal administrative structure, but in many instances the bureaucratic machinery went into full swing, when expediency would have dictated quick and direct access to senior administrative staff.

There is very little doubt as to the gravity of the situation. An extension of the curriculum development project was to be the setting up of a local examination system for technical education. Now that the curriculum development project has not materialized as expected the question as to the possibility of setting up local examinations comes into focus. This is further compounded by the decision by the Ministry of Education to announce without notice that students in technical education will not be allowed to write City and Guilds examinations as from now; they will all have to write the local examinations. This was like throwing the cat among the sparrows. Both students and teachers found themselves cut asunder in mid-stream with the examinations only months away. It may well be asked, why the stir? The students were writing the local examinations already; but everyone knows that it is the City and Guilds that is recognized by the government and private employment agencies. Further it is City and Guilds that is also used as a reference point for admission to higher technical education. The local examinations held by the technical institutes were all based on the very City and Guilds syllabuses. So, in fact the local examinations were not based on a local curriculum, thus the urgency of the need for curriculum development in technical education becomes ever more pressing.

Conclusion

The foregoing has been an attempt to present some indication of the relationship between curriculum development and technical education in Guyana. Reliance on syllabuses of foreign-based examinations such as City and Guilds have not proved to be in the best interest to Guyana, in providing the much needed manpower for industrial development. Instead it has created a sort of complacency which has proved inimical to recent efforts to develop a local curriculum

for technical education. The fact that independence has been achieved since 1966 must reflect more than just political independence. The ability to decide how to produce the much needed skills for national development must be regarded as a team effort involving industry, the technical institutions, the community, and the government. Effective solutions to this problem will not be realized by single groups in isolation, nor will they materialize at one try. The often expressed feeling that Guyanese do not possess the expertise is not true. If the search is made conscientiously, and what is sought is not coloured by other allegiances, it is positive that there are Guyanese qualified and willing to make a contribution.

Curriculum development for technical education, like for any other form of education must be an on-going process, for knowledge is ever changing and more so in the field of technology. Developing countries like Guyana often experience tremendous problems in keeping abreast in the field of knowledge because they are short of the resources such as facilities for experimentation and evaluation of what is attempted, but this is no reason for not trying. The situation described above where students are not allowed to write the City and Guilds examinations will create difficulties for some time, but perhaps it will apply the needed pressure to start something in the direction of writing our own technical curriculum, and setting our own technical examinations. The situation is not hopeless; there is much help that can be obtained from the Caribbean Examinations Council, and it is positive that City and Guilds will be willing to assist if approached as it did in the case of West Africa.

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11360

TECHNICAL EDUCATION AND TRAINING WITH RESPECT TO TECHNOLOGY TRANSFER IN GUYANA

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Subsequent to the end of dual control of schools and the introduction of free education by the Guyana Government in 1976, significant changes occurred in administration and organization at every level of the educational system. These changes emerged from the inevitable setback of the country's socio-economic development due mainly to the acute shortage of skilled manpower and an ill-balanced educational system. Adam Curle speaking about the difficulties which face countries like Guyana remarked:

> " ... Some countries are under-developed because fewer than 10 per cent of their population have been trained and educated in such a way as to make proper use of their innate capacities. These countries not only lack competent technical and professional personnel of every sort, they are also without the educated and responsible citizenry to provide the necessary frame-work within which such development can take place ... such countries are poor because their Human Resources are poorly developed."

This statement was supported by W. W. Anderson in a manpower survey which revealed that only 12.5 per cent of the work force at the sub-professional level were trained while 36 per cent were in need of additional training.

In the 1980s, Guyana will need to redouble its efforts in order to eliminate the deficiencies in the educational system or promote the structure necessary for human resource development in the various sectors of the community.

This paper therefore, will drift your thoughts in retrospect, then offer some suggestions which, hopefully, can bolster the very tactics and strategies, related to technology transfer, used in the learning institutions which provide technical education for our youths and adults. We will confine our thoughts to the 1970s where the nature and emphasis of our present educational programmes evolved, because of the influence of technological and scientific development, from academic subjects with limited technical skills to a more thorough and general education coupled with technical and vocational skills. Later, we will link our thoughts with the unpredictable 80s.

In the formal education system, there were set goals which could be achieved in the secondary school system comprising the community high schools and the junior/senior secondary schools. In the community high schools, our youths acquired a working knowledge about the methods and techniques used in the industry, office and field by exposure to a number of disciplines using power and hand tools along with indigenous as well as imported materials. They graduated with saleable skills at the completion of the 4-year programme, being capable of producing and servicing some workshop equipment and supplying their particular communities with articles or products they needed. Suggestions from the communities were always acceptable although the technology would have been too traditional at times.

The junior and senior secondary schools with their science laboratories and workshops with more mechanical equipment helped the youths towards creativity and problem-solving, thereby preparing them to become technicians, engineers and teachers. They often designed and manufactured articles after acquiring the basic skills and knowledge.

Meanwhile, the Work-Study Programme complemented the technical education programmes by exposing students to real life working situations. Every attachment to industry was monitored to produce the desired result.

The major setback at that point, however, was that students who were blessed with outstanding mathematical and scientific abilities as well as those who showed aptitude for technical work, prepared to exert their energy in disciplines outside of technical education, primarily because of parental influence and the prestige which accompanied certification.

The challenge in the 1980s does not rest only with the dignity of labour but on the recognition of what the individual contributes to society regardless of certification. This notion does not imply no certification. Perhaps, we can be hopeful for the future since the adults of tomorrow are the youths who are exposed to technical education/training at a time when our socialist revolution demands so much from education and our schools are expected to meet such changes. Perhaps we can be reassured from a statement in the Evening Post of 1961, where the columnist pointed out:

> " ... Every important reform which must be worked out in the life of a people or nation, must be begun or fostered in the school."

While the formal education system was going through its metamorphosis appropriate steps were taken to ensure that the vocational institutions and universities at home and abroad accepted youths who wanted to further their technical education, provided they had the required abilities and interests. On the other hand, many agencies - governmental, voluntary, private and political - afforded the opportunities for continuing education, popularly referred to as adult education. School facilities were open to all persons who might have had no schooling, schooled partly, mis-schooled or over-schooled, but wanted to benefit from new methods and techniques.

Some courses facilitated the way for the technology developed by the Institute of Applied Science and Technology to be transferred. The adults by their enthusiasm and the fulfilment of their objectives, showed that they gained quite a lot from such courses and that learning was a worthwhile activity. Interest continued to mount as if they received a new lease of life. Dewey summed up such educational excitement as follows:

> " ...Education must be reconceived not as merely a preparation for maturity ... but as continuous growth of mind and a continuous illumination of life. In a sense, the school can give us only the instrumentalities of experience. Real education comes after we leave school and there is no reason why it should stop before death."

Now let us discuss some basic issues which, though placed in no order of priority, can have a striking influence with regard to technology transfer in Guyana. No attempt was made to exhaust them at this juncture. However, as we continue to analyse the suggestions to be put forward, two philosophical points must be borne in mind. Firstly, that we are deliberating on education for development and secondly, education for production.

Facilities

We will no doubt agree that adequate equipment, laboratory and library facilities, ready raw materials, and furniture are necessary inputs to be placed at the disposal of all those who desire to upgrade their skills at a learning institution. Since financial constraints control these facilities to a large extent then except for teachers who are resourceful, the environment can develop into an atmosphere of stalemate.

To this problem, institutions which have gained success in the improvization of whatever is short in the environment must share their expertise or knowledge so that other institutions can spend less time in pursuing the same technology area. In a similar manner, attempts should

be made for these institutions to benefit from the technology developed in industry. This approach will facilitate technology transfer, bridge the gap between school and industry and develop inter-institutional relationships. This entire concept can be reviewed as participatory research.

Text Book Committee

Our schools and other institutions which provide for technical education have always made ample use of the text books from the developed countries. Yet, there are reasons for some precautions to be taken, particularly in the pursuit of appropriate technology. Unless a proper selection of books is made on the technology relevant to our needs, teachers will continue to prepare children in methods and techniques which are at times obsolete and unsuitable to our industrial development, but useful in the propagation of imported technology. Too often, we tend to forget that technical content is continually superseded by new discoveries and advancements and such technology can bear new dimensions to our society. It is in this context, I propose that a select committee be established to determine the type of reading material which our schools will use as a guide in technical education. In the final analysis, the opportunity will exist for a smooth technology transfer in keeping with industrial practices.

Exhibitions

National Exhibitions tend to awaken consciousness toward technological advancement. Yet, the follow-up is not always as effective as the exhibitions. To my mind, successful transfer of the technology involved will be more advantageous if there would be closer co-ordination and collaboration of the work of the agencies which display articles at these exhibitions so that the public may be able to follow the collatable and documented materials published in periodicals, magazines and booklets and the training bodies and individuals become in possession of material for technology transfer. Such approach will be absolutely useful to students or participants in formal and non-formal settings who must be sensitized to technological advancement.

Motivational Technique

In order to motivate people towards a greater contribution in the field of technology and, at the same time, provide more opportunity for learning experience, more national awards and increased annual incentives - financial or otherwise - need to be offered to persons individually or collectively who make contributions in the field of technology. The procedures leading to such achievements must be closely monitored, collated and documented, thereby ensuring easy interpretation of facts and application of knowledge.

Attitudes/Values

Since technical education programmes will need enrichment by the many new methods and techniques envisaged from technological development, then the efforts by our local experts or resource persons, must get the desired response by every section of the community. In such circumstances, our youths and adults will need to display the correct attitude and values whether at home, in industry or at learning institutions. In other words, the appreciative reaction by the public and particularly those engaged in vocational activities must be conspicuous. To achieve this effect, our educators must bear in mind that they are all involved in technology transfer and that they must help people to become conscious of the technological advancement by making technical education part of their "business" rather than leaving it to the technical educators only. The implication here is that less unpleasant remarks will be made by the consumer who, by then, will understand the importance of the efforts of others. In other words, every teacher must ensure that opportunity is taken to help the learner to develop every aspect of his being. Thomas Gillian in his comment on the personality development,

stressed the following point:

> Training in a skill is important but this alon becomes worthless to the individual who does not learn the importance of promptness, tidiness, attitude, patience, diplomacy, tact, ability to work with other people, poise, avoiding dishonesty, of expecting something for nothing from a system that has grown and can strive only on competitive economics.

Guidance and Counselling

In general terms, our technical education programmes must be supported by a more purposeful vocation guidance/counselling programme in order to alleviate frustration which faces people at work or even before they enter the world of work. Such an exercise will entail careful manoeuvring by those concerned with continuing education as well as for formal education. Use of statistical reports on manpower forecasting with regard to different types of skills in different industries, trades and services as well as the effects of local technology particularly on the economy of the country, will serve as a guide in helping everyone to pursue the appropriate technical course and create a desire for people to want to learn.

Conclusion

Our economy will demand more and more skilled people to fulfil challenges in production and productivity. As a consequence, efforts must be made to improve the quality of the work force through a dynamic technical education programme which must be initiated from the secondary school level onwards. Such programmes must bear relevance to the state of the economy while keeping pace with technological advancement. For example, the social and economic demands brought about by the fuel crisis will need emphasis on alternative sources of energy. This does not mean other methods and techniques will not be taught but that the education we provide in our school is "timely". Here again, assistance will be necessary from our agencies concerned with research and human resource development.

Finally, the foregoing proposals are intended to accelerate the quality of the programmes conducted in the learning institutions in keeping with our national objectives and signify the involvement of everyone in the community. Perhaps, if equal status was given to technical subjects with academic subjects, necessity to establish committees will be less urgent. If these challenges materialized, then by the end of the 1980s, we will discover our real worth as an inventive nation.

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EDUCATION/TRAINING ASPECTS OF TECHNOLOGY TRANSFER AND INDUSTRIALIZATION

11361

Lucille W. Harper

Methodology

The Technology Unit distributed 102 questionnaires with a 94.4 per cent successful response, and held personal interviews with over 100 persons involved in education/training in formal and non-formal education/training institutions. Data was also taken from the most recent annual reports, prospectuses, brochures of organizations, and other published sources of information.

The framework for the study included:

1. A look at current government policy in education/training given the national socio-economic objectives.
2. A review of institutions involved in education/training in Guyana.
3. A review of courses available at pre-secondary, secondary and post-secondary level.
4. And finally a determining of the interaction between the education/training system and productive work.

Results and Discussion

Formal Education/Training Resources

The evidence suggests that policy-makers assumed that formal education was a very important vehicle for social change and national development. They believe that constructing new schools and emphasizing community high school programmes, reducing drop-out and repeater rates would result in an increased percentage of individuals educated for occupation and social development, since expanding school services would keep pace with and overtake the growth in population.

The media for formal education at the lower and intermediate levels were respectively 430 primary schools, 33 per cent of which have recently been restructured to carry community high school programmes, 84 secondary establishments, viz. 50 secondary schools, 28 community high schools and six functioning multilateral schools. At the higher level, there was the University of Guyana which trained in a limited number of areas mainly for the first degree, the two (2) technical institutes, two (2) apprentice training institutions attached to the sugar and bauxite industries and the Guynec (Manpower Development and Training Department) which has a joint programme with the Government Technical Institute.

An examination of the capacity of 56 per cent of the secondary establishments in four main areas, viz. Lower East Coast Demerara, Georgetown, East Bank Demerara and the Demerara river, when correlated with total population revealed that only 11 per cent of the eligible nine-plus population could be accommodated. Demographic divisions aggravated the capacity problem. In Georgetown where the population in the 10-14 age groups was only 7,812, secondary institutions and industrial training centres numbered 16 and three respectively. This compared adversely with the Berbice river where the population in the related age group was 19,779, 2.5 times larger than the Georgetown figure, yet only one community school and the Guysuco Apprentice Training Centre serviced the related population. As a result they depended on the 12 secondary schools, two community schools and one multilateral school in New Amsterdam and Corentyne, already insufficient for their own population to supplement needed services.

Secondary schools basically provided general education, and because of the lack of integration between education and productive work, some schools introduced industrial work-study programmes as supportive education. Graduates of the five-year schools, however, left with only the academic, foreign oriented and evaluated General Certificate of Education "Ordinary level" or Caribbean Examination Council credentials before joining the world of work or tertiary institutions. The seven-year institutions graduated students with the General Certificate of Education credentials at the "Advanced level", and became, in the majority of cases, undergraduates of universities overseas.

Community high schools provided education with a technical bias for low achievers who graduated below craft level. Because of major structural inadequacies, these schools were restricted to agriculture, woodwork, home economics and handicraft. In addition, the training was for self-employment which was generally neglected.

The costly multilateral schools provided education along three main streams - Arts leading up to the General Certificate of Education examination, "Ordinary level", a technician and a craft stream. Each stream should have satisfied entrance requirements for the higher technical training institutions. However, the level of training in the latter two, unlike the academic training, was not adequate enough to satisfy these entrance requirements.

Training of tutors for all levels of formal education/training depended mainly on three teachers' training services which were not linked in any way with industry, though utilizing practical forms of teaching practice, and the first degree or the post-graduate Diploma in Education at universities, at home or abroad. Trainers of trainers also emerged from the same system.

An attempt at continuing education was evidenced in the Single Adult Education Association. This is a formal institution providing a combination of 57.5 per cent practical subjects, 27.5 per cent academic subjects and 15 per cent development subjects. The problem of training facilities was surmounted by the practice of trainees periodically practising with the tools of industry in institutions with existing facilities e.g. tailoring practice was done at Lodge Community High School.

In an effort to provide services of a wide range, the institution had to sacrifice depth, and was limited in scope mainly by lack of knowledge of national manpower needs. Generally adult education was provided at secondary level through extra-mural studies at existing establishments, or institutions attached to labour unions which graduated students at employable level mainly with the General Certificate of Education "Ordinary level" credentials and/or Business Studies certification. To accommodate mature students, Kuru-Kuru Co-op College, the two technical institutes and the Guysuco and Guymine Apprentice Training Institutions provided extra-mural programmes. Data was not available for the University of Guyana's expanding extra-mural department.

Formal training was provided to technical students at the Government Technical Institute and the New Amsterdam Technical Institute, in disciplines ranging from agriculture to electronics at craft level, six (6) disciplines ranging from architectural drawing to telecommunications at technician level, and commerce and secretarial science at certificates and diploma level.

The other recognized formal training institutions catered mainly for low achievers, and their entrance requirement was basically primary school background or two (2) subjects at the General Certificate of Education examination "Ordinary level". The programmes lasted not more

than a year, and greduates reached craft level. These institutions included the Guyana Industrial Training Centre which provided technical training in six (6) disciplines ranging from plumbing to welding. Another was the Critchlow Labour College which catered mainly for 30 per cent front-line supervisors, and 65 per cent rank and file, 95 per cent of the time, and a very small percentage of higher management in industrial relations and trade union education. The graduate certificate which has recently been evaluated at General Certificate of Education "Advanced level" serves as entrance to the Social Science Faculty at the local university. There were also three Home Economics Centres, and the Y.W.C.A. May Rodrigues Early School Leavers Centre which provided vocational training mainly for self-employment in subjects ranging from catering to household management. Kuru-Kuru Co-op College, the main unit for co-op management training locally and regionally offered courses for certificates in subjects ranging from co-operatives in schools, including co-op management, credit union management and accounts for co-operatives to a diploma in co-op management. In this way it attempted to fulfil the needs of co-operators of sub-professional level up to the level of managers of medium and small-size co-operatives, or parallel organizations.

Implications of the Present Formal Education/Training System

The system has suffered over the years partly as a result of the colonial past, where an illusion of free choice of vocation for all had existed, but the colonial masters had reserved the best positions for themselves. Other problems arose because of conflict between demand and output capacity. Still others arose out of the organization of the system which allowed the continuation of privileges for the elite few.

Emphasis in these formal institutions, the majority of which were schools, was academic, and the academic capacity exceeded the technical training capacity for industry both numerically and in the curriculum content. This situation, together with individual mobility especially of members of lower income groups, led to what Baksh termed educational inflation and wastage of ability since individuals aimed for the highest levels of education in order to out-compete those with lower levels of education to fill scarce or non-existent jobs. 1/ See table 1 for statistics.

TABLE 1 2/

Non-Participation in Guyana Labour Force as at 1977 by Levels of Education

EDUCATION LEVEL	PERCENTAGE NOT IN LABOUR FORCE
1. No Education	71.0
2. Lower Primary	48.4
3. Upper Primary	48.3
4. Lower Secondary	40.7
5. Upper Secondary	21.3

1/ Taken from "Formal Education and The Guyanese Social Structure" by Ahmad Baksh - Transition, Vol. 2, No. 2, 1979. Journal of the Faculty of Social Sciences and the Institute of Development Studies, University of Guyana.

2/ Source: Taken from: World Employment Programme Research Working Paper. The Labour Force in Guyana in 1977. A preliminary report by N. Caesar and G. Standing, Statistics Bureau, Ministry of Economic Development, G.T. Guyana, December 1978, page 35.

There was little interaction between the education system and the production system. Proper technical/vocational training and orientation to productive work were not integral parts of the school system from primary level. Attempts to improve this by work-study programmes were rendered ineffective by insufficient capacity in industry for placement of students. Indeed it became apparent that the historically inherited academic bias, prolonged and maintained by community preference, provided the main link between education and industry. It was emphasized by industry, technical and industrial training institutions which by and large requested the academic entrance requirement ranging from a primary school background to the General Certificate of Education and Caribbean Examination Council credentials. Technical qualifications and experience were treated only as a second-best alternative. Graduates of community high schools and vocational institutions also suffered from fragmented education/training since these institutions were not linked to formal and non-formal tertiary institutions. Some 25 per cent of the institutions examined suffered from unemployment after graduation. Fluidity in the system was hindered since entrance into higher education/training institutions was not automatic, and occurred only after elimination examinations.

The main efforts by the State to achieve greater social justice were, the policy of free education from nursery level to university level initiated in 1975, and an increase in the community high school services. Admittedly, these measures succeeded in removing the economic cost of education particularly at primary level, and simultaneously implied increased opportunity for secondary level selection where previously, costs had posed a social barrier to those who could not afford. Educational achievement, however, has always been more dependent upon environmental conditions outside the formal institutions than inside.

State control measures at all levels within the free education framework were enacted through the Ministry of Education and the Public Service Ministry. They did not take the form of the planned approach practised at various levels in China, the Union of Soviet Socialist Republics, Cuba and other 'third world' countries. In these countries vocational choice was mainly dependent on the needs of development as perceived by the State. Instead, education/training for the labour market continued in an atmosphere of apparent free choice of vocation operating within the laws of supply and demand. It was this state of affairs that gave rise to the dearth of skilled teaching staff for all levels of formal education/training, and compounded with salary differentials motivated labour away from the teaching profession.

Generally formal education/training has proved to be inadequate from the point of view of industrial requirement. It was clearly not related to the absorptive capacity of the labour market nor the needs of the economy. Moreover, at all levels, the institutions lacked the required quantity of skilled personnel, staff, accommodation, finance, equipment, materials to fulfil the needs of the institutions themselves and in turn those of the economy.

A microscopic examination of the media in the system revealed that a few establishments studied applied the integrated approach of formal and non-formal education/training, relating theory and practice in industry. Some examples are the two (2) Apprentice Training Institutions of Guysuco and Guymine, the Guynec (Manpower Development and Training Department, the Kuru-Kuru Co-op College, the teachers' training programme at the Guyana School of Agriculture, R.E.P.A.H.A., Belbaag, and the hinterland counterpart of the Guyana School of Agriculture, B.A.I.). Implementation of this measure compared favourably with three methods applied in China in which the result was fed back into and became an integrated part of the method, a more advanced application of similar methods. They were:

1. The dialectic materialist theory in which knowledge was based on practice but sound knowledge was based on repeated switching from practice to theory and from theory to practice, theory being evolved from practice and then applied in order to guide practice which in turn made it possible to check and develop theory.

2. "Open door" education in which peasants joined the university to study and teachers worked in factories, industries, agriculture etc.

3. The "Triple Union System" in which there was interaction among teaching, research and productive work sectors. Teachers were encouraged in their professional training to study science and technology in depth and to take part in research and productive work. Workers and technicians with extensive practical experience have been recruited as part-time teachers, and each year the university selected a number of graduates to join the ranks of the teaching staff.

   In this way, education/training served the policy of the proletariat and was combined with the world of work, while higher education and the university served the people.

Non-Formal Education/Training Resources

The survey showed that 75 per cent of the organizations, the majority of which were production or service oriented were actively engaged in "in-house" and/or "on-the-job training". One explanation for this was the poor existing interconnection between education/training and productive work. Another was the policy of industry to satisfy assumed needs by way of the academic certificate - a carry-over of the colonial policy. The varying objectives of industry and commerce and the historical differences of organizations together with the varying years of existence and levels of operation were other responsible factors. In other instances where performance was the criterion of achievement, e.g. management, agriculture and handicraft, non-formal "on-the-job training" fulfilled human resource needs. In this way non-formal training supplemented and complemented the formal system.

The majority of participants in this type of education/training were graduates of the school system and formal technical training institutions or other tertiary institutions which had already largely influenced the direction of their further training. They functioned at tertiary level and formed the mass of the sub-professional staff of industry and commerce. The majority of professional staff constituting the top of the administrative strata were often products of education and training processes in specialist schools abroad. This was particularly true of industry that required high levels of specialized technology, for example communication, aviation, navigation and engineering industries.

The majority of technology applied in local industry was foreign and specialized in varying degrees according to the services in which they functioned. In the process of making training appropriate and countering foreign exchange problems there evolved the practice of partial institutionalization in industry to produce personnel with the ability to operate, maintain and repair facilities, to modify them to suit local circumstances, and to innovate in response to the dynamics of the industry's own internal development. Costs considerations proved prohibitive to small industry acquiring these complex institutions, and as a result only Guysuco, Guymine and GNEC have functioning establishments of that future.

Besides the "in-house" and "on-the-job training" courses, organizations utilized auxiliary training programmes or encouraged specialist studies through a variety of methods. These included extra-mural programmes of already existing institutions, correspondence courses, or sponsorship of workers in institutions at home and abroad for the production of professional resource personnel, for making sub-professional personnel appropriate to industry, and for general upgrading of personnel of all levels. Generally the training took the form of seminars and workshops.

This survey recognized twenty-four (24) different training methods used in the whole education/training system to produce and maintain the skills necessary for efficient production. It has also identified courses which were termed residential, day courses, evening courses, and special courses as part of the first degree programme at the local university.

The non-formal education/training that accrued from National Service where sponsored students and students of higher education/training had to serve as a pre-requisite to graduation, and the Guyana Defence Force where the education programme had a military promotion bias, also aided in meeting the need for the technically trained. They were affected by the same constraints of other formal and non-formal institutions.

There was a minimum of training of sub-professionals to fill professional positions usually made vacant by resignation, retirement, migration or other aspects of the turnover problem.

Entrance requirements and training courses for the sub-professional staff in these institutions were mainly dependent on the level of technical skills required in the industry of employment. Industry advertised vacant posts, but on the whole practised initially internal mobility which provided many short-term advantages, but was best realized when high entrance requirements were maintained in every stratum of the occupational infrastructure. Some 75 per cent of the medical institutions and 100 per cent of the sample of communications institutions practised internal mobility.

Sex did not seem to present a barrier to mobility though it was apparent that certain jobs displayed a female bias e.g. stenographers, and others a male bias e.g. laboratory technicians in the Soil Science Research Unit, Ministry of Agriculture, where much strenuous field work was done.

Front-line management personnel accrued mainly from the academic first degree programmes at the University of Guyana. This education was made more appropriate to the needs of the country's two (2) main industries of sugar and bauxite by their own training units which formed significant parts of the industries. Guyana Management Development and Training Centre and the Public Service Ministry provided services to other agencies for the same purpose. Guysuco and Guymine still sponsored senior management personnel to have them specialize in management, particularly with a technical bias, and also to maintain their supply of trainers for their "in-house" and "on-the-job training" programmes.

Agriculture and handicraft education/training, unlike management education/training commenced in schools and were evaluated like academic subjects at the General Certificate of Education and Caribbean Examination Council examinations. Fluidity into the tertiary non-formal institutions was apparent though industry's capacity to absorb the trained personnel, except in the teaching profession was limited. Generally research and development institutions for agricultural development had entomological, agronomical and veterinary bases.

Hinterland and outlying areas had already suffered more than urban areas from insufficient formal education/training structures, the feeder-institutions, and all other problems of the education/training system. These constraints proved more crucial in non-formal institutions.

All health training establishments required science subjects as part of the basic entrance requirement. They mainly produced intermediate level health workers (WHO terminology) and the Medex training aimed at decentralization into rural and hinterland areas. Because of specialized technology involved, 75 per cent had overseas examination connections.

Implications of the Present Non-Formal Education/Training System

Empirical evidence showed that 42.5 per cent of the non-formal institutions suffered from skilled personnel shortage as a result of brain-drain, 45 per cent from inadequate accommodation, 62.5 per cent from general staff problems, 52.5 per cent from insufficient teaching and training facilities, and 32.5 per cent from other causes which were mainly financial.

These institutions generally practised and perpetuated the colonial pattern, emphasizing the school certificate even where the job mainly required manual skills. In addition, they functioned in the absence of initial manpower surveys. There was little evidence of job aids, group training, remedial action or post evaluation in the realization of the "in-house" and "on-the-job" training programmes.

More often than not, it was individual mobility and aspiration rather than industrial legislation that provided the main driving force behind specialized training of sub-professionals to generate the skilled personnel critical to the needs of industry and services, though industry did reward and encourage this practice through incentives.

Generally the foreign and local technology applied in the formal and non-formal institutions were not appropriate to the objectives set for the technology such as employment generation of skilled personnel critical to the needs of industry and services. Indeed, the unemployment that resulted from over-education in schools for jobs that were scarce or non-existent (Baksh) was compounded by the practice of internal mobility in non-formal institutions which in turn limited the absorption of newly trained.

Transportation costs and lack of adequate accommodation was a major constraint to the development of the technology across districts. As a result there was little evidence of lateral training to make best use of resources.

The medical services training was generally not decentralized, and with the exception of the Medex training scheme which provided personnel mainly for the hinterland and outlying areas, overtrained in terms of existing facilities, but not in terms of population needs. The medical emphasis was still curative rather than preventative.

The small degree of centralization which resulted from the practice of user-agents utilizing the existing facilities of others to realise their "in-house" and "on-the-job training" materialized more out of need to utilize scarce and costly resources rather than out of a concerted effort to avoid duplication. More often than not, these programmes failed to yield optimal results because of limited training capacity particularly in the case of joint programmes, and also because the theory was not usually applied with machinery operating in industry.

On the whole trade training centres were costly, small in relation to population needs, and serviced mainly their respective industries. As a result a single establishment like Guysuco which had the necessary capacity and trained human resources, eventually serviced the vehicles

of most corporations. Cost considerations also prohibited the establishment of research and development structures within industry and this in turn rendered impossible the documentation of research findings which could have been utilized in formal education/training institutions.

In short, besides functioning under the constraints mentioned, the programmes of "in-house" and "on-the-job training", and those for sponsored students to local tertiary institutions, turned out to be, except in a few cases, a further dose of theory, taught by trainers of the formal education system.

The basic conclusion to emerge from the study is that existing educational and training institutions are not fully geared for the technological challenges facing Guyana.

ASPECTS OF INDUSTRIAL PRODUCTION AND TECHNOLOGY TRANSFER

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Introduction

1. This paper deals with aspects of industrial production and technology transfer in Guyana. It is broadly divided into two parts. Part I focuses specifically on firms' production problems, while Part II deals with the benefits that Guyanese economy can derive by adaptation of appropriate foreign technology.

2. This is based on a survey carried out by the Technology Unit on a number of firms in the public, private and co-operative sectors. Technology can be defined as methods, process, technique, and know-how used in production of goods and services. It includes capital embodied technology and human skills; use of raw material; intermediate products and is part of the production process. It has been identified as a factor for economic growth and development.

The Historical Perspective of Production

3. Production and industrialization have been a focal point of Guyanese economy for the benefit of society particularly since the achievement of independence. Though there was industrial production before independence (colonial era) it was largely determined by foreign direct investment and was exploitative in nature. Investment in production and technical know-how during the period was dominated by multinational corporations and large private investors, unlike today about 80 per cent of the total economy rest with the public sector while the other 20 per cent are owned by the private sector.

4. In 1952, the British Industrial Commission identified quite a number of production possibilities in the West Indies, including Guyana then British Guiana, processing of foodstuffs from agricultural products, and processing of edible oil from coconuts of which its agreement was signed in 1945. 1/ Other productions and manufacturing, identified by the Commission, are citrus products; fruit canning; confectionery; preserves; rice; beer; timber; etc.

> In the case of Guyana the situation can be summed up as follows:
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> "I think that if there is one thing about which all Guyanese are in agreement it is that we must develop manufacturing as a means of achieving a higher standard of living for our people." 2/ He suggested the necessity for industrialization.

5. The policy of the Co-operative Republic of Guyana seeks among others for socio-economic development coverage of its people through exploitation and proper utilization of human and natural resources. Achievement of this objective can be possible by application of appropriate techniques of production and motivation, planned and well defined goals, and proper management control, etc.

6. The Guyana Pharmaceutical Corporation Ltd., for example a public corporation, highlighted production needs of Guyana and their development in a broad three-fold research and development (R + D) objective. Firstly, identifying and optimizing the use of the scarce

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1/ See Industrial Development in Jamaica, Trinidad, Barbados and British Guiana - Report of British Industrial Commission, October 1952.

2/ See Hubbard, H. J., Historical Perspective of Industrialization: Published in Guyana Graphic, Monday, 8 January 1973, p.4.

resources and minimizing cost of production in keeping with national aspiration. Secondly, development shall initially take the approach of 'backward linkages' i.e. making use of local skills and raw materials for the production of consumer and capital goods. And the third objective is promotion of products for export market. 3/ Similarly our data show that about 48 per cent of the firm's products, including other corporations such as Guymine and Guysuco are also strongly emphasizing the use of indigenous know-how, raw materials and the like.

7. For development of indigenous technology and commercialization of new products, there is need for transfer of appropriate foreign technology to Guyana. This technique shall be elaborated later in the paper. The immediate effect of such technology in the economy is 'forward linkage'. Having achieved the right and appropriate linkages, namely the combination of backward and forward linkages this will enhance industrialization potential "all things being equal".

8. The role of indigenous technology for development process is also recognized to be important.

Firms' Production Problems

9. Much is known of Guyana's natural resources which are not yet exploited. The problem is of the strategy to be used to transform these resources into end-products. To achieve this objective there is the need for a review and improvement on work discipline by firms, public and private agencies and to avoid clashes of interest between those who have the capability to make production decisions with those who have not. Producers seem to be aware of most of the production problems but what is beyond their capability is how to solve these problems. What the firms probably require is personnel with technical skills to direct and manage these firms. Even if these problems and means of solving them are identified, there will still be problems of decision implementation.

10. An appropriate national policy on technology can cause the people to firstly, appreciate the need for indigenous technology and its importance for national development, a well-defined educational system with proper school curriculum; training on the job; institutional building with strong information media and R + D activities are few among others that may help in achieving this development. Secondly, implementation of an appropriate foreign technology policy can serve to strengthen local technological capability.

11. Some of the problems are caused by the unavailability of foreign exchange which limits the capacity to import. This has been identified in Guyana and other developing countries as constraints to socio-economic development especially in view of the oil prices.

12. Another problem that slows production is inadequacy of raw materials. A large number of firms have problems of raw materials. The consequence of this factor among others such as constant power failures etc. is that the producing firms would be operating below plant capacity and machinery and equipment will be lying idle. Many other economic problems could arise through unstable supply of raw materials and of inputs.

3/ See Guyana Pharmaceutical Corporation Ltd. Research and Development Policy, Revised 1977.

13. Lack of skilled personnel is also common among firms. Insufficiently skilled workers can cause a decrease in the products line. To increase production there is need for skilled workers with some years of experience to their credit. In many firms also, there is lack of people with both practical experience and theoretical knowledge.

14. Firms also identified lack of technical and management skills especially in the middle and top level capacities, whereas some firms also depend on the need for a specific and high level of management skills to cope with decision-making ability in relation to production and other related activities. In Guyana there is need for increase of technical skills in the specific areas such as agricultural technology (including dairy) since this sector has a dominant role in the economy and in engineering design to facilitate designing of new machinery and tools to cope with developmental process resulting from increase of the above skills. There should be more professionals such as foresters, nutritionists etc. to assist in developmental drive through diversification of skills. Spare parts problems are also common. The reason for this problem among others, is that most machinery and equipment for production have foreign inputs and because of the foreign exchange and licensing arrangement difficulties, it became very hard to obtain spare parts from the makers of these machineries.

15. An optimum solution which includes saving on foreign exchange is to encourage local technology, more so the engineering design for relief of the spare parts problem and to formulate national policy on transfer of intermediate foreign technology. Because of the shortage of spare parts and technical skills, maintenance and repairs to industrial machinery are equally affected. It is important, more so in developing countries where there is the problem of foreign reserves that maintenance and repairs should be accelerated. But due to lack of skilled personnel and spare parts, maintenance and repairs to industrial equipment have been affected.

16. Another problematic aspect of production is the rising cost of fuel already mentioned, which is also a global concern with exception of oil producing countries, thus there is need to implement an energy import substitution drive, including technological implementation.

Benefits from Transfer of Technology

17. Industrial technology is an integral part of industrial development, hence there is need for dissemination of information on technological innovations originating in various countries. Transfer of technology is a technology that originated outside one's national economy but acquired and used locally. In most developing countries technologies used are foreign transferred. However, the selection of technology requires both information and evaluation. It is important that the agency responsible for the selection should be very much aware of the countries to acquire the skills. The agency should also possess the ability to evaluate such information for purposes of decision-making. It is equally important that the agency has the capabilities in the negotiation of terms and conditions.

18. Admittedly transfer of foreign technology to a different sociological environment creates problems in absorption. Recognizing this important situation, there is need for a joint action to make this worthy effort beneficial for both parties, i.e. the transfers (foreign) usually accompany such technologies with technical advisers and consultations to train local personnel of transferee (Guyanese). It is the onus of the transferee during the negotiations to be sure that the technology, about to be acquired, will suit the environment of the location for which it is desired. Absorption of technology gives rise

to human resource development and potential. It is therefore important that resource power, education and training, engineers and scientists and curricula in association with applied research and production activities etc. are geared towards absorbing the acquired technology.

19. Development of technology indigenous or acquired calls for research and development (R + D) activities. And disseminating results from such efforts contributes meaningfully to the technological advancement of locally and foreign used technologies and solving the problems of the rural areas.

20. Very often there are problems as to the right strategy in attempting to develop technology. It is difficult to state a 'clear cut' strategy, but it should not only take the form of creation of specialized and skilled manpower resources within the country but also the strategy should ensure that such resources are deployed in the desired directions with the objective of satisfying the needs of the masses. It means then that the basic issues of indigenous technological development should be considered in the forefront.

21. There is increasing awareness that inappropriate application of technology can distort the pattern or form of industrial and economic growth, resulting in a failure to derive expected overall development goals of the country. Therefore, in planning technological development, the planners will have to consider the pattern whether to continue as it was imported from foreign or whether to adjust it to suit the local conditions. The foundation for the latter pattern of technological development will have to be much deeper and stronger than the former.

Policies

22. National policy measures have a major role in the development of technologies and for improving terms and conditions of imported technology. Such roles can be identified in areas such as:

(i) Promotion of research and development, a tax rebate can be allowed to R + D effort.

(ii) Policies on education and training by way of introducing vocational courses in educational curricula; re-orienting technical courses in higher institutions adding on crafts work and collaboration of industry and practical training for example Guymine, Guysuco and Guynec.

(iii) To consider policies for the strengthening of engineering construction capabilities. The engineering design and consultancy organizations can be encouraged and charged with the responsibility of assisting in the training of apprentices.

(iv) Policies on human resources development to enhance technological capability in traditional society.

(v) There should be national policies that could promote adaptation of technologies suitable for use of local raw materials, local skills and activities which would be labour intensive. Such policies should be a phased programme of reduction of imported raw materials and labour.

(vi) Indigenous technology and capabilities should be protected and encouraged to be ready to take over completely from foreign technology at the appropriate time.

23. It is possible that with a meaningful policy on foreign technology several benefits are possible. For example, improving competitiveness among firms in production of domestic and capital goods, financial and administrative assistance, modernization of production processes and marketing, promotion of infrastructural support to industrial activity and promotion of export goods, increase in industrial agriculture, forest production and development of rural production, control and prevention of pests and utilization of pesticides and insecticides, increase in R + D efforts, commercialization of new products and employment creation, and savings in foreign exchange costs.

24. Another important factor or component of the technology is that it should serve the general objectives of society, including its social and human aspects, the quality of life and the preservation of the country's natural resources.

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RESEARCH AND DEVELOPMENT

Transfer of Technology and Industrial Development

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Before we examine the specific issue of Research and Development in science and technology in Guyana and how it relates to the transfer of technology on the local scene, it is apt to pay some attention to the global research and development situation.

The observation that "knowledge is power" has gained considerable credence as governments and corporations sink vast amounts of money into research and development. These investments now being made in the production and application of knowledge will influence economic and political relationships around the industrialized countries and between the industrial and developing countries for some time to come.

It was recently estimated that some 150 billion dollars is poured into global R + D, employing about three million scientists and engineers. The allocations in this budget naturally reflect the priorities and interests of the industrialized countries. Thus twenty-five per cent of the global budget for research and development is utilized by military programmes, and involves some one million scientists. This is to be compared with seven per cent expenditure on health and three per cent expenditure on agriculture, two areas of great significance to third world countries. What is clear, is that military programmes alone, account for more financial and intellectual resources than are devoted to R + D on health, food production, energy and environmental protection combined. The crucial problems of the third world are neglected, and attention is focused on R + D geared toward meeting the political and economic goals of industrial nations.

A recent study has shown that in the early part of the last decade, the United States of America, the Union of Soviet Socialist Republics, the Federal Republic of Germany, Japan, France and Great Britain and Northern Ireland accounted for about 85 per cent of the world's

R + D expenditure and employed 70 per cent of its scientists and engineers. The developing countries of Africa, Asia and Latin America spent less than 3 per cent of the global R + D budget and employed just .3 per cent of the world's scientists and engineers. It was estimated that there were about 300 scientists and engineers working on R + D for every one million workers in developing countries while the industrial world had about 4.000 researchers per million workers.

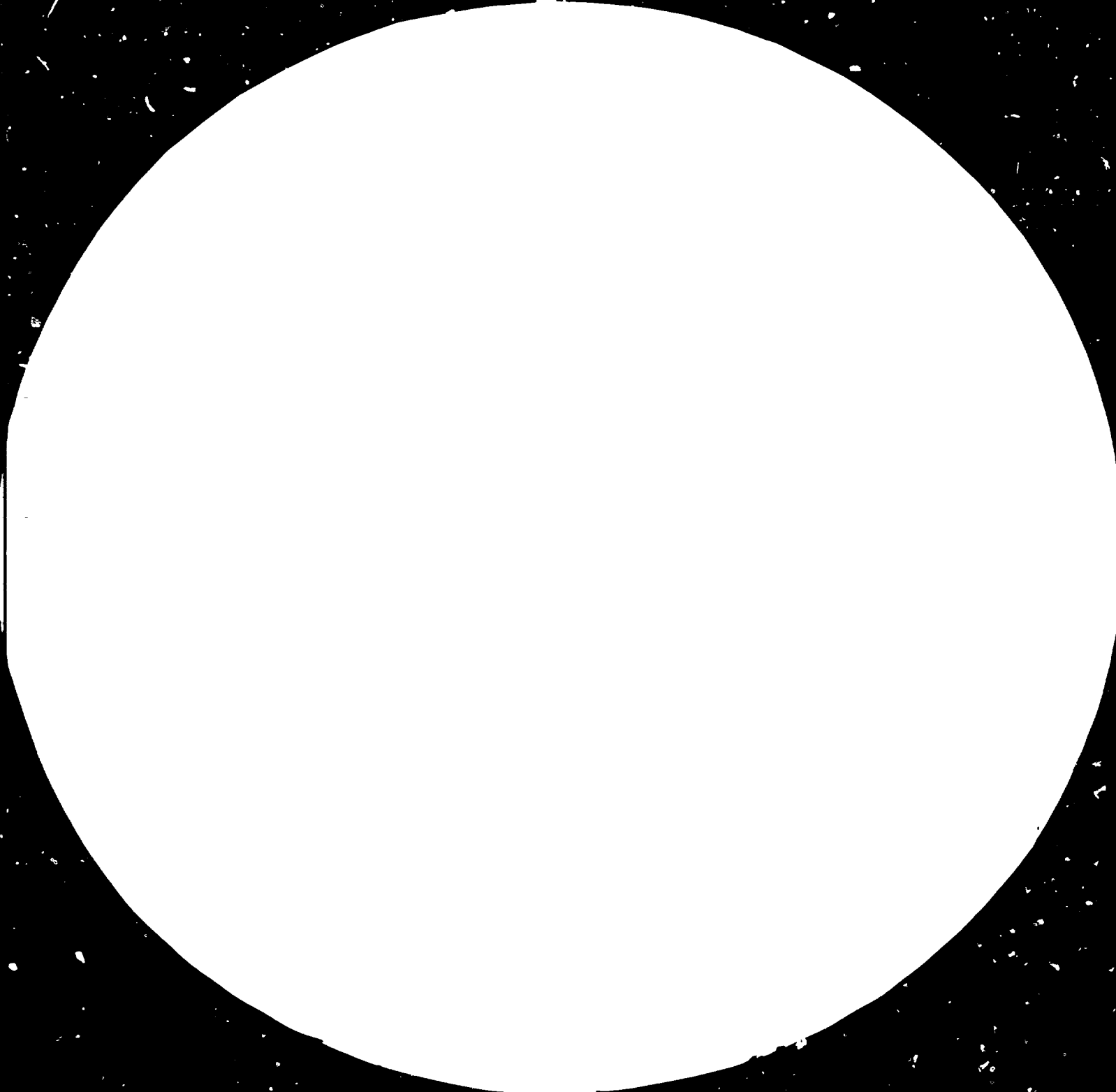
The significance of these figures lies in the fact that the world's R + D capacity is concentrated in the industrial world, and as such, continues to focus on the problems of the industrialized countries. The developing world thus remains dependent on imported and often inappropriate technology for its economic development. The lack of R + D capacity in third world countries results in them becoming technologically dependent on the industrial world. The lack of trained scientists and engineers in developing countries leaves the latter at a great disadvantage in negotiating over the import of technology.

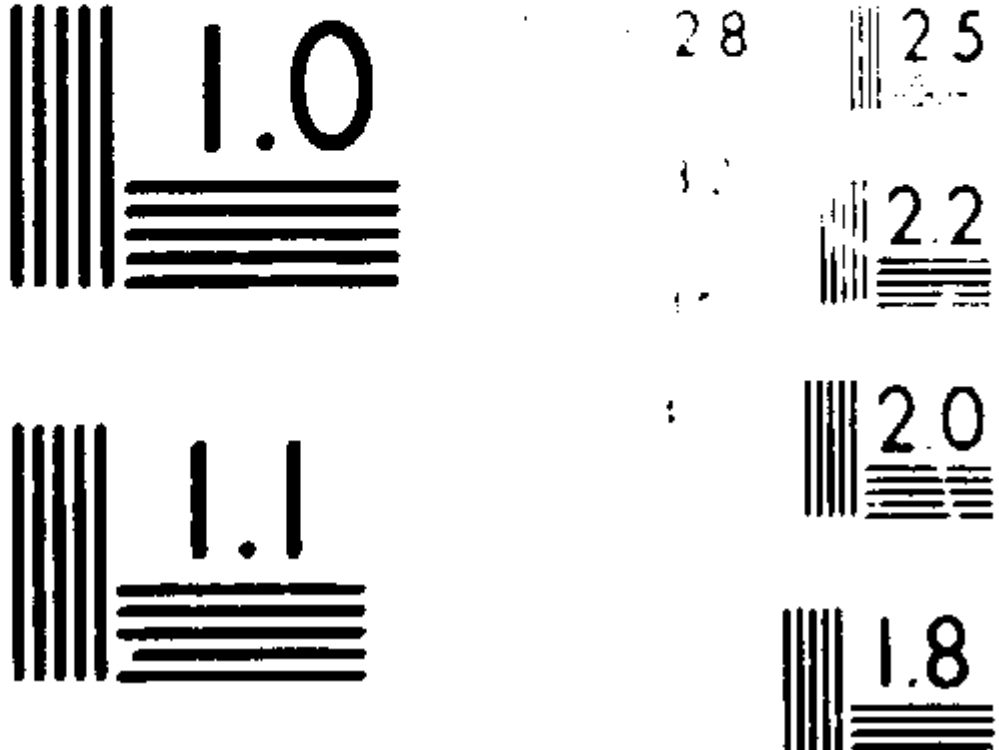
Transnational corporations operating in these countries invariably have their own research laboratories in the centre of the capitalist system. The installation of plants by these enterprises usually does not involve the transfer of technical and scientific knowledge. It has been observed that the lack of R + D capability in third world countries also leads to their technological dependence on the industrial world. Not only are new technologies developed outside the economic control of the developing world, but the lack of trained scientists and engineers in developing countries can also put poor countries at a disadvantage in negotiations over the import of technology. Those developing countries that do not even have such a minimal R + D capacity to be able to evaluate different technologies, are, in a basic sense, in the hands of those who control the technologies.

Not only does the lack of R + D capacity in third world countries perpetuate their dependence on imported technology, but it also means the technologies produced are overwhelmingly geared to the economic environment of the industrial countries - they are capital intensive, labour-saving, and adapted to large-scale enterprises.

Given the validity of these observations, it is clear that one of the basic conditions militating against the effective transfer of technology in the third world is the latter's lack of the capacity and capability to absorb such a transfer. One way in which this situation can be corrected is by the development of an endogenous technological capability. One of the vehicles for this development is the building up of a local research and development capability in the country.

During the last decade, we have witnessed some significant changes in the productive sector in Guyana. The two main industries - sugar and bauxite - were nationalized by Government. Previously, both industries were run by foreign based transnational corporations. Research and development work in the bauxite industry was conducted in Alcan's high powered laboratories in Canada. No attempt was made to conduct relevant R + D work at Mackenzie, as it was then known. Enough technology was transferred to give the local work force the capability to make the local operations an efficient production unit. Guyana was earmarked as a primary producer of calcined ore and later of alumina. There was no question of developing the technology for the production of refractories, for the utilization of some of the wastes generated by the production process. There was no interest in the vast kaolin resources which existed in

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the overburden in some of the bauxite areas. The same was true for the sugar industry, where most of the local work force were trained to be good producers of the primary product - sugar.

With nationalization, however, it was realized that R + D activity in these two industries was of vital importance if they were to make a significant contribution to the development process. Thus a completely new R + D laboratory was set up for the bauxite industry. Apart from R + D activity aimed at maximizing the efficiency of the production process, such a facility could now expand its horizons and look at possibilities which would not have been considered under the previous arrangement - the local building and commissioning of kilns, greater engineering activity to replace equipment which before had to be imported, development of a refractories industry based on calcined bauxite, product diversification, utilization of wastes generated, alternative energy arrangements for the firing of kilns, etc.

Other Research and Development in Guyana takes place in several public sectors. These include:

(a) Sugar Industry - mainly agricultural research related to problems associated to the efficient production of sugar;

(b) Forest Industry;

(c) Agricultural sector - mainly concerned with crop production (rice, legumes, etc.);

(d) Other industrial areas - here there is minimal activity in food processing but as yet there is no significant development

Up to a few years ago, the main R + D activity in Guyana was still concerned with increasing the productivity of the traditional productive sectors in the country. Apart from the research and development facilities developed at Guymine no significant development took place in these sectors. It was recognized that with the projected expansion of the manufacturing industries, there was ample scope for research and development activity in areas such as, for example, leather and textile manufacture, food and mineral processing. Further, the country's vast forest and mineral resouces opened up vast promise for development. Even within the traditional sectors, one identified the need for a significant R + D input into such areas as waste utilization (bagasse, rice straw, wood waste). However, like most underdeveloped countries, Guyana lacked the technological capacity to effectively carry out the necessary developmental work in the few areas cited.

One significant development however, was the recent establishment of the Institute of Applied Science and Technology, which is the research arm of the National Science Research Council. Its establishment confirms the Government's commitment to the importance of Science and Technology in the development process. It is expected that IAST will form the nucleus for those R + D areas which are identified as being crucial for our national development, and which due to constraints of trained manpower and facilities, cannot be undertaken by the existing infrastructure. Further, IAST's facilities are to be built up in such a manner that when fully equipped, it will provide an excellent centre for research and development work identified as relevant to our own situation.

If R + D must contribute significantly to the transfer of technology then the provision of first rate facilities is a sine qua non for such activity. We must have the capacity for example to carry out complete and accurate geochemical analyses to determine the value of our ore deposits, to effect the complete analyses of indigenous material to determine their

suitability say for compounding animal feed, indeed to carry out in situ, any basic operation necessary for the successful completion of the job in hand. In fact, I regard this as crucial to the significant development of our technological capability. If this is done, then foreign expertise can be brought in to work in the local situation on local research and development problems. Local counterparts can be identified to work alongside the foreign expert thus facilitating the easy transfer of technical know-how. Further, the foreign expert has the advantage of operating in the local milieu and is more able to adapt processes and equipment to suit local conditions.

Let us examine a concrete example of the utilization of this strategy for the development and utilization of our vast mineral resources. Apart from bauxite, Guyana has commercial deposits of other minerals, e.g. kaolin, feldspar, talc, which are not being utilized at the moment. Some years ago, it was recognized by the University that the development of our mineral deposits was a vital area in the future industrial development of Guyana. As a result of this realization a link scheme was organized between the Chemistry Department at the University of Guyana (U.G.) and the Mineral Sciences Department at Leeds. A lecturer from Leeds was appointed to the Department in Guyana, and five years later this programme has resulted in the following:

(a) A set of trained manpower in the mineral sciences area, including post-graduate trainees sent to Leeds to work on local mineral processing problems, and special trainees from the bauxite industry.

(b) A full degree course in Applied Chemistry with a mineral sciences bias in the Chemistry Department at U.G.

(c) Active research work in several areas of mineral sciences as it relates to Guyana.

With the establishment of the Institute of Applied Science and Technology, it was decided that one of the priority areas for development was in the field of the mineral sciences. As a result, with the generous support of the United Nations Development Programme (UNDP), the Institute is now in the process of building up its capability in mineral processing research work. There is to be installed, equipment for all the development work necessary on the laboratory scale, and a pilot plant for mineral processing activity. The laboratory work is already well underway, and the pilot plant is now being installed. The lecturer who was sent from Leeds is now the Research Director in charge of this programme. Staffing in the unit is amply provided by graduates from the University of Guyana programmes.

Already, as a result of the nature of its development, we are in a position to "unpackage" the technology necessary in the pilot plant area. Because of his familiarity with the local scene, the resident expert has been able to advise on the suitability of equipment. Further, some of the pilot plant equipment has been put together by a local engineering firm.

Once installed, Guyana will have the capability of doing pilot plant studies in mineral processing. This is significant at a time when the Government has identified this as an area for development. The Institute will be able to provide all the data necessary for the commercial production of, say, feldspar for Guyana's glass industry, talc for the pharmaceutical industry and kaolin for the ceramics industry. With a proven capability in these areas the Government's efforts will be considerably strengthened in negotiating for technology in the mineral processing area. If contracts are to be signed, say for feasibility studies to be done in the development of a particular mineral deposit, then Government should be in a

position to suggest, or rather to insist, that if processing is involved, it must be done locally, even if it means utilizing foreign expertise to use the local facilities. There can be no more effective method of transferring technology than by this process.

I have chosen this particular example to illustrate one way in which increasing one's research and development capability can lead to technology transfer as it contains some of the basic elements necessary for ensuring such transfer through the R + D process.

These may be identified as follows:

(a) An R + D policy guided by Government's development programme and declared priorities and closely linked to the development of indigenous resources.

(b) The physical environment and facilities necessary for the full investigation of the problem. This requires financial commitment from the Government as such facilities are sometimes very expensive.

(c) Trained manpower which in this instance was provided for, by the anticipation of the need by the University, which then took the necessary steps for the implementation of the programme.

(d) Utilization of foreign expertise working in close collaboration with local counterpart staff on problems identified by Guyana.

(e) Development of the infrastructure and personnel to allow for the assessment, selection adaptation and application of available technology.

It is suggested that a similar technique can be used to build up our technological capability in high priority areas such as for example food technology, wood technology, etc.

There are constraints, however, to the development of endogenous R + D capability and some of these may be recognized as:

(a) The tremendous costs involved for the development of such capability. Thus there is need for a serious commitment of funds to R + D development by the Government in the first instance.

(b) The need to recognize that building up of this capability is a long-term process. While local R + D must balance its activity between short-term and long-term projects, the development of endogenous R + D capability is in fact a long-term process. Note that the mineral sciences example alluded to earlier took about five years to materialize. If this is not recognized there is an inherent danger that policy-makers will tend to become impatient with the scientific and technological community for not "delivering the goods". As one writer so aptly puts it, "Policy makers should also defend technological institutions concerned with long-term problems from undue political pressures and fluctuations; should ensure that these institutions receive adequate funding, and that the allocation of funds reflects national priorities; and should bring the needs of these institutions and their special perceptions of the needs of the country to the attention of political and entrepreneurial decision-makers. These efforts are critical to the long-run technological development of the country and tend to be overlooked by officials and administrators with short-term horizons and large sums of money to administer".

(c) Lack of co-ordination of R + D activity at the national level. Co-ordination of the entire R + D activity is essential if meagre resources are going to be effectively

utilized. At the moment, several agencies are involved in R + D. As expected the majority of these are the state agencies.

However, to prevent useless duplication, it is necessary to formulate a national research and development policy. Such a policy should not only identify areas for intensive R + D activity but should also give priority according to developmental goals. Having selected the priorities the decision should be made as to where the R + D activity would take place, and full support of the Government should then be given to that programme. The function of overseeing such an activity could well fall within the ambit of the State Planning Commission.

Earlier in the seminar, one speaker suggested that R + D costs may be partially met by imposing a levy on industrial firms operating in the country. This is an excellent idea, but it has a greater chance of implementation, if the firms are aware, that the levy is being used to execute some of their own Research and Development projects, identified in a wider national R + D policy, and for execution by the appropriate institution. That institution may be the Institute of Applied Science and Technology, or the R + D laboratory at Linden, but once the decision is made the fullest support must be given to expedite the execution of the project.

(d) Lack of an organized information system geared to the needs of the industrial and productive sector in Guyana.

Finally, if a research and development institute such as IAST is to be truly effective, it must serve many purposes in addition to its role of support for operational entities (both private and public sector). Incidentally, it must be recognized that most of the private sector, utilizing a great deal of indigenous technology cannot support an R + D facility and it is here that an organization with the capacity and capability has an important role to play. The Institute must scan the horizon for problems or opportunities that others in the country have not recognized, to apply technology to local problems and to keep abreast of technological progress outside the country and its possible domestic implications.

Essentially, then, the suggestion is, that the transfer of technology process can be facilitated and catalyzed by the development of a strong indigenous science and technological base. In a recent article on the pay-offs of Science for Development in the Least Developed Countries, J. Davidson Frame has stated that:

1. "The existence of domestic scientific capabilities enables Least Developed Countries to engage in scientific research which is directed toward national needs. This is particularly true in such areas as tropical medicine and tropical agriculture, areas which generally are of little interest to the advanced countries. If the Least Developed Countries themselves do not engage in research in such areas, it is possible that the research will not be done at all.

2. "The existence of Least Developed Country science capabilities facilitates the training of professionals who are key personnel in the development process.

3. "Science in Least Developed Countries will strengthen these countries' general problem-solving capabilities.

4. "The existence of indigenous scientific capabilities will reduce Least Developed Countries' dependencies on outsiders. This is perhaps the strongest argument for supporting science in the minds of third world intellectuals, who are understandably sensitive about their dependence on their old colonial masters or on what is often seen to be the new masters --

the transnational corporations. Some see in these dependencies serious obstacles to economic development, since the ultimate objectives of those who are responsible for the dependencies do not correspond to the development needs of Least Developed Countries.

"Even though it may be costly to establish scientific and technical capabilities which can be imported from the technically advanced countries, the price of a certain degree of scientific self-sufficiency may not be considered too high a price to pay by Least Developed Countries' decision-makers if by paying this price a country can reduce its dependence on outsiders. It may even be argued that in the long run, the reduction of dependencies brought about by scientific self-sufficiency will be highly cost effective. A situation worth pondering is Mexico's current independence in oil production which resulted largely as a consequence of denial to Mexico of western oil extraction technologies earlier in this century.

5. "Because many of today's technologies require fairly sophisticated scientific knowledge if they are to be fully understood and appreciated, the existence of a scientific establishment in a Least Developed Country may enhance its ability to adapt imported technologies to local conditions. When foreign technologies are first imported into a Least Developed Country, they often reflect the production requirements of the advanced countries. Adjustments of these technologies may make them better suited to the very different conditions existing in the third world.

"Possessing the capability to adapt foreign technologies may also serve as a direct stimulus to development. Charles Cooper (1972) has noted that Japan's phenomenal economic growth was closely tied to importing technologies, learning from them, adapting them, and discouraging direct foreign control of them. Least Developed Countries with adequate scientific establishments may be able to follow the Japanese example.

6. "To the extent that indigenous science makes the development of domestic technological activity possible, it can improve the foreign trade position of Least Developed Countries. As Charles Cooper notes, with science established in a Least Developed Country, 'Foreign exchange costs of technology transfer can be reduced and the bargaining position of the recipient country in purchasing technology will be improved' (Cooper, 1972, p. 7). Cooper adds that such an eventuality will occur in the long run, not in the short run.

7. "Science will satisfy certain aesthetic and spiritual needs of Least Developed Countries' scientists who engage in it."

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CONSUMER PROTECTION AND TECHNOLOGY TRANSFER

Eileen Cox

President, Guyana Consumers' Association

To know what protection is needed for consumers we must know what are accepted as Consumer Rights. Recently our Consumers' Association received, through the International Organisation of Consumers' Unions, some posters relating to the seven rights which are widely accepted as Consumer Rights. These rights are listed as:

- The Right to Safety - the right to be protected against the marketing of goods which are dangerous to health.

  This right is self-evident and I would think that every government in the world is aware of its obligation to protect consumers against the marketing of dangerous devices and equipment. Food, clothing, cosmetics, indeed all consumer items should be safe products.

  Nevertheless, dangers do come unannounced into our daily lives. Some dangers exist in the open and persist over a period of time, not so much in the marketing but in the handling of raw materials. In any transfer of technology one of the first questions to be answered is: Are the conditions of operation safe for the workers and for the community? Will the goods themselves be safe?

  If the proposed industry is related to medicinal drugs, vigilance is necessary to ensure that the manufacturers, if they are based overseas, do not foist on unsuspecting consumers drugs that have been banned in the country of origin.

- The second Right listed is the Right to be Informed - the right to be protected against dishonest, deceitful or grossly misleading information, advertising, labelling or other practices and to be given the facts needed to make an informed choice.

  Today when public morality is at its lowest ebb, the monitoring of products to be placed on the market becomes essential. Protection of the consumer is particularly important where there is a population like ours - averse to reading labels and instructions. Words with two connotations are used in order to confuse consumers. Thus a pint of milk could be an American pint when consumers expect it to be an Imperial pint.

- The third generally accepted Right is the Right to Choose - that is, the Right of the consumer to access to a variety of products and services at competitive prices. In the case of Government or private monopolies it is the right to have an assurance of satisfactory quality and service at fair prices.

  This is a right which, with foreign exchange difficulties, becomes disputable. Governments may restrict the choice to a very limited number of goods. In some cases consumers may have no choice at all. In a situation like this where there are monopolies, whether private or state-owned, and where the variety of products is limited, it becomes essential to have a Bureau of Standards or some agency to monitor the quality of all essential products. The Bureau would also

help to protect consumers against infringement of the two rights already mentioned. Such a Bureau must be fair in carrying out its functions. No turning of a blind eye on products manufactured by State corporations or influential manufacturers. The whole society will gain if there is a Bureau to set a high tone of morality.

- The fourth Right is the Right to be Heard - the right to be assured that consumer interests will receive full and sympathetic consideration in the making and execution of government policy.

  This is the most fundamental of the rights. Given this and given an Association that is viable, knowledgeable and in touch with consumers, then there should be little room for consumer complaint. However, the decision-makers will most certainly be reluctant to consult on each occasion that a decision affecting consumers is to be taken. Projects will come and projects will fail when the consumer viewpoint is ignored. One hopes that eventually the wisdom of consumer consultation will be recognized. Because of the growing importance of consumer satisfaction, this day, I believe, is not far off.

- The fifth Right is the Right to Compensation against Damage - right to compensation for misrepresentation or shoddy goods or services. It is further recognized that free legal aid, where needed, should be available or an accepted form of arbitration for small claims.

  Consumers' Associations or consumer groups can negotiate for compensation. This is usually forthcoming where an Association has access to the news media as no manufacturer wants to hear his name mentioned in a broadcast. Consumers' Associations may not be in a position to offer legal aid but in our case we refer consumers to a Legal Aid Bureau.

- The sixth Right is the Right to Consumer Education to enable the consumer to act as an informed consumer throughout his life.

  If a Consumers' Association is to be one of the advisers in the management and development of technology, then consumer education must not be neglected. It must begin at an early age and must cover a variety of topics. Consumers must be well informed and must be trained to look at questions objectively. They must stand on firm ground when they argue their case. A Consumers' Association has the duty to inform all consumers of their rights but it is for Ministries such as the Ministry of Information, Agriculture, Health to keep consumers informed by the issue of pamphlets, news-sheets and so on.

- The seventh Right is the Right to a Clean Environment. It is defined as the right to freedom, equality and adequate conditions of life in an environment that permits a life of dignity and well-being. In return the consumer bears a solemn responsibility to protect and improve the environment for present and future generations.

  As one can see this right is widely interpreted to cover human rights.

There are some other Rights which I would add just to ensure that one does not lose sight of them:

The Right to receive value for our money. This applies to services as well as to goods;

The Right to spiritual and cultural development;

The Right to be treated as first class human beings in the country of one's birth;

The Right to adequate health services;

The Right to a modern penal system.

These are the rights I add and if you examine them carefully they are all contained in the right to be treated as first class human beings. Take value for your money. There are laws against the offering of counterfeit money. It leads to police action. But the selling of worthless goods is not regarded in the same light. The seller is more important than the buyer. The right to spiritual and cultural development with access to books of all kinds, the right to adequate health services and a reform of the penal system all go with a dignified way of life. Health services are particularly important in the case of mental illness and other illnesses where the patient cannot travel overseas for treatment. Consumers are also workers and unless these rights are protected they may find themselves unable to perform at their best.

A study of the environment is therefore important in the transfer of technology. Punctuality cannot be achieved without a reliable transport service; workers who cannot obtain essential items at the corner shop will not be able to concentrate on their work; without security and unemployment benefits they will be troubled and if they must support unemployed brothers, sisters, fathers and mothers, they will probably be malnourished and will certainly be living under depression. If their work is out-of-doors, can they really perform efficiently for eight hours under a tropical sun? Will rubber gloves be acceptable? These are the kinds of considerations that must be taken into account when planning. A dissatisfied worker will produce second-grade products. We end up with a dissatisfied consumer.

For the protection of consumers some countries have been setting up Ministries of Consumer Protection but this kind of protection will not be enough without the establishment of Consumer Associations. There is no substitution for voluntary service and for fair and objective consideration of plans. It is not very easy to have a viable Association for consumer groups become pressure groups and, for that reason, many consumers will stand aloof.

Our Association which was set up 10 years ago, with the assistance of Ms. Viola Burnham, has as its objects:

To protect consumers;

To improve the general standards of living through aspects relevant to consumer education;

To help families spend the family income wisely;

To represent consumers before Government (legislative) bodies;

To provide advice on legislation and other matters affecting consumers;

To represent consumers before public, industrial, commercial bodies and Government agencies;

To raise the hygienic conditions of production, improve processing, packaging, transportation and marketing of food products;

To improve hygienic conditions in all public places where food is sold and/or consumed and to rais the standard of presentation of food in all such places;

To improve the quality of goods and services;

To work with national standardizing bodies in developing methods of tests for consumer goods;

To provide consumers with information about frauds, rackets, false advertising, harmful products, shoddy goods, unsafe machines;

To work only in the interest of consumers, remain completely independent, free from pressures of business, industry, advertising o- other interests;

To work with other consumer organizations;

Generally to do such things as are incidental or conducive to the attainment of the foregoing objects.

Now let us see what can happen in the transfer of technology in the most essential areas of housing, feeding and clothing the nation.

In Guyana a tremendous change in architecture has occurred over the past 50 years or so. Rory Westmaas in an excellent essay describes this change in "Co-operative Republic Guyana 1970". ...

The change in architecture would, of course, have its effect on the consumer. The new home, without shutters, is no longer the relaxing place it used to be. At night, in the rainy season, with sash windows closed, ventilation is poor. Open windows are a temptation to prowlers by day or night. House-owners have therefore virtually imprisoned themselves behind grille work installed at windows and around verandas. Guard houses are now erected at their main gates by the more affluent.

In order to allow consumers to choose wisely before they build, there ought to be some place where various types of architecture can be exhibited. There is also need today to find means of reducing the high cost of buildings. Ideas from other countries may serve us well.

Feeding a nation is a matter of great concern for all planners who set out to build a nation. An army travels on its belly; so does a labour force. If the nation suffers from malnutrition, it will be hard to meet targets and the educational system is not going to be effective in producing the attitudes desirable for a self-reliant people.

In the transfer of food technology to developing countries it is almost a certainty that processed foods will take the place of fresh foods in the majority of households. The change is accomplished with ease as wives and mothers take their place in the working force. Therefore consumers must be protected against themselves to ensure that there is still an adequate intake of vitamins and minerals.

One has to be vigilant. The manufacturers of processed foods, whether private or State corporations, do not consult with consumer groups before launching their products. Indeed, secrecy is vital in order to keep rivals out. The result may well be that after the product is launched it is found either too expensive for consumers in general or it is distasteful. One instance of this is processed cheddar cheese, locally known as "rubber" cheese. Consumers find themselves having to consume this because there is no choice. They are deceived because it is described as "cheddar cheese".

Another example of name confusion which deceives consumers is in the description "vegetable ghee". Mahatma Gandhi in his book "Diet and Diet Reform" says "Ghee or butter is the fat content of milk drawn from an animal". Manufacturers in India produced a substance called "Vanaspati" which was similar to ghee in texture and flavour. The profit margin for Vanaspati was high and as the industry expanded ghee production fell. Gandhi argued that Vanaspati should not be allowed to go on the market under names such as "Vegetable ghee" or "Vanaspati ghee" or any other name which would be apt to deceive the customer as to its real origin or composition. He further said that Vanaspati should not be allowed to be marketed in packages of the same pattern as those used for packing ghee. All packages containing Vanaspati, he contended, should be distinctly labelled. As Vanaspati was not as nutritious as ghee he pointed out that the health of the nation was likely to suffer by the deception.

Today the deception still persists. Pumpkin with a little colouring and a few tomatoes becomes tomato ketchup, cornflour with a small quantity of ground peanuts becomes peanut butter. To watchdog such activities is the work of consumer groups. The name of the product must not be deceptive. No authority is going to interfere unless there is a Bureau of Standards and unless standards are set. Even then the consumer groups may have to take the initiative to call these deceptions to the notice of the Bureau.

Clothing consumers in the tropics should have been a simple matter but difficulties arise because of indifference to consumer tastes. Today with the high cost of electricity and with both members of the household working, there is greater need for wash and wear clothing, drip-dry material. Satisfaction is not found because producers do not have consumers' wishes in mind.

Shoes, too, become a problem. The conservative consumer has a choice like this: Buy shoes in the latest styles or be shabby. Sarah Jackson in a pamphlet "Economically appropriate technologies for developing countries: A survey" quotes this from Marsden's "Progressive Technologies":

> "One country imported two plastic injection-moulding machines costing $100,000 with moulds. Working three shifts and with a total labour force of forty workers they produced 1.5 million pairs of plastic sandals and shoes a year. At $2 a pair these were better value (longer life) than a cheap leather footwear at the same price. Thus, 5,000 artisan shoemakers lost their livelihood; this, in turn, reduced the markets for the suppliers and makers of leather, hand tools, cotton thread, tacks, glues, wax and polish, eyelets, fabric linings, laces, wooden lasts and carton boxes, none of which was required for plastic footwear. As all the machinery and the material (PVC) for the plastic footwear had to be imported, while the leather footwear was based largely on indigenous materials and industries, the net result was a decline in both employment and real income within the country."

This is a good lesson for all those concerned with technology transfer.

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STANDARDIZATION IN AID OF TECHNOLOGY TRANSFER

Lorna Lawrence

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Standardization - A Process

1. The current definition of standardization adopted by the International Organization for Standardization (ISO) states that Standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the co-operation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements.

2. It is based on the consolidated results of science, technique and experience. It determines not only the basis for the present but also for future development, and it should keep pace with progress.

3. Some particular applications are:

(a) Units of measurement;

(b) Terminology and symbolic representation;

(c) Products and processes for which the following are the main concerns (definition and selection of characteristics of products; testing and measuring methods; specification of characteristics of production, for defining their quality, regulation of variety, interchangeability, etc.);

(d) Safety of persons and goods. 1/

4. An intermediate product of the standardization process is the production of Standards. These standards are subject to approval by a recognized authority. They may take the form of:

(a) A Documentary Standard which will contain some or all of the following basic elements: definitions and terminology; product description; acceptable performance criteria (sometimes in classes or grades); test methods and procedures, also requirements for quality assurance including sampling plans, average quality limits, reliability limits, and safety criteria especially on high technology manufactured goods, resulting in Standard Definitions; Standard Systems of Classification; Standard (Code of) Recommended Practice; Standard Specifications; Standard Methods; Standard Tables etc., and

(b) A Fundamental Unit or Physical Constant, for example, metre, ampere..., which collectively is the backbone of a meaningful measurement system.

Levels and Aims

5. The standardization activity described above can take place at many levels viz.: individual, company, association, national, subregional, regional, multinational group, and international, each with specific aims and objectives as detailed in table 1. 1/

1/ Standardization - a new discipline - by Lal C. Verman.

TABLE 1

Level and aims of standardization

Level	Aim
Individual	To facilitate meeting the needs of the project in hand and promote the use of existing standards of various levels as may be appropriate.
Company	To facilitate company-wide interchangeability of materials and to co-ordinate all operations, to promote industry-wide and national standardization and to develop mutual co-operation in the spheres of technological and economic activity.
Association	To facilitate industry-wide exchange of goods and services, to promote national standardization and to develop mutual co-operation in the spheres of technological and economic activity.
National	To facilitate national exchange of goods and services, to promote international standardization and to develop mutual co-operation in the spheres of intellectual, scientific, technological and economic activity.
International	To facilitate international exchange of goods and services and to develop mutual co-operation in the spheres of intellectual, scientific, technological and economic activity.

6. Irrespective of the level at which the standardization efforts are aimed the many technical considerations may be identical as can be seen in diagram 1, [2/] which is conveniently referred to as the "standardization space".

The National Consideration

7. This is perhaps the most important of all levels. Its scope and influence reaches to all lower levels as well as the international level. It is at this level that the requirements of individual, company, and industry are co-ordinated and integrated, and purposeful national standards emerge which serve as effective instruments for guiding the development of the nation's industry and commerce and bringing order in the existing pattern of the national economy while at the same time serving as a basis for forging international agreements on international standards.

8. In Guyana the proposed authority for formulating standards is to be the Guyana National Bureau of Standards (GNBS) which would be created by an Act of Parliament viz.: the Standards Act. In the exercise of its duties and functions, the Bureau of Standards would establish a National Standards System which essential features would be as shown in diagram 2.

2/ Ibid.

DIAGRAM 1. Schematic representation of the standardization space

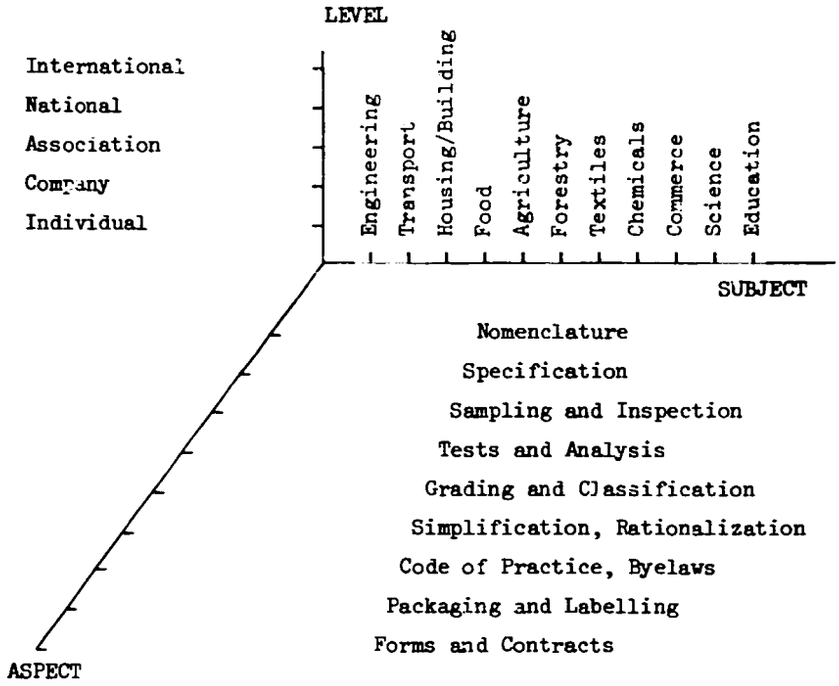
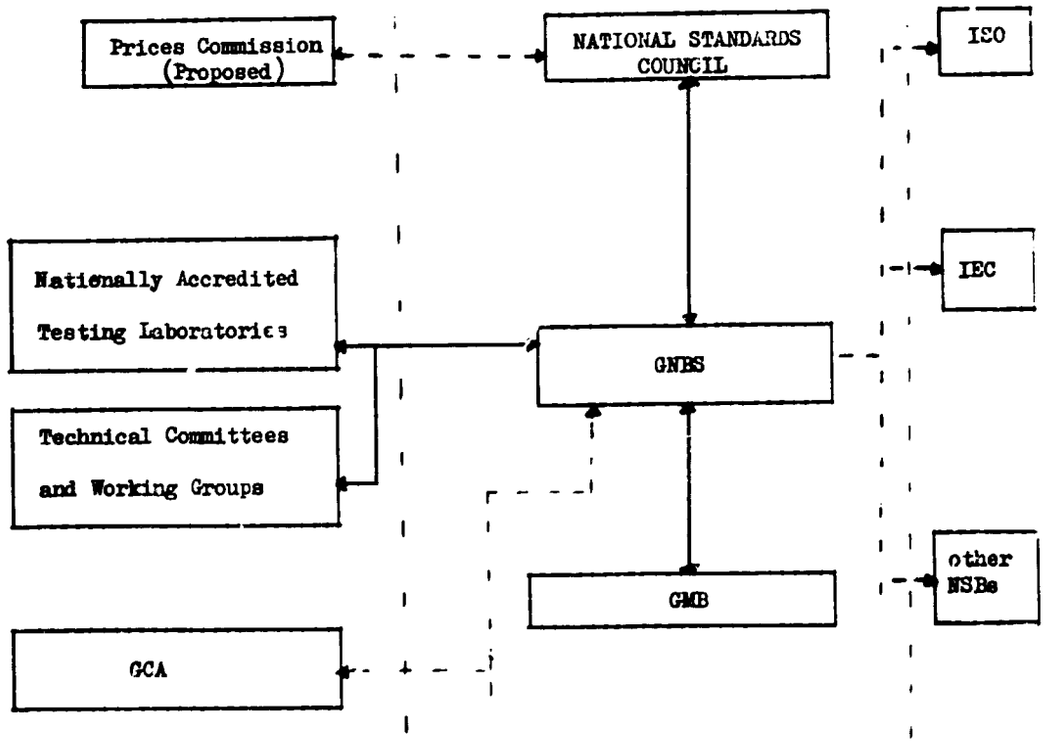


DIAGRAM 2: (Proposed) National Standards System for Guyana



LEGEND:

--- Indirect organizational link

---- Direct organizational link

ISO International Organization for Standardization

IEC International Electrochemical Commission

NSB National Standards Body

GCA Guyana Consumers' Association

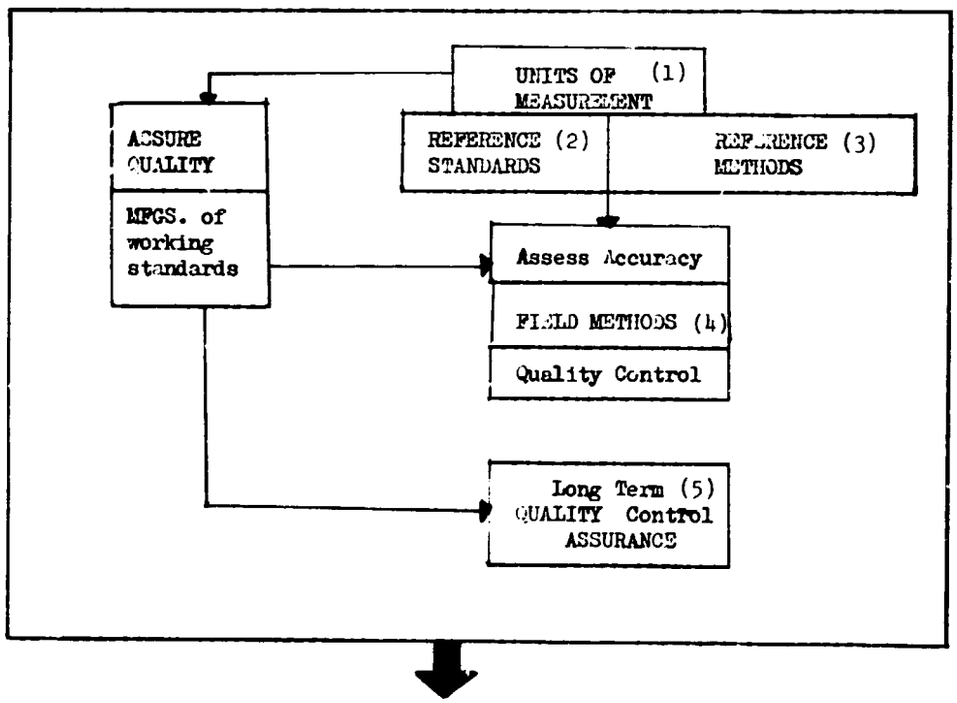
GMB Guyana Metrication Board

GNBS Guyana National Bureau of Standards

9. Since the Bureau cannot employ on a full-time/all-time basis the wide range of needed expertise, and since also consultation with a wide cross-section of informed opinion is essential, the standards-writing activities of the Bureau will be done through Technical Committees and Working Groups "serviced" by trained Standards Officers. The Technical Committees will be representative of a cross-section of knowledgeable people such as manufacturers, scientists and technologists, marketers, distributors, consumers et al. The committees will draft or adapt specifications, codes of practice etc., consider comments thereon, review and recommend standards to the Council for adoption as voluntary or compulsory standards.

10. Many standards inevitably embody numerical quantities to be realized. This quantification is essential as it is widely accepted that "To Measure is to Know". Hence another responsibility of the GNBS would be the establishment of a Metrological capability as illustrated in diagram 3.

DIAGRAM 3: A meaningful national measurement system



Measurement values that are Precise, Specific, and free of Systematic Errors.

The Regional Consideration

Regional Standardization is designed to meet the peculiar economic and trade needs of a group of countries involved. Such a group is CARICOM, whose Caribbean Common Market Standards Council (CCMSC) comprises the representatives of three NSBs of CARICOM and Standards representatives from the other member States.

The International Consideration

11. The ultimate and highest goal of standardization effort is to achieve international accord on all technical questions which are related to the exchange of goods and services between one nation and another. Active participation of all member bodies of ISO and IEC in the

international discussions on standards enables each to influence final decisions and have peculiar needs duly reflected in the international recommendations so as to ensure acceptability by the people who will use them.

12. The organization and activities of ISO as succinctly described in ISO - in brief, 3/ is presented below.

ISO is the specialized international agency for standardization,

ISO comprises the national standards bodies of 81 countries;

The results of ISO technical work are published as International Standards, which represent a global consensus of opinion;

The technical work of ISO is carried out through 1.600 technical committees, sub-committees and working groups;

The ISO operations are administered by the equivalent of 500 full-time staff, including the 100 permanent staff at the Central Secretariat in Geneva;

More than 300 international organizations are in liaison with ISO;

Nine ISO meetings take place, on average, every working day of the year. A total of 20,000 experts from all over the world take part each year in ISO meetings;

In all, some 100,000 experts in different fields are involved in the ISO work;

By September 1976, the work of ISO had resulted in 5,000 International Standards representing more than 30,000 pages of concise reference data.

Technology

13. Technology may be seen as the application of scientific and empirical knowledge for economic, industrial and other productive purposes. It is a resource characterized by a long gestation period risk, cost and life cycle reflective of a design applicable to a specific situation of a given production mix, and is transferable, marketable and price negotiable.

14. The foregoing parameters collectively paint a complex picture thus for convenience it is useful to think of technology as a package comprising two essential components viz.:

basic technology e.g. active elements;

sub-technologies e.g. operations, processes.

Technology Transfer (Modes and Forms)

15. Technology transfer can take place through a variety of forms and modes in international turnovers e.g.:

(a) licences, patents and know-how;

(b) supplies of machinery and equipment;

(c) supplies of complete industrial projects;

(d) technical services rendered by foreign specialists;

(e) joint investment projects;

(f) export of specialists;

(g) training of personnel by foreign experts.

3/ ISO - in brief - 1976-09-20.

16. Close examination of 15 (a) to (g) highlights a number of important implications in Technology Transfer viz:

(a) technical;

(b) economical;

(c) social/cultural;

(d) legal;

(e) educational;

(f) managerial;

(g) environmental;

(h) political

some of which have national and international characteristics, short- and long-term effects which complicate the task and nature of the Process of Technology Transfer.

17. Because technology is a process in evolution, many levels of technology coexist, consequently, the question of Choice of Technology arises. This is a major problem in itself which is not amenable to easy solution. But optimal solutions must be found for, as H. Dickinson in Dissemination of Appropriate Technologies points out - the choice of technology is as important as the aim of technical development itself.

18. Of direct pertinence to the topic under consideration is the Technological implication of Technology Transfer. To evaluate the technological factor, several alternative designs employing different processes will have to be worked out in detail which would involve accurate information on Specifications of machinery and equipment, materials, processes and skills.

The Role of Standardization in Aid of Technology Transfer

19. It is first necessary to appreciate that Technology Transfer operates within a system within which the transfer is effected vertically as well as horizontally provided the appropriate interfaces exist. (Schematically this may be represented as in diagram 4.)

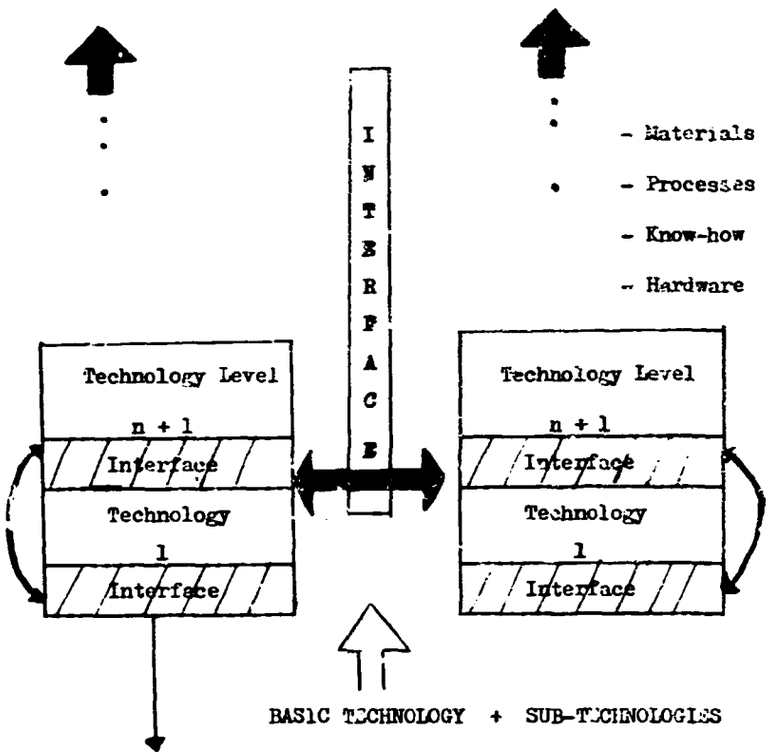
Data and Information - Pivotal

20. The procedures for the formulation of International, Regional and National and other documentary standards, provide a documentation and technical information system that is an important factor in resolving technical considerations in the process of Technology Transfer, and because of the breadth and scope of its subject matter is the basis for developing a national capability in technical information and documentation services.

21. As a consequence of the above methodology, the general state of the art is revealed, the latest technology on the subject matter is discussed, and where no standards exist knowledge of a technology can be accumulated by introducing proposals for standardization in the proper forum.

22. When an international standard is published, there is a chain of transfer of technology from international to regional and so on to company level. One major difficulty, however, with this process is in the area of Proprietary Technology. It is not possible to write a standard in IEC (the International Electrotechnical Commission) and possible in ISO around a Patent, unless the patent owner agrees in writing that the technology involved is available to prospective buyers.

DIAGRAM 4: Schematic representation of the technology transfer system



- Establish proper link between science, innovation, technology etc.
- Identifies, isolates the critical areas and technologies and provide feedback for development and application

23. A non-understood terminology, dimensions or tolerances only slightly different, performance criteria only slightly more or less rigorous, or non-standard test methods and procedures, can make any product, or technology non-transferable or non-acceptable.

Rationalization

24. Standardization is about rationalization and simplification and thus allows for the breakdown of complex "technology packages" into their logical elements and components, thus simplifying the transfer of technology by facilitating analysis of essential elements of processes and items of equipment rather than on entire operations or complete plants resulting in:

(a) ready identification of products that may be redesigned for manufacture by capital saving technologies, and

(b) ready identification of products than can be broken into components for individual assessment with a view to endogenous technological substitution realizable by the application of the concept of Functional Interchangeability - a condition achieved when those characteristics of the finished product which affect its operation (frequently characteristics other than linear dimensions) have been standardized to the necessary degree of accuracy - by specifying the quality and performance characteristics of the inputs or materials substituted and the technology of manufacture required.

25. This single concept of standardization allows Technology Transfer to be independent of any single source and affords freedom of choice regarding inputs and supply needs.

Procurement

26. Standards are effective procuring instruments in that they assist in choosing capital equipment and component parts of limited varieties including those which minimize the cost of and the need for repair and maintenance, by specifying quality and performance characteristics based on national considerations of local problems and conditions.

Conclusion

27. In concluding it is worthwhile to observe that standardization is a cause and effect of development and transfer of technology and as the industrial and technological base widens in a developing economy such as Guyana's and extends to an increasingly diversified range of manufacturing activities, the necessity for accurate measurements and implementation of appropriate standards would require that Standardization be a priority investment in Guyana.

PART FOUR

ASPECTS OF TECHNOLOGY TRANSFER MANAGEMENT

THE SUGAR INDUSTRY

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H. B. Davis

Chairman, Guyana Sugar Corporation Ltd

Mr. Davis pointed out that the question of technology transfer is synonymous with the concept of appropriate technology. On this premise he introduced a quotation from E. F. Schumacher - "If you want to go places, start from where you are. If you are poor, start with something cheap. If you are uneducated, start with something relatively simple. If you live in a poor environment, and poverty makes markets small, start with something small. If you are employed, start using your labour power; because any productive use of it is better than let it lie idle. In other words, we must learn to recognise the boundaries of poverty. A project that does not fit, educationally and organisationally, into the environment, will be an economic failure and a cause of disruption".

Technology transfer and its management in the sugar industry must be viewed in the context of the socio-economic changes which have been taking place, not only in the total society and specifically within the pale of the sugar industry, but also from the pressures of its international environment.

There are basically two organizational aspects of the sugar industry: the first is agricultural or agronomic; the second relates to the mechanical processing of sugar-cane into raw sugar in our sugar factories. It is important that this organizational division of the industry be made early in this presentation so as to facilitate a good understanding of the use of imported technology and the fostering of indigenous technology in both the cultivation and the factory areas. What also ought to be understood are the adjustments in the management structure and management approach which had to take place so that optimum efficiencies would be obtained from the technological inputs.

Mechanization of Cultivation

There was no agricultural or agronomic revolution in the growing of sugar-cane in its true sense. Indeed, the industry's approach has been one of experimentation and trial-prolonged, if necessary, rather than precipitate implementation of new methods and techniques. The industry over its long history has learnt to appreciate that technology or a system should not be transplanted in totality, if at all, unless it has been carefully studied for its feasibility and particularly its adaptation to the total environment. Technology transfer has therefore been gradual and progressive - developed through a slow process of evolution.

Consolidation of the acquired technology and acquired essential discipline in its gainful use was followed by more advanced technology gradually as conditions matured and the quality of its technical management ripened.

Management of Early Transfer of Technology

It was only about thirty-five (35) years ago that the first tractor BTD18 of 120 h.p. was introduced in the industry.

This machine performs land forming operation including harrowing, drain digging and the levelling of dams. Around the same time too, draglines were introduced. With the level of experience obtained, the training of operators and general acceptance by the work force of

this type of field mechanization - the stage was set for further mechanization some years later by the introduction of wheel type tractors. These machines are used mainly for the pulling of cane punts which operate within the cultivation area through an elaborate system of waterways.

Mules which were used for punt haulage were gradually replaced by wheel type tractors; in effect it meant that jobs relating to the care and handling of mules had to be phased out - note, "phased out" which was a deliberate management approach to facilitate the transfer of workers to suitable alternative jobs and the retraining of what was called the "mule boys" - a terminology which became redundant but not the workers.

The back-up services required for mechanization such as the establishment of field workshops created better opportunities for workers. The workers were therefore appreciative of the fact that mechanization did not operate to their disadvantage but instead provided higher levels of compensation and more opportunities by the creation of more skilled positions. Despite the socio-political framework within which the industry operated at the time, I will say that the initial transfer from manual operations to the use of machinery in the field was without significant repercussions and human problems because of the gradual implementation.

Implementation of Further Field Mechanization

With this successful background, the industry had little difficulty in the implementation of further field mechanization and, therefore, the industry has now reached a position where it is using advanced agricultural equipment such as:

1. Hydrostatic drive machines which operate at regular speeds and depth, thereby facilitating controlled output.

   The Dondi drain digging machines which fall into this category perform well. However, Mr. Davis had reached the conclusion that whilst drain digging work is performed at high speed, the quality of the work is not satisfactory. In other words, manual drain digging is more effective than the technology which we continue to use. However, I must note here that people at least on our estates do not want to return to the job of manual drain digging.

2. Hydraulic excavators such as the Hymac and Mustang which operate like the human arm do precision work.

3. Larger wheel type tractors of 160 h.p. which increase production per hour because of their size.

4. The Superior Caterpillar D6SA which is replacing the old TD18 to which reference has already been made. It is a faster and more versatile machine with a better engine.

Mr. Davis gave the above examples to indicate that it took the industry over three decades through an evolving process to successfully reach this level of field mechanization, although it is progressing with further mechanization of field operations which will be related later.

What took place over this period was essentially to facilitate the identification of suitable technological methods and machines to adapt their use to the production environment - allowing time for adjustments as a result of the changes before proceeding with further technological inputs.

Change in Organization and Management Structure

It is pertinent to mention that the management and, in fact, the general organization structure had to change in order to provide revised structural arrangements for further development. For example, with the introduction and extensive use of field machinery it became necessary to establish a field workshop on every estate location and an industry central workshop which is equipped to carry out overhaul and repairs for all the industry's agricultural machinery.

Spin-off Effect of Field Mechanization - F.E.E.U

In addition, the industry has set up its own Field Equipment Experiment Unit with the following functions:

1. Development of new equipment
2. Evaluation of introduced equipment
3. Standardization
4. Training to meet new needs

The transfer of technology to mechanize some field operations caused the establishment of workshop units to provide back-up services. These units in themselves require technological in-puts for operational and developmental purposes.

1. Management of Ridge and Furrow Trials

Mr. Davis referred to the system known as ridge and furrow which is really a new field layout to accommodate almost complete field mechanization. This system was first observed in the State of Louisiana, United States of America. After careful appraisal it was decided to experiment locally with the view to its implementation on a phased basis mainly because of the shortages of certain categories of field workers, particularly in the areas of cane harvesting, planting and drain digging, also the economies which could be derived from such a system. Several field trials were carried out at various estate locations and, based on the results of the experiments, a pilot project was launched in which all the experiences of the experiments were put.

The ridge and furrow system facilitates mechanical planting, mechanical fertilizing and herbicide operations, mechanical harvesting and loading and mechanical follow-up operations after harvesting. In addition, the transfer of this system and the related technology encouraged the development of new skills particularly in land farming.

It must also be appreciated that the ridge and furrow system was not transplanted in its totality but the Organization's approach has been deliberately one of adaptation through several field trials, also the modification of equipment to suit the environmental conditions through the services of the Field Equipment Experiment Unit. The fact to glean is that the introduction of the system and its related technology emanated firstly because of the need to supplement the existing manual labour required for the maintenance of the existing cultivation and expansion of the industry's intake of new land.

2. Policy of Logical Transfer of Technology

The industry's policy is to proceed gradually with such type of mechanization learning from its experiments and expanding only when there is the certainty that there will be a minimum of dislocation and disruption.

3. Forward Planning

The industry's approach also has been to predict changes which are generally reflected in its written plans - more specifically in three-year plan and other operational plans which provide the objectives and also the in-put requirements - human and material for the attainment of the objectives. In effect, therefore, the industry proceeded along the path of Management by Objectives which points to the goals and the specific requirements for their attainment.

Cane Breeding and Managerial In-put Requirement

Mr. Davis drew attention to cane breeding which is done at the industry's Sugar Experiment Station. The manpower required for this unit is of a highly specialized nature. Therefore, in addition to formal training, its personnel must be continuously exposed to technological developments in other sugar producing territories. The industry is sensitive to the special role and importance of the station for the continued improvement, if not survival, of the industry. A case in point is the skilful handling of the smut disease which a few years ago threatened the very existence of the industry.

The approach in the management of the industry's Experiment Unit, therefore, is to ensure that it is provided with adequate specialist manpower resources on a continuous basis and that its personnel apart from their basic training are frequently exposed to relevant technologies outside the country. They are also given the opportunity to interact with their colleagues and counterparts regionally and internationally on a regular basis. The current relationship between the sugar industry of Cuba and the sugar industry of Guyana, for example, facilitates an annual exchange of visits and documentation which enables the industry in both countries to keep abreast in several key areas. In essence, therefore, the industry, in order to maintain and further improve existing technologies, looks for the transfer of ideas so as to bring about successful adaptation of new and relevant technologies. There is also a transfer of technological developments from one estate to another.

Technology Transfer Factory

Sufficient has been said about innovations and improvements in the Field Department and now our approach should be related to some of our experiences in the factory area if only to reinforce the management practices already mentioned when dealing with the cultivation area. Advances and expansion in the cultivation must have repercussive effects on the processing operations. In other words, sugar factories must have the capacity to take off the volume of cane cultivated in each of the two crops of any year.

Factory capacity must, therefore, keep pace with the amount of cane grown so that there is a balance between the field and factory in terms of the production of cane and the ability to process. Apart from factory expansion there has also been further technological improvements in order to streamline existing operations and obtain greater efficiencies. The Organization being fully aware of the pitfalls of transferring a technology prematurely into an operating plant sought to ensure the preparedness of its skilled manpower resources as far as this was possible prior to the implementation of a new technology. There are some experiences, however, which revealed that where the preparation exercise could not have been satisfactorily carried out inconveniences and set-backs were encountered.

Suffice it to say that over the several decades the operation and management of a basic sugar factory have been learnt, in fact I am tempted to say that a "factory culture" with its own unwritten work ethics has developed in addition to operating and maintenance skills.

Management Pitfalls

Some of the management pitfalls which the industry managed to avoid in the transfer of technology in the field area were not totally avoided in dealing with the factory's sphere of operations. At one factory where modern milling equipment was installed to accommodate additional canes due to a land expansion programme, operating and maintenance problems were encountered because of the speed with which the exercise had to be carried out. There is also the case of the SRI (Sugar Research Institute) clarifier which was installed to achieve a faster rate of juice settling. This equipment took some time to be fully effective because workers had to adapt to its use. The essential point to highlight is that where adequate time had not been given for the transfer of technology, although there has been general acceptance and co-operation among all levels of workers operating, difficulties have occurred which impeded desired efficiencies expected initially.

There is also an example of rejection of technology transfer in a factory (DDS Pan Boiling System - a method involving pan-boiling automatics used since 1870 in Denmark's sugar production where it is applied to the extent of about 70 per cent) for three reasons:

(i) The belief that the technology was replacing the workers;

(ii) Inadequate transfer of knowledge to operate the equipment; and

(iii) Intolerance of the operators to the initial difficulties of the transplant of the technology.

Further, a Grain Selection Equipment was damaged beyond repair when installed at a factory. These examples are provided to highlight the fact that unless the management procedures and approach, some of which were outlined earlier for the transfer of technology, are adhered to, the Organization must be prepared for inconveniences, setbacks and in some cases out-right failure.

Potential for Transfer of Advanced Technology in Factories

There is much potential in our sugar factories for the transfer of advanced technology which has been developed during the past two or three decades. In the field of processing of sugar alone, some of the obvious new transferable technologies on an advantageous economic basis are:

Completion of the installation of gantry and feed-table in replacement of cane hoists;

Highly intensive cane preparation for near complete cell rupturing before milling;

Replacement of clarifiers by new and rapid flow units and their auxiliaries;

Automation of evaporator operations;

Automatic pan-boiling by either

(a) batch type, or

(b) continuous type;

Transformation of raw sugar into semi-refined and later refined sugar according to markets.

Quite naturally, Guysuco must take into consideration the social and economic effects on the industry and the country before proceeding with the introduction of advanced technology.

Reference is now made to two other areas which are related to factory operations.

Paper Manufacture

Firstly, the Corporation is giving serious consideration to the manufacturing of paper and particle board from bagasse which is currently used as raw material for the production of energy for our sugar factories. In ventures of this nature, there is the opportunity to extend the industry's managerial and other skilled resources with the minimum of complications - in fact, the apparent continuity of operations in a project of this nature lends itself to support by the existing manpower resources from within the industry.

To reinforce the point of extended use of manpower resources and material from within the industry, the Corporation is also in the process of establishing a Materials Conservation Centre.

Materials Conservation Centre

In simple terms, this unit will rehabilitate machinery components which, because of continuous wear and tear, have exceeded their economic life but not necessarily their maximum mechanical functional limits. The operation of the Conservation Centre is based on an economic-engineering system and services which were developed through an innovative modification and amalgamation of a number of complementary technologies and management techniques. The objective of the Conservation facility is to manufacture critical components on a batch production basis in sufficient quantities and frequency to meet the needs of our sugar factories. The components are manufactured by rebuilding and resurfacing of worn items which are in abundance on our scrap heaps.

Of particular interest to note according to our technical personnel, is that most components have failed when less than three per cent by weight of materials have been worn away. The economic gains are obvious particularly at a time when every opportunity must be used to conserve our scarce foreign exchange. Here again, manpower resources from within the industry can be used or developed for any peculiar operations.

Computerization

The role of computer science in the Organization is briefly the following. To be specific, data processing started in 1968 with the introduction of a computer inventory control system. Since then, the use of data processing has extended to cover the preparation of tax schedules and general ledger accounts. More recently, the computer is used to evaluate field statistics and produce reports that enable management to decide upon the most economical ratoonage policy for each estate.

The Corporation recognizes the potential benefits of computerization as a technology which can be used to assist in the management of the entire enterprise and the technologies which are in current use and those of the future. Mr. Davis spoke about some of the significant technologies transferred or expected to be introduced into the industry and the management approach for their transplant and maintenance and at the same time he focused on some of the pitfalls when the ground had not been properly prepared.

Mr. Davis concluded by emphasizing the essential points relating to the management of the technologies transferred within the Guyana Sugar Corporation.

Firstly: The technology has to be identified as being appropriate for the Organization and the socio-economic environment within which it will be used. Planning for the transfer of the technology must therefore be done and this includes effective budgeting since financing is the prime mover.

Secondly: The introduction of a technology must be done on a logical and in some cases phased basis.

Thirdly: Specialist knowledge is essential and critical and this is obtained through formal training, seminars, frequent exposure of personnel to areas overseas where relevant technologies exist. In addition, there must be a system for the exchange of information on a basis as currently exists in the Guyana/Cuba arrangement, and our relationships with our Caribbean colleagues in SAC as well as our membership in the GEPLACEA Sugar Producing Group.

Fourthly: Continuous training for managerial and skilled personnel. In this regard the industry has its own facilities at the Port Mourant Training Centre and Ogle and in its several workshops and uses its own resources for training its skilled workers, managers and to some extent its specialists. In order to bolster its internal training, the industry provides further training through a Cadetship Scheme and by engaging overseas consultants on a contractual basis. It is critical that training must be arranged for the handling of more complex and precise technologies.

Fifthly: The facilities and opportunities for research on a continuous basis must be created.

Sixthly: There must be periodic review of the Corporation's organizational structure to ensure particularly that an adequate managerial structural arrangement exists at all times for the management of the technology. The establishment in each area of operation must be maintained and reviewed in order to obtain the desired efficiencies. The industry, therefore, pays special attention and takes great care in the recruitment and selection of its manpower resources. In addition, it has, for a considerable time now, implemented and used a manpower appraisal and succession system which has a direct linkage with manpower development. Manpower development and resourcing cannot be over-emphasized, particularly in the context of the transfer and improvements of technology.

Seventhly: The total compensation for specialists and managers must bear relationship to their economic worth and their expectation or else an intensification of the brain-drain will not only have adverse effects on manpower resourcing but can have disastrous consequences on the maintenance of a technology. In addition, the Organization must ensure that the opportunities are created for continued job satisfaction. In short, the total working environment and work ethic must be conducive to disciplined good performance.

Eighthly: Communication is vitally important, particularly in the initial stages of the transfer of the technology. The Guyana Sugar Corporation uses such media as structured briefing sessions, news bulletins and face-to-face contact between managerial and non-managerial workers. In addition, the Corporation has several forums for the active participation of workers in decision-making. Some of the relevant committees are:

1. Works Councils;
2. Productivity Committees;
3. Energy Conservation Committees; and
4. Safety Committees.

These Committees are used to good effect since through them the consequential commitment arising from participation is obtained from all levels of workers.

Ninthly: The social implications must be considered so as to avoid or minimize any disruption in the Organization and the displacement of persons. Job displacement is now a matter of national concern and, therefore, there must be effective liaison between the Corporation and the relevant Government agencies.

Mr. Davis finally pointed out that "technology transfer" can be regarded as a "change agent" in the working environment and the country as a whole and, therefore, the management experiences and approaches to which I have referred may be found useful in the successful

transfer and adaptation of a relevant technology. Furthermore, growing cane in Guyana is no easy task. Contrary to the so-called conventional wisdom, the conditions are not ideal. The technologies which originate externally must be carefully selected, evaluated, modified where necessary, assessed, and very carefully implemented.

We need also to bear in mind that the technology which is introduced must supplement or complement labour and not displace it. Our strategy for managing technology transfer requires a careful balancing of the opposing elements. It also calls for a greater degree of overall knowledge by executing officers, especially those responsible for production.

THE CASE OF GUYANA NATIONAL ENGINEERING CORPORATION *

Pat Carmichael

Executive Chairman, Guyana National Engineering Corporation

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Introduction

The essential requirement for the industrial restructuring of the world is an adequate and equitable arrangement for the transfer of technology i.e. the movement of techniques and hardware from developed to developing countries, as well as among developing countries. Developing countries usually suffer from both lack of information as well as the consequential negative effect on their negotiating ability in their pursuit of relevant technology for their developmental programmes. The international system governing patents and patented technology is heavily weighted in favour of those who possess such technology. The fundamental proposition forming the process of the existing system then seems to be protection of the rights of the individuals in knowledge and technology.

The New International Economic Order on the other hand, emphasizes that knowledge and technology are a universal heritage of all mankind, and should be used for rapidly industrializing developing countries and thereby improving their living standards. It also visualizes an orderly and equitable institutional arrangement for effecting the technology transfer process.

The question which now emerges is, can the technology transfer process be completed simply on the basis of institutional arrangement alone; especially so when quite a significant amount of these changes have a tremendous impact on skill and employment levels in all sectors of the developing countries' economies? Decisions with regard to an area of research and the subsequent introduction of technological change within most of the countries where these technologies are developed, are directly a function of technical and economic criteria - the people criteria is usually regarded as an adjunct to these criteria. Within developing countries however, the work force and the community in general have a vested interest in participating in any plan to change the nature of work or the work environment through intensive capitalization - a de facto implicit concomitant to the technology transfer process.

It is for these reasons that this paper will attempt to examine "Approaches in Technology Transfer Management" as it relates to the Public Enterprise, and particularly Guyana National Engineering Corporation (GNEC):

(a) Managing the problem of choice of technology;

(b) Management of problems associated with implementation of the technology chosen.

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* Prepared by Mr. P. Carmichael, Executive Chairman, GNEC and Industries Group and read by Clinton Williams.

1. Managing the Problem of Choice of Technology

Guyana National Engineering Corporation Limited, in its objectives for the 1981-1982 period states as follows:

> The Guyana National Engineering Corporation will in 1981, increase its total income by 20 per cent over the projected 1980 level, ensuring that the total contribution of the engineering, manufacturing and service operations increases from its current level of 30 per cent of total income (1980) to no less than 40 per cent of the total income in 1981.

These objectives are to be achieved within the constraints of a determined Pricing Policy and Employment Policy established at the beginning of the year, as well as within the guidelines established in its Six S Mission which states as follows:

"The Mission of the Guyana National Engineering Corporation, is to participate towards the Industrial Development of Guyana by providing efficient and effective SERVICES both in labour and supplies, pursuing a programme of SELF-RELIANCE through the utilization of local skills and materials, as well as the development and improvement of relevant SKILLS.

"In pursuit of these goals, the Corporation will generate a SURPLUS from sale of goods and services, as well as effecting SAVINGS to the economy through an active import substitution programme.

"All of its endeavours will be directed finally towards the attainment of the National SOCIALIST goals."

Implicit in these objectives is the rapid growth of the engineering and manufacturing sector. In basic industries like iron, steel, cement, building materials, etc. the dominating opinion for a long time has been that only large-scale solutions are economically viable. On the other hand, there exist many small-scale plants not only in India and China but also in the United States of America. If the conventional ways of calculating the economies of the plant dominate, there is then a bias in favour of alleged economies of scale. When the system's economies are introduced however, the economies of scale may disappear altogether. Hence an investment in a basic industry warrants a close examination of all consequences for the country. Our attempt is therefore to determine a method of analysing the possible alternative solutions that may better meet the long-term interests of Guyana rather than those favoured by the manufacturers of equipment. To achieve this we try to identify all the main characteristics (economic and well as non-economic).

In addition, we try to reformulate these characteristics as criteria on technology that can be used by GNEC and Guyana to direct our technical development and foster the technological linkages essential to the industrialization process.

(a) Evaluation Problems

Essentially, the basic problem with respect to choice of technical solution can be outlined as follows:

In a particular type of industry, several possible technical solutions may exist; each one with its operating characteristics. In Guyana, the prevailing conditions with respect to critical aspects such as water or waste disposal, meet the operating characteristics to a varying degree. The juxtaposition of the situational conditions and the operating

characteristics will define which technical solutions are probable, provided that the missing additional requirements can be met. The range of possibilities can now be identified, as well as the degree of dependency that will accrue as a consequence.

The merits and demerits of the possible solutions have to be assessed. This assessment will make a balance of a number of features in addition to costs. Political considerations that fit the long-term interest of the country, as well as scope for actual action to complete what is missing, have to go into the solution. Such a solution may be labelled the case for appropriate technology, if it truly reflects the capabilities of the industry. Technology by itself can but partially provide solutions. "Truly appropriate technology can only come from demands of the people by whom and for whom it is to be used, once they have successfully realized their own political and economic strength" (Dickens 1974). The risk is overwhelming that as a Socialistic Third World country, Guyana, in order to use a technique initially developed in a western country, has to adopt the capitalist organization in order to make efficient use of the technique.

(b) Technical Solution

Our approach within GNEC, with regard to identification of available techniques for manufacturing processes has been mainly through the use of data banks of a number of institutions. We regard a technology as available when it is possible to design our model on the basis of the existing knowledge as well as specification of operating characteristics. We aim at the order of magnitude even though not detailed precision in estimates at the initial stages of the project. Determination of a comprehensive study however, presents two problems, firstly, the situation is dynamic, which means that smaller or greater changes in equipment occur all the time.

A particular kind of technology therefore permits a great variety of individual solutions. It is for this reason that our approach involves the study of the component parts that make up the complete machinery or plant (e.g. our approach to analysing foundry equipment involved, basic operating characteristics of both the rotary as well as electric furnaces). The second problem is that since specifications do not always cover all the operating characteristics, in particular, with respect to that labelled as "Auxiliaries" we always find it necessary to study in retrospect, the details of completed projects to find out what is involved. The costing for the machinery is usually straightforward, but is much more complicated for other cost elements (e.g. use of electric generator sets for operating electrical furnaces in the Foundry Expansion Project).

(c) Situational Aspects

Each country has its own specific situation and each industry has its own situational characteristics. GNEC too, has its own situational characteristics. Some of the important parameters which determine these are the following:

Raw material consideration;

Potential demand (consumption characteristics);

Infrastructural and logistical aspects i.e. transport and communication facilities, water and electricity, waste disposal, warehousing and material handling, etc.;

Manpower availability;

Existing industries;

Technological interlinkages, etc.

The ideal situation would have been to study in retrospect a few completed projects in order to reveal what aspects are more important. In particular, we at GNEC would have liked to spot a few successful projects within the public or private sector and to find out those which displayed any salient features. Unfortunately however, within our immediate environment, there are not too many of such projects which we can identify, and our task is constrained by the use of stochastic forecasting based on predetermined probalistic weighting.

(d) Policy Consideration and Action

Decision-making is a process. One element is analysis, which is the recognition of the circumstances, the factors, the data and the information that are to be taken into account The two preceding sections were about this element.

The second element is the "shaping" of a decision. This is a complex element because of the inadequacy of data as well as ambiguity. It is therefore at this stage that the process begins to move from the objective to the subjective plane. Since the decision now involves assessment, judgement and political considerations which are made by human beings in a social and political context, within GNEC a decision is first proposed, thought about, commented on, modified, and eventually crystallized and formulated. In particular, we recognize two features in this process - one is that usually, a proposed technical solution requires a number of consequential measures to be taken in order to fulfil the decision. These measures and actions are usually accompanied by a significant cost element both in terms of the action itself, as well as a time-lag for its achievement. The implementation of organisation may go against already established interests in both economic as well as political terms. That is why in our analyses we had to pin-point these separately (the study of a Tractor Assembly Project within Guyana). The other most important feature is the kind of political consideration involved. We have never tried to make an evaluation of the political aspirations expressed by the government; instead, we are continually seeking guidelines from the policy-makers (our Kuru-Kuru and Sophia Seminars can attest to this fact) in order to fashion our decision-making process. Further, we have tried to combine political guidelines wherever these are available with current development theories in order to define our "Mission" which then forms a multi-objective basis upon which evaluation of alternatives are based. Of the three established development theories namely:

A neo-classical economic theory (the liberal model);

The theory of planned growth (a socialist planning model);

The concept of self-reliance (dependency, self-reliance and ecology).

Our Six S Mission will show a definite preference for the concept of self-reliance. This then provides the bases, as outlined before, upon which all decisions, and in particular, decisions about transfer of technology choices are based.

2. Organizational Restructuring for Decision-making in the Technology Transfer Process

A brief examination of our traditional operations structure would indicate an obvious bias for routine service. There has been however, a continuous corresponding change (in 1981 objectives) in emphasis in areas like:

Improvement in maintenance facilities;

Housing and construction;

Spare parts and other components in the import substitution drive;

Manpower training.

In addition, the self-reliance alluded to before, poses an even greater strain on our rather meagre skills and professional manpower resources.

Since many of the projects identified would require varying kinds of inputs referred to under the discussion on evaluation, before successful introduction into the normal production operation; and since the activities employed therein have been previously shared among the operating divisions and the staff departments on a haphazard basis, it was absolutely essential that we examined the "whole" question of technical consultation and project evaluation, not as an appendage, but as a critical and indispensable activity. The issue in question now centres around whether such a unit should be allowed to function as a separate staff department on its own or whether it should form part of the Executive Chairman's immediate responsibility. Perhaps the latter might be more opportune at this time, given the random prevailing socio-political conditions which influence policy decisions in terms of new investments as well as the adaptation of prevailing operations.

The objectives of this department are as follows:

Provision of technical, scientific, engineering and other forms of information, and/or consultation services, within all departments of the corporation, as well as to the public;

Improvement of current production processes inclusive of materials and human operation systems, both in terms of quality as well as quantity;

To identify, and where applicable, to conduct research in all areas of the corporation's activities, e.g. work standards and performance measures, machine allocation and utilization;

Where possible, to manufacture, test, and introduce prototypes into the normal production process (in conjunction with other agencies e.g. Faculty of Technology, University of Guyana and Institute of Applied Science).

It should be obvious by now that the role of this department immediately focuses on inter-disciplinary work and hence a consequential predeterminant is the need for continuous consultation. This consultation process itself not only encompasses divisions and departments, but includes both organized and disorganized groups from within our system (e.g. the WPC, the Trade Union and informal work groups, etc.).

The idea then of a Technical Management Department is to provide a multi-level staff support system to ensure comprehensive data collection and information retrieval to aid our decision-making process. The liaison activities would facilitate strengthening our participatory planning system within each part and within each level of the Corporation on a continuous basis, thus exhibiting the properties of simultaneity and inter-dependency of the planning process and the implementation activity.

3. Management Problems Associated with the Technology Chosen

A recent study carried out by the Fund for Multi-national Management Education (FMME; a non-profit group largely supported by industries, governments as well as United Nations contributions) entitled "Technology Transfer Management in Developing Countries", in which sixty-seven (67) specific companies in Brazil, Kenya, Korea and Tanzania were investigated, revealed the following general conclusions:

That firms in developing countries have a very limited capability for diagnosing their own individual problems as well as little understanding of how application of new technology can be useful and valuable;

That instead of conforming to specific production bottlenecks as identified by the companies themselves, re-diagnoses often reveal that the problems are often related to inadequacies of mere general managerial principles and their application to specific problem situations.

These conclusions are supported by many policy documents (UNESCO, An introduction to Policy Analysis in Science and Technology, No. 46, Paris 1979; OECD, Facing the Future; Managing the probable and Managing the unpredictable, Paris 1979; Independent Commission on International Development Issues (Brandt Commission) 1980).

We within GNEC have had our share of managerial inadequacies, most of which do lend themselves to the problems identified above. For these reasons, it is continually becoming clear to us that the most pressing problems in the Management of Technology Transfer is therefore one of diagnosis and planning and not one of implementing the technological hardware itself. Our approach to technology transfer management as regards the implementation process might be examined in two (2) respects:

Managing the material or physical resources;

Developing a technical and management capability for the technology transfer process.

4. Managing the Material or Physical Resources

Materials on technology transfer are plentiful. Engineering instructions on how to build a fishing boat, a tractor or an irrigation pump are readily available to anyone in the world. These can occur in a variety of forms: in manuals, journals, documents, blueprints, etc. Further, there are always skilled instructors and/or consultants to impart sufficient knowledge about the job or process to augment Technical Expertise and concretise any basic concepts which might be unclear.

Within GNEC, information for decision-making and management of our operations frequently originate from within our system. This is due to some extent to a large reservoir of skills and experience inherited from our predecessors "SPROSTONS" (e.g. we have successfully introduced sawdust as a fuel input for the production of clay products at our Coverden operations). However, we are forever conscious of the problem of obsolescence of technical information and for this reason we have sought to solicit help from a number of local institutions and consultants. For example, we collaborate extensively with the Faculty of Technology at the University of Guyana, primarily in Foundry Practice and metal-working processes. The Institute of Applied Science has been helping us in our investigations in clay products and feasibility studies for the Ceramic Industry. They are at the moment investigating the

suitability of charcoal as a replacement for imported coke as the fuel for our Cast Iron Foundry. In addition, they are helping us to resuscitate an old kiln as well as making a new one to increase the production capability of clay bricks and blocks. Further still, we have engaged a local consulting agency - Terrence Fletcher Associates - to research the use of claybricks for road-building purposes. The results of that study should be quite obvious by now.

On the external scene, as was explained earlier, we utilize to a large extent, especially for small developmental projects, the Intermediate Technology Service (ITS - a non-profit organization which operates out of the United Kingdom, and provides free technical information and assistance in the field of small projects; more importantly in cases where off-shore costs are involved for consultants, this agency is geared to undertake these also).

Two recent significant results of this relationship have been seen in the reorganization of our workplace at our light metal manufacturing operations "ALPROGUY" and improvement of the technical aspects of our brick production facility at Bel-Lu Factory.

We have also been working closely with the Danish ship research laboratories as well as the Danish Self-Help programme and in consultation with local fleet owners and we have perfected a design of fishing trawlers that fits the needs of the region. Our production programme is to commence within a few months.

We have also built up a working relationship with Damen Shipyards of Holland and we are currently building a cargo vessel for the North-West District with Damen support - primarily in technical details and materials, while utilizing our own skills in assembling and welding of the vessel.

Further, two of our Supervisors will leave very shortly for a two-week exposure on on-job training at Damen in Holland in technical aspects of ship construction. Damen has also sent a consultant to advise on some of the technical aspects of the assembly of the vessel, thereby helping us with on-job training for the technology transfer activity, while at the same time maintaining standards.

In general, within all our developmental programmes, we insist on a technical assistance aspect in which we ensure transfer of technical expertise on a two-way basis since we believe that technology isolated from the source tends to stagnate and must be refreshed.

In addition, technology is like a language in that it has idioms that are accessible to only those who have been immersed in the technology and, to some extent, in the environment in which it was produced.

5. Developing a Technical and Management Capability for the Technology Transfer Process

Technical Capability

As we mentioned in our Mission, the industrialization of Guyana cannot be complete until we have the necessary skills to carry out this industrialization programme, and we at GNEC feel that we have not only to produce the skills, but to produce them for national needs. In this regard, over the past five years we have made good progress in reviving some of the dying skills, such as pattern-making, boiler-making and wooden boat-building skills that are relevant to Guyana's needs, but that had, over the past years, been lost because of new developments in the outer world. On the other hand, we have promoted skills such as bricklaying.

One serious constraint in the use of clay products we found was the inadequacy of bricklayers, and the limited number of bricklayers. GNEC in 1977 set up a live-in school at its Bel-Lu Factory which lasted six (6) months, and gave potential bricklayers both theory and practical training in the skill. We continued on-going exercises, towards the improvement of bricklaying skills, and this culminated in 1980 with the National Bricklaying Championships which was a resounding success.

We have also paid serious attention to our Apprenticeship Training Schemes which were based on an outmoded and old fashioned principle, certainly irrelevant to Guyana. We have a need in Guyana for both quality and quantity in skills, and so we have changed our total concept in terms of generating skills by moving away from the archaic method used by the Board of Industrial Training for methods in which skills are developed, in the short term, in people who become productive and can use those skills in a very short space of time. We have now moved to a modular approach in terms of developing skills so that craftsmen can build on a ladder-like structure from one skill base level to another. In order to meet our future needs as well, we have had to embark on a programme for preparing managers for the future and we have introduced in 1980 our "A" Level Cadet Scheme for which we have twelve (12) participants. We are hoping that they will play a very meaningful role in the very substantial development programme we have for GNEC in the future.

Finally, but surely not of the least importance, has been the very revolutionary role on our part in formalizing the relationship between the Government Technical Institute and ourselves so that jointly we could pursue the exercise of developing skills not only for our own use but for the national need.

We will be looking for all opportunities where we can work together with other technical training institutions so as to make this part of our Mission a reality, and to accelerate our efforts in terms of our responsibility as regards our contribution to the technological transfer process.

6. Developing and Adapting the Management Capability

Poor personnel practices, inadequate diagnoses and planning, and use of inappropriate technology, inability to adapt to rapidly changing conditions in turbulent economic and political climate. These and other environmental problems mitigate against the application of sophisticated management techniques and principles to the problems peculiar to our problem situation. This is not to say that skills in basic management e.g. organization, planning and delegation, etc. should be discarded.

Our approach takes cognizance of this dilemma and we try to solve the problem in two ways:

1. Utilization of external agencies primarily management development and training centre;

2. Development of an internal management development capability.

This approach of course presents another problem i.e. the need for first, a systematic needs survey to establish the needs of a particular manager (or group) and then to compare the merits and demerits of the internal and external courses against the background of the needs identified.

Our natural preference is the use of our own internal development mechanism, since we regard it as fixed cost facility, hence our goal consciousness would dictate fullest utilization. Secondly, we feel that our in-plant courses are better equipped to cater for our own internal needs, since they are designed by our internal people who are familiar with our objectives and have a good appreciation of our problems. Further, we feel that the internal course can be better structured among common interests, be unhampered by problems of varying technology, and, as an internal facility, be more flexible to respond to the needs of our managers especially in areas of follow-up and evaluation.

We are also quite conscious of the merits of external courses, primarily in areas of expertise, novelty in technology, and/or image and status. The fact that we are constrained, poses an even greater strain on our methods of diagnoses and needs analyses. Our organizational analysis is comprised of a varied set of phenomena and methods. We however use two basic sets of information to compare performance and determine deficiencies.

Performance indices - these can be regarded as quantifiable accomplishment or failures against the background of predetermined time horizons. Factors such as overall effectiveness; growth rates, productivity (labour); profitability measures and return on investment (ROI); quality records, inventory management and to some extent, labour turnover and accidents are used in the analysis.

Behavioural objectives - emerging from expectation scaling mechanism and obtained primarily through the questionnaire technique. In this set, factors such as job satisfaction, motivational levels, morale, the level of conflicts or cohesion, role of norm congruence, participation and shared influence, are examined.

Essentially, the manpower development department would co-ordinate the process by which data and information are elicited from the operational sections. Further, in conjunction with the other sectors which comprise what we describe as a multi-level staff support, it serves as a data bank transmitting and retrieving information regarding the training and development process in order to ascertain the extent to which aspects of the process contribute towards organizational change.

The technical management team, referred to earlier, would analyse all deficiencies pertaining to the work environment, waste, scraps, consumer satisfaction. Information such as reliability of products, quality levels, etc. originate from this department. The industrial engineering section on the other hand would establish retraining and development needs on the basis of workplace redesign, product or production modification, other technological changes, etc. The finance sector is now being asked to look into ways of measuring labour productivity and cost effectiveness of some developmental exercises in order to determine a method for allocation of resources.

Finally, issues such as grievances, industrial conflicts and other motivational questions are continually examined where there is perceived inference from the technological transfer process.

The above gives a synopsis of our approach in management of technology transfer.

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TECHNOLOGY TRANSFER - THE GUYANA SCENE

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Accelerated economic growth depends to a large extent on the creation of new technologies and the improvement of existing ones. Modern technology or improved technology has two main effects:

(a) Savings on factor inputs (labour, capital, raw materials);

(b) Increased output (more per capita goods and services).

Modern technology is not confined solely to machinery and equipment but also to the organization of production flows (management) and skills of employees (qualitative change of labour). The introduction of modern technology, therefore, will have quantitative and qualitative changes, all of which should bring about a better quality of life for the people as a whole.

Economic development over the last decades has been based on the introduction of modern technologies in industry, agriculture, mining and services. Each country, however, has its own peculiar experiences. Even among countries of Western Europe and North America (the developed countries) technology transfer is a constant phenomenon.

The developed countries spend large sums of capital, labour and materials on the improvement of technologies. The developing countries can ill afford this needed investment and so expect to profit from the developed countries by the transfer of such technologies as are needed.

How this transfer takes place depends on the countries' histories. Guyana for example, is a settlers country. People from Europe, Africa and Asia came to make Guyana their home. They, especially the Europeans, brought the most modern technology available at that time. The sugar plantations of Guyana were advanced in comparison with similar agricultural activities in Europe. Guyana also, being a colony of Britian represented an extension of the United Kingdom's economic growth and the sugar industry benefited from all the research and development conducted by the English plantation owners. The Africans and Asians brought their systems of small-scale agriculture - ground provisions, rice, vegetables, cattle, pig farming. Mining and commerce followed closely West European and North American standards. Guyana cannot claim to possess an indigenous technology, like countries of Africa or Asia.

Technology transfer for Guyana has a different meaning from that applicable to other countries. The markets for which the goods or services are produced determine the level and scale of technology. Guyana's market is small and consumers' preferences are biased in favour of goods and services obtainable in the developed countries of Western Europe and North America. Production in agriculture (sugar, rice), bauxite and industry is geared towards the world market.

There is a constant flow of technology from the developed countries of West Europe and North America to Guyana. Each economic sector has its own peculiar method and a few practical examples are given below.

1. Industry:

(a) Purchase of machinery and equipment that have inbuilt cost of technology in the prices;

(b) Turnkey projects - the entire project - feasibility studies, site development, construction and running of the enterprise over a limited period are the responsibilities of the suppliers;

(c) Overseas training of Guyanese;

(d) Re-migration of Guyanese who lived a considerable length of time overseas;

(e) Fairs and exhibitions abroad;

(f) Sale of products to North American and European markets.

2. Agriculture:

(a) Purchase of inputs - machinery and equipment, fertilizers, transport equipment, etc.;

(b) Overseas training;

(c) Technical assistance from foreign government and international agencies.

3. Mining:

(a) Foreign investment, e.g. the exploration and extraction of oil and uranium.

4. Services:

(a) Overseas training;

(b) Technical assistance.

That Guyana benefited so far does not rule out the need for its own research and development institution. The National Science Research Council fulfils a need and its work was the subject matter of other papers.

This institution examines:

(a) Basic research;

(b) Training;

(c) Quality and standard classification;

(d) Sources of technology - international agencies, foreign governments, other Regional and Development institutions, transnational corporations;

(e) Establishment of a data bank.

(f) Collaboration with local enterprises.

The National Science Research Council would do an excellent service in monitoring the development of technology and passing the information and knowledge to those who wish to invest for furthering the development of the country.

CO-OPERATIVES - A TECHNIQUE OF NATIONAL DEVELOPMENT ESPECIALLY IN DEVELOPING COUNTRIES

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Introduction

We must admit that economic and social conditions throughout the world are in dire need of improvement. Large and small countries, developed and developing, are all affected by the almost chaotic economic situation. However, the developing countries are the more seriously affected, so much so, that they are all clamouring for a New World Economic Order.

Why is this so? It should be remembered that most developing countries were former colonies and are or were dependencies of industrialized countries. In all cases, however, they are economically dependent on developed countries for markets for their products (mostly agricultural), and they are mainly primary producers. They are also dependent on developed countries for manufactured goods, which in many instances, were produced from their own raw materials. Usually too, the sale prices of such imported manufactured goods are much lower than the cost of locally produced goods due to the economies of large-scale production and use of the most modern machinery and technology. Thus local initiative is stifled, skills disappear, and consequently, the people are forced to abandon their indigenous technology due to the lack of adequate markets for their products. The people also begin to look to the developed countries for self-development. It is in this context that we should examine the positive role in national self-development which can be played by co-operatives, particularly in developing countries.

The Emergence of the Concept of Co-operativism

The co-operative approach was introduced into the economic system mainly to correct the inadequacies and harsh dehumanizing consequences of the Industrial Revolution - a situation which, to a certain degree, still exists today. The circumstances of that system prescribed the principles and procedures for co-operative organization. Briefly the situation was thus:

(a) Technology had provided for machinery to replace labour in the production process;

(b) Productive enterprises were owned by the capital owners, and production was for service to invested capital;

(c) The masses were unemployed and unable to purchase the product of the machine; and

(d) The masses (workers) had no economic power (capital owners were few); had no political power (only capital owners had the vote and women were not allowed to vote) and thus were practically helpless in changing the situation.

It was out of this social and economic milieu that the co-operative was founded on certain precepts and their corresponding practices, which all reflect a single idea - that the human person - the individual - is supreme; that man is more important than capital in the scheme of things; that there should be an end to the exploitation of man by man.

It is important for us to appreciate the precepts and their corresponding practices which distinguish the purpose of the co-operative approach to business from that of other economic forms of enterprises. These precepts and practices are:

Precepts	(Corresponding) Practices
1. The primacy of the individual implying a perception of the dignity of the common man.	Co-operatives regard the individual member as being important to the society, hence every member is allowed one vote on any matter put to the meeting regardless of the share capital subscribed by him.
2. The equality of man which may be perceived behind the easily seen inequalities of status, strength, power, wealth, etc.	Every member is allowed one vote regardless of status, wealth, influence, sex, age or any other consideration.
3. The effecting of social reform through improving the quality of the individual and by promoting education through group action.	Co-operatives emphasize education of members, not only in matters relating to the affairs of the society but also in other areas. In addition, by thinking and working together in their societies, members broaden their outlook and deepen their perception of each other, of the society, and of the whole environment.
4. The perception of the economic problem as part of the larger problem - the moral problem from which is derived the socialist approach to the distribution of wealth.	In co-operatives the surplus earned is distributed among members in proportion to what each member did to help earn it - "From each according to his ability to each according to his work".
5. The establishment of a new relationship where the economic organization forms the basis of a new culture where the possibility of exploitation of man by man is removed.	In co-operatives the members relate to each other in a way that the possibility of exploitation of one by another is eliminated. In a producer's society all members work in the collective undertaking. In a consumer's society, all members pay the same rate for the goods or services obtained, and all members are given the same quality of service.
6. By participation, all men share in the well-being of the society.	The active participation of a member in the business of the society whether as a co-producer or as a buyer of its goods or services, ensures for the member his share of the benefits which accrue to the society.

Co-operatives and Socio-Economic Development

The introduction focuses attention on the plight of developing countries. They are plagued with poverty (indeed it is estimated that over 65 per cent of the world's natural resources are located in the developing countries) because of a highly organized economic system which is geared to exploit poor people and plunder poor countries. The solution to this problem is not

only a new international economic relationship - important as this is - but also a new socio-economic relationship within developing countries. To achieve this, developing countries must mobilize, organize, educate and motivate the broad mass of people for active participation in development and in executing programmes designed to effect such social and economic reforms. The co-operative formula is eminently suited for this purpose as its role is not limited to the spheres of production, consumption and income distribution but it also plays an important part in evolving a democratic society of people having attitudes and an outlook favourable to development.

The main schools of co-operative thought are:

(i) The Socio-Reformistic School - The Social Reformers

The stimuli that brought this school into existence were widespread poverty, low wages, unemployment, low level of living, exploitation and indeed no social justice. The dominant figures in the school were Robert Owen and Charles Fourier.

(ii) The Econo-Reformistic or Anti-Capitalist School

The leaders of this school of thought - Louis Blanc, Sydney Webb and Beatrice Webb - attacked the profit system. They believed that the social and political significance of the co-operative movement lies in the fact that it provides the means by which the capitalist system can be supplemented by a more democratic procedure, wholly without the incentive of profits or the stimulus of pecuniary gain.

(iii) The Socialist School

The adherents to this school - Marx, Lenin, Engels - believe that co-operatives are essentially a socialist institution oriented to socialist ideology. Some followers see co-operatives as a public, rather than a private institution, while others see co-operatives as junior partners of the State in a centrally-planned socialist economy.

(iv) The Co-operative Commonwealth School

The followers of this idea - Charles Gida (France), T.W. Mercer (England), George W. Russell (Ireland), George V. Kean (Canada) - believe that there can be an economy in which practically all, or a dominant part of all businesses can be carried on by consumer co-operatives which can enter all fields of economic activity to carry out the functions of production, distribution and consumption.

(v) The Co-operative Sector School

The idea behind this school of thought is that co-operatives constitute a distinct economic sector in their own right, essentially different from both capitalism and public enterprise, but with some features of one and certain features of the other. The adherents of this school also believe in the mixed economy and they see co-operatives as co-existing with both private business and public enterprise and all three complementing each other in forming the national economy. Dr. Georges Fauquet, author of "Le Secteur Cooperatif" was one of the leading spokesmen for the co-operative sector.

Notwithstanding the various schools of co-operative thought, it is my opinion that the culture of a people determines their approach to co-operative development and the role co-operatives have to play in achieving the socio-economic aspirations of the people of that country, provided the fundamental co-operative principles are observed. Dr. Alexander Laidlaw, in his paper to the Experts Consultation on Co-operatives and the Poor, held at the Co-operative College, Loughborough, United Kingdom in July 1977, defined a co-operative as "a business organization in which the components of ownership, control and use are integrated by being all vested in the one body of people - the members", while the French economist and co-operator, Charles Gida (1847-1932) defines a co-operative as "a grouping of people pursuing common economic, social and educational aims by means of a business". Whatever definition is given to a co-operative, most adherents to the co-operative ideology have agreed that a co-operative has a dual nature - it is a business (economic) organization and it has a social commitment.

Co-operatives as Business (economic organizations)

As business organizations, co-operatives can be found operating in all economic sectors. There are:

(1) Production Co-operatives among farmers, fishermen and artisans;

(2) Finance and Credit Co-operatives among all groupings of citizens;

(3) Retail and Distribution Co-operatives supplying foodstuff, medicines, insecticides, fishing gear, household requisites, indeed all consumer items; and

(4) Service Co-operatives engaged in supplying services of all kinds, viz.: Agricultural Services, such as machinery, leasing of land, drainage and irrigation, marketing of produce and so on; Industrial Services such as marketing of products, catering, repairs and maintenance, etc. Personal Services such as laundry, weeding, gardening, cleansing, porterage, garbage collection, etc. Public Utility Services such as housing (rental and/or hire purchase); transportation, electricity supply, day care centres, homes for the aged, medical and the like.

Because they are businesses, co-operatives have to observe the basic functions of management - planning, organizing, directing, co-ordinating and controlling the work of others and the normal business rules. Their executive officers, in performing the work of management in a technical field, must give attention to objectives, ideals, functions, policies, leadership, human factors, the environment in which the society operates, procedures, organization structure and morale, in the same manner as any other business organization.

However, because co-operatives are structured to ensure that real power is vested in the members, and the main objective of the co-operative is to satisfy the common needs of members, members are more exposed to and involved in the process of decision-making, implementation of change and sharing directly the fruits of the development process. They have more than just a passing interest in the success of the co-operative for they are the promoters of the organization, they are its owners; they control its operations, and they consume the goods and services which it provides. This establishes a closer bond between the co-operative and its members, whether they are workers or consumers. Hence its educational value in developing the type of human infrastructure, so vital for real development, should never be overlooked.

Co-operatives as a Means of Intensifying Educational and Vocational Training

In the UNESCO Report to the Secretary-General on the Role of the Co-operative Movement in the Achievement of the Goals and Objectives of the Second United Nations Development Decade, the following statement occurs under the heading of "Transfer of Scientific Knowledge and Technology" - "if the benefits of development are to be shared by the mass of people, it is imperative that the knowledge and technology required for modernization should be channelled through those means which will have an impact on the largest number of potential users of such knowledge and technology. In that respect, the co-operative movement has a large network of institutions and services, both nationally and internationally, through which this kind of accelerated transfer of knowledge and technology to actual users can be made most effective. This will be not only in reference to modernization of agricultural production but also in improving the quality and output of traditional artisans and the diffusion of modern techniques in management, accounting, processing, packaging, transport, etc., which are essential to modernization". Every co-operative can be a first class education unit and can teach its members, through the participative teaching method, not only technical subjects such as proper agricultural production techniques, accounting and business methods, etc. but also civic topics such as community welfare, health and sanitation. Members can therefore develop many skills and become quite knowledgeable about public and business matters and create a sense of social responsibility. Thus in co-operating, people develop self-confidence, acquire a spirit of mutual confidence, develop business and administrative capacities and promote general welfare of their local communities.

Some Suggested Strategies which may be Adopted

In developing countries, co-operatives should play very positive and dynamic roles in national development. To achieve success, however, certain institutional and other arrangements are necessary, for example:

(1) There should be a national policy on co-operative development outlining clearly the Government's intentions vis-à-vis the co-operative movement and the latter's role in the process of the economic and social development of the country.

(2) There should also be established some agency to be responsible for the development of the co-operative movement. This agency may take several forms, e.g.:

(a) A Co-operative Development Advisory Board to advise on policies, programmes, assistance, etc.;

(b) A Co-operative Development Department - responsible for promotion, registration, supervision, audit and liquidation; or only for registration, inspection, audit and liquidation;

(c) A Co-operative Development Centre or a National Co-operative Development Agency, as is the case with Grenada. These bodies are charged with the development of co-operatives along sound economic lines. In Grenada's case, the Agency brings together all Government bodies which have relationships with co-operatives, e.g. agriculture, fisheries, banks, co-operative department and so on - hence effective co-ordination and servicing of co-operatives is envisaged.

(3) A national co-operative development plan as a part of an over-all national development plan should be adopted. The plan should provide for production-oriented and employment-creating co-operatives and emphasis on capital mobilization and utilization within the co-operative sector. Carefully planned and executed education and training programmes should also be provided for, and there should be established linkages between co-operatives and public enterprises, e.g. labour co-operatives for cleansing and weeding should be established to undertake, on a contractual basis, the garbage collection, cleaning of drains, weeding of parapets, etc. now done by the Mayor and City Council which incurs high costs in doing the work; transport (taxi) co-operatives can be organized, linked to the Guyana Transport Service, to perfect the transportation system throughout the country. The over-all cost should be less than if the Guyana Transport Service expands its fleet of vehicles as the personal interest of the member/owner of the co-operative vehicle is heightened and he would realize that his earnings depend on his keeping his vehicle in good order.

(4) Co-operative legislation should be carefully scrutinized and revised to make it more appropriate to the desires of the country and its people. Care should be exercised to remove those bits of legislation that stifle growth within co-operatives and in fact render them incapable of achieving self-government through initiative, creativity and self-reliance. In this connexion, careful examination should be made of the role of the Registrar of Co-operatives and his powers and duties.

(5) Research should be undertaken to discover new approaches to the development of co-operatives and innovation should be courageously implemented, e.g.,

(a) Regional Co-operative Unions could be given the responsibility for the development of co-operatives in their particular regions. Assistance (technical and financial) could be given to such Regional Unions through their National Union, by the Central Government based on acceptable development plans, in the preparation of which they participated.

(b) The National Union could be given over-all responsibility for the promotion, supervision and education of the co-operative movement and charged by the Central Government with responsibility for ensuring that the National Co-operative Development Plan is successfully implemented. Again assistance (technical and financial) should be given to meet shortfalls due to the inability of the movement to finance the total budget.

(c) In the field of major agricultural projects, in order to attain rapid economic success while meaningfully involving the farmers in the development process, small co-operative farms, linked to a State farm could be established. Such co-operatives would have the advantages of an assured market for their crops; technical advice and services from the State farm.

(d) A special type of co-operative particularly in areas of production, could be organized and structured to include the Government or a particular production agency, as a member. Initially, the Government or the agency would provide the major financial and technical inputs and the committee of the society should be structured to reflect the relationship of the proportion of inputs by Government and other members. As members, other than Government, increase their capital inputs and acquire the necessary "know-how", representation on the committee would be altered accordingly. Profits of the co-operative are also divided proportionately. This could be a permanent arrangement or just a temporary one. (See essays on Modern Co-operation - Co-operatives and the State, by Laszlo Valko).

(e) Hans-H. Munker in his article on "The Formation of Integrated Systems of Co-operative Societies" - (ICA Issue - Volume 71, No. 2, 1978) reported that in German Co-operative Science, three different structural types exist having regard to the relationship between the Co-operative enterprise and members' enterprise. These structural types are the traditional co-operatives, the market-linkage co-operative and the integrated co-operative. The traditional type is well known, while the market-linkage type really provides an organization where the society is managed both by a committee of management elected by members and professional managers.

The integrated co-operative, however, provides a very interesting relationship between members' enterprises and the co-operative enterprise in the following manner:

(i) The co-operative complex (i.e. the combination of members' enterprises and the co-operative enterprise) takes a form similar to that of an industrial combination: members retain certain competences in internal management and production but follow a common strategy of operation;

(ii) The members' enterprises are integrated into the co-operative enterprise in such a way that the management of the co-operative enterprise determines simultaneously the operations of the co-operative enterprise and of the individual members' economic units, by establishing:

a common production plan,

a common market strategy, and

a centralized system of decision-making.

(iii) Members can only influence the general policy of the co-operative complex and have to empower the employed professional management to set the operational objectives for the entire co-operative complex;

(iv) The members' enterprises work more or less under the control of the co-operative management.

There is no limit to the creation of models for co-operative development. Constant reviews, involving a wide cross-section of professionals and co-operators, are necessary to ensure that new dynamism is given to the movement thus ensuring its continued contributions to growth and development.

Conclusion - Faith in People

A capable people, well educated, well informed and much involved, is the key to the abundance of modern economy as they are the major source of economic growth. There appears to be strong reason for believing that most low-income countries are under-investing in human capital. Those countries that have the best records have not won them because they have the best land, or mainly because they have increased rapidly the producible capital in agriculture, but because they have acquired the knowledge and skills required, and a confidence in their ability to develop a modern society. Because of their inherent nature as people's institutions, co-operatives have the capability of accumulating into powerful units the skills, innovations, energy and activities of small individuals, which otherwise would remain ineffective. Co-operatives open up new sources of production, service and economic performance, which would have remained undiscovered, and promote a sense of solidarity among the people.

PART FIVE

REGIONAL ASPECTS OF CO-OPERATION AND TECHNOLOGY TRANSFER MANAGEMENT

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Technology Development and Management in a Regional Integration Setting: The Case of CARICOM*

Byron Blake and Trevor Hamilton

Introduction

Technology is now the dominant factor in production - in the identification, control and exploitation of resources and the organization of production enterprises. This dominance of technology derives partly from the increasing sophistication of production processes (a function of technology itself), partly from the fact that it is embedded in two other critical factors of production, namely, labour and capital and partly from the rapidly increasing demand for consumption goods, especially in a highly processed form.

The increased demand for technology has not only created a need for the development of indigenous technology, but has stimulated a rapidly growing international trade in technology - euphemistically called the transfer of technology. Both the development of, and trade in technology however raise a number of issues for effective management, particularly on the part of developing countries.

The issues of technology management in developing countries such as the CARICOM countries do not only relate to protecting and encouraging technology, but include arrangements for importation and use of developed countries' technologies, ensuring that the prior development of a technology does not unnecessarily restrict domestic innovation and that the international system responds to the requirements of the developing world in the area of technology in much the same way as it has responded to the demand of the developed capitalist world. That small countries need to manage technology is as evident as the fact that they can hardly hope individually to tackle such a complicated set of issues effectively. Co-operation at regional and interregional levels offer some opportunities to assist the process of technology management.

A number of mechanisms and possibilities for national action towards the more effective management of technology have been discussed in other papers at this seminar. Here, we will simply outline the case for regional co-operation in technology development and management, draw attention to some co-operative activities already in train in the CARICOM region and indicate some new possibilities for increased regional co-operation in technology development and management.

A Case for Regional Co-operation in Technology Development and Management

The demand for technology and hence the need to manage technology arises at the national level. National development strictly defined requires each country to have its own technology policy and to take action towards the effective stimulation and management of technology in support of its development objectives. This is not just a reflection of nationalism or even

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* The authors are members of the staff of the Caribbean Community Secretariat. The views expressed in this paper do not necessarily represent those of the Secretariat.

the need to stimulate national technological development. It is also a necessary condition to the effective absorption of foreign technologies. This point was well made by Philip Handler, President of the United States National Academy of Sciences in an article quoted on Industrial Research/Development, where he agreed that "You can't give science and technology to anyone ... First you must build an infrastructure. The best thing we can do is help (the developing nations) to educate a fair fraction of their people so that they can themselves engage in research and development to some degree. You cannot simply introduce modern technology into a society that's unprepared to manage it". 1/

This infrastructure for technology development and management is expensive from both the manpower and financial viewpoints. It requires the existence or creation of critical mass of human and infrastructural resources in an increasingly wide range of areas. This level of infrastructure is often not present in small countries.

The demand for technology is derived from the demand for final goods and is thus at one level a function of the market size. 2/ The individual CARICOM States have been unable to stimulate significant economic development because of the limited absolute size and institutional organization of their markets, the limited resource base (human, natural and financial) and the openness of their economies to external forces. Similarly, they have made very little progress either in the development or management of technology. The limited size of the market not only implies that a number of technological activities could not be economically feasible but that a number of opportunities for forward and backward integration would not be exploitable. Put differently, there would be a number of discontinuities or gaps deriving from non-feasible activities on the "technology tree". It is however the exploitation of the range of technological activities deriving from a basic technological activity which provides for the development of the critical technological mass such as is to be found in the Research and Development Departments of the major industrial corporations in the developed countries. Failure of national strategies to satisfy the national demand for economic development has forced the CARICOM States to opt for a strategy of collective self-reliance through the establishment of the Common Market. 3/ The creation of the Common Market increased the size of the market, extended the resource base, improved opportunities for integrated production, increased human and research capabilities and increased the need for improved income distribution among and within member States. Activation of the opportunities created a demand for technology which can only be satisfied in a self-reliant manner by the development of parallel systems for the co-operative development and management of technology. Several illustrations are possible.

The creation of the Common Market arrangements have, for example, increased the market for agricultural products such as carrots produced in St. Vincent, onions produced in Barbados and white potatoes produced in Jamaica. Technological and agronomic factors in production and marketing have prevented the required expansion of these crops by these countries to take advantage of the market opportunities. None of the countries concerned has been able to put together the resources necessary to conduct the research and find the required technological solutions. In all cases, resort has had to be made to the regional co-operative centre for agricultural research - the Caribbean Agricultural Research and Development Institute (CARDI).

1/ Philip Handler in Industrial Research/Development, November 1979, p. 106.

2/ The mix of goods and services is also a function of technology. For a discussion of the link between production technology and consumption technology, see ISER Science and Technology Policy in the Caribbean, Vol. 28, No. 1, March 1979.

3/ Some of these countries have been extending this concept to interregional relationships through such arrangements as the African, Caribbean and Pacific (ACP) Group and the Non-aligned Movement.

The Common Market has set targets for large increases in food production under the Caribbean Food Plan and for rapid development of industrial production within the framework of a regional industrial programme. Both the Regional Food Plan and the Regional Industrial Programme contemplate the maximum utilization of regional resources - raw materials and labour. 4/ Attainment of this objective however requires the use of technology which is compatible with the region's input structure. Experience at industrialization in response to policies of the individual member States and to opportunities provided by the Caribbean Free Trade Association (CARIFTA) and the Caribbean Common Market (CARICOM) indicates that in the unmanaged situation the technical production function is unlikely to respond to the regional input availabilities. In fact, increased market size provides an incentive for transnational companies to set up subsidiaries or to enter into contractual arrangements with regional manufacturers to produce for the regional market, under licence from the parent firm, products formerly supplied through extra-regional imports. These technology licences often stipulate the source of raw materials. The case of the flour mills in the region which are each supposedly technologically only capable of grinding particular types of wheat, illustrates that such discrimination in raw materials used sometimes extend beyond local raw materials. This has led to one of the most repeated criticisms of the industrialization process in the early stages of Caribbean integration, namely that it has permitted the continued importation of raw materials from third countries which with minimum processing satisfy the criteria for area origin. 5/

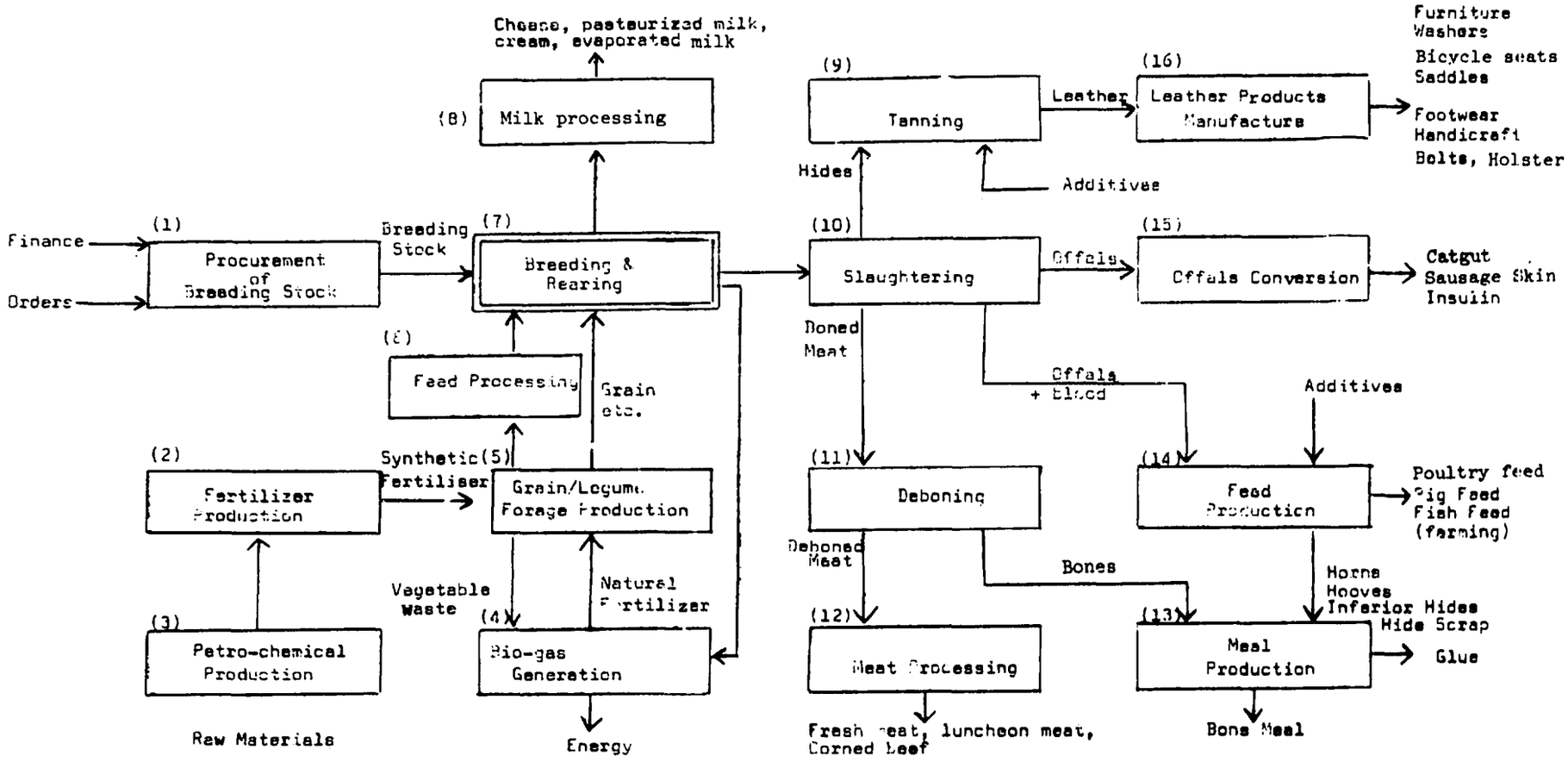
The Regional Food Plan and the Regional Industrial Programme create simultaneously a demand for technology on a scale which could be feasible and a requirement to manage the inflow of technology in a manner which ensures that the demand is not pre-empted. Management of imported technology in this context does not imply a prohibition on technology imports, but rather, selectivity in imports, in the grant of patents and in the conditions attached to technology licences.

The cluster of feasible production opportunities and the implied larger volume of technological activities under these programmes might be illustrated by reference to one of the subsectors identified for rapid development in the Regional Food Plan. Consider the livestock subsector whose potential linkages are illustrated in the following flow chart:

4/ See Articles 46 and 49 of the Treaty of Chaguaramas.

5/ An attempt has been made to deal with this particular criticism through the shift from a 'value-added' to a 'process criteria' for origin. Success of this New Origin Criteria will however depend on the state of technology as no country will sacrifice an established activity.

Simplified Flow-chart for Livestock Subsector Development



Note: Numbers in parenthesis relate to the set of technological activities appropriate to this particular aspect of development.

Each of these processes is supported by a range of technological activities. Some of the potential technological activities relating to the various production processes are listed below:

(1) Genetics

(2) Chemical processing

(3) Chemical processing

(4) Bio-chemical processing

(5) Genetics, animal husbandry, effective large-scale pasture management

(6) Feed formulation and processing

(7) Genetics, disease control, animal husbandry, infrastructural facilities, e.g. for watering stock, making corrals, expertise in handling stock.

(8) Food technology

(9) Leather technology (chemical process for tanning; proper conditions for storing fresh hides to avoid damage due to maggots and other insects).

(10) Veterinary surgery for conducting ante-mortem and post-mortem examinations to check whether the animal is fit for human consumption. Measures for conforming to laws prescribed for satisfactory standards of sanitation and for "humane" slaughtering methods. Handling techniques to avoid damage to hides and therefore drop in market value of them.

(11) Technology and know-how for removing bones from meat. Involves use of many small tools to facilitate maximum removal of meat.

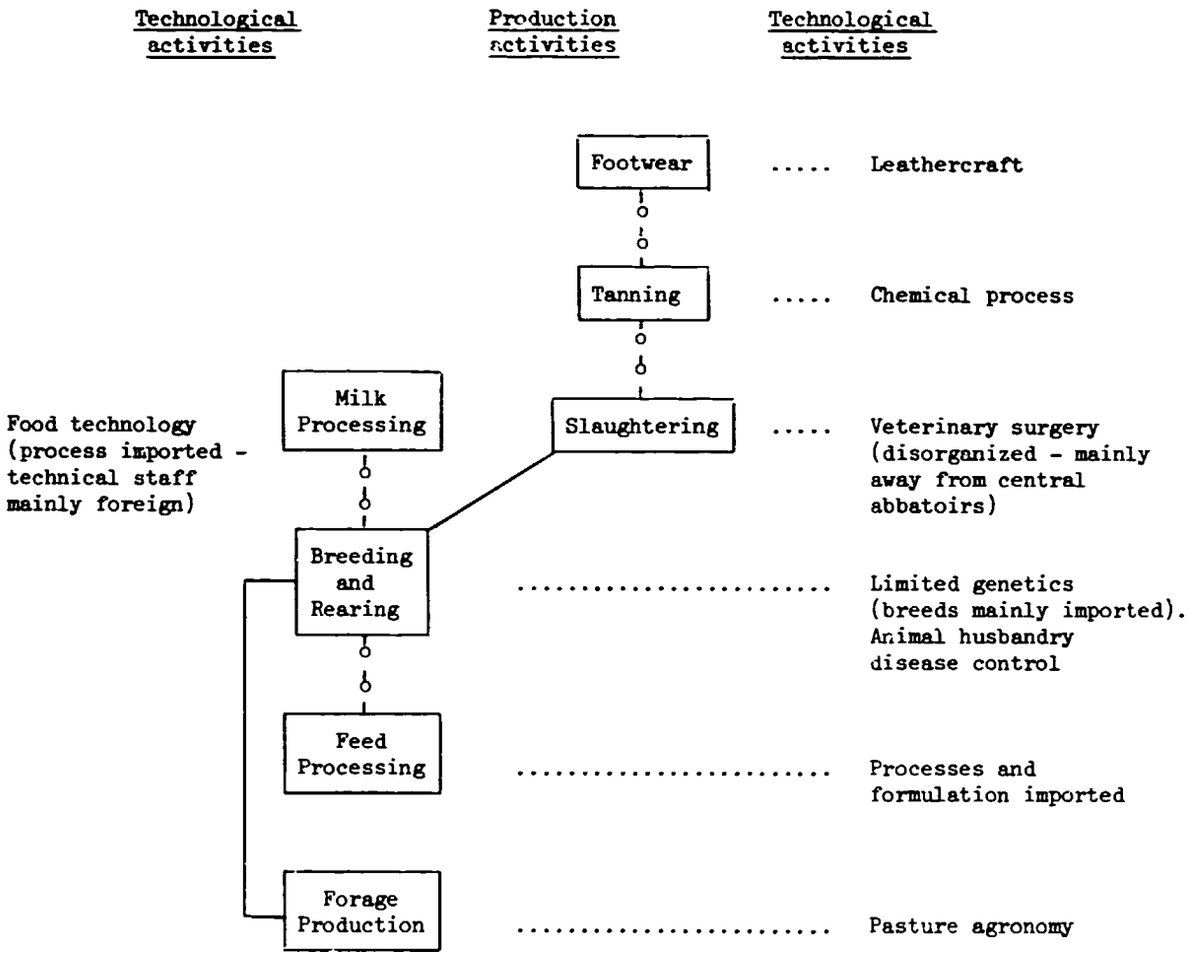
(12) Food processing and technology. Meat technology, involving attention to the different types of meat, e.g. sirloin, tenderloin and round steaks.

(13) Grinding of bones down to required size. Pressure cooking with horns, etc. Filtration to separate glue from bonemeal.

(14) Food processing generally. Technology for extracting insulin from animals' pancreas, and specific materials from certain glands, e.g. "thyroid", "parathyroid".

(15) Technology for using leather to make furniture, washers, gloves, bicycle seats, saddles, footwear and other leather goods.

Prior to agreement on the Regional Food Plan most CARICOM States had some livestock production programmes, some had feed-mixing plants, some had shoe-manufacturing plants, one had a fertilizer processing plant and one had a tannery. All feed-mixing plants operated on 100 per cent imported raw materials, the fertilizer plant on nearly all imported raw materials, while the tannery operated well below capacity for lack of a sufficient flow of domestic hides. In the country with the largest number of activities the structure was roughly as follows:



-o-o- Indicates partial supply.

The above diagram indicates the limited range of feasible activities on the national basis as well as the disconnections including situations in which only a fraction of the raw material requirements could be met from local sources and the limited technological options. A comparison of the two diagrams indicates the difference in the demand for technology as a result of the regional programme. A number of technological activities which were not economically feasible on a national scale now become feasible because of the larger regional demand. To ensure that the regional demand remains an effective demand for regional suppliers however, production must be organized through regional centres such as the Caribbean Food Corporation (CFC). The CFC as the major institution for implementing production projects, under the Regional Food Plan, will, over a time be generating a demand for technology similar to major private corporations. The CFC is not structured however to develop its own large-scale research and development capability, a function which has instead been assigned mainly to the Caribbean Agricultural Research and Development Institute. This requires a high degree of co-ordination between these two regional institutions.

The creation of the Common Market has increased the scope for the production and sale of goods among the member States. Export of goods, however, places more stringent demands on the standards relating not only to the product itself but to the quality of packaging, labelling and even measurement. Maintenance of standards in domestic production in economies such as those of the CARICOM is highly dependent on the quality of the equipment and inputs imported from outside the region. Manufacturers must be able to specify the quality of the equipment they need and also to assess that the equipment they receive meets their specifications. Prior to this, most CARICOM States had little need to emphasize the technological requirements for determining and maintaining standards since the limited manufacturing was usually for a protected national market with limited consumer pressure and no regulation to improve or maintain standards. In any event it is doubtful whether the volume of production in a number of these states could have justified the establishment of full-fledged standards bodies capable of servicing a range of production, say, from food processing, raw materials testing, packaging to machinery testing. 6/ Increased demand and an agreement to share information and thus permit specialization is likely to be the most effective way of ensuring the development of the necessary technological competence among the standards bureaux of the region. The Caribbean Common Market Standards Council, established in 1976 by the Common Market Council of Ministers, is so structured as to permit this type of specialized development while simultaneously making services available to even those countries that have no national standards capability. Some degree of specialization and hence competence has begun to emerge. The Jamaica Standards Bureau has been developing a strong competence in work relating to food standards, food processing and packaging. The Caribbean Industrial Research Institute in Trinidad and Tobago has been concentrating on services to industry mainly in the energy, construction and manufacturing sectors, development of agricultural technology and the provision of technical information. The regional standards bureaux, organized as they are, provide a much larger technical back-up for the work of each bureau than the resources available directly to the individual bureaux.

6/ In the absence of such standards bodies, the Government Chemist had the power to test products, particularly in the food and drug category, but the absence of regulations limited their effectiveness.

Another critical role for the standards bureau in technology management is the assessment of imported technology. This technological capability is not only necessary to support industrialists importing specific technologies, but perhaps more importantly, to backstop any national administrative machinery established to monitor the importation, licensing or patenting of technology. To the extent that the regional demand and organization lead to a strengthening of the regional bureaux of standards, that would itself strengthen their capability to assist in the management of imported technologies.

A basic objective of national strategies is the encouragement of employment and hence the spread of incomes. The creation of the Common Market has not only reinforced this need for internal income distribution, but also for distribution between the member States. The distribution of incomes both within and among states however is largely a function of the technology involved in production. The fact that imported technology used so far tends to be capital-intensive and hence biased towards income concentration places pressure on the Common Market to develop or seek out technologies which are not only more labour-intensive but which are of scales which could operate economically in some of the smaller states. The failure to develop such technologies to date is a source of tension as the less developed countries continue to bargain for economic activities within their borders.

It is possible to argue that technology management is only creative in the context of technology development. In this context, control on technology imports and the granting of patents and licences is a technique to encourage or to prevent the discouragement of technology development. This requires legal arrangements and institutions designed for the purpose. Some CARICOM States have recognized that their patent laws are outdated and that they do not have the resources to devise appropriate laws. This point was summarized by Mr. Henry Ford with respect to Barbados when he argued that "the existing legislation was instituted at the beginning of the century while Barbados was still a colony. Now Barbados is an independent country with a manufacturing base and artistic producers of its own ... better legislation and protection of all Barbados' artists was needed". 7/ In their quest for technical support, some countries have sought assistance from international institutions, in particular the World Intellectual Property Organization (WIPO). 8/ Even in this area, however, it is clear that much of the necessary expertise exists in the region, although in a highly dispersed manner. This regional expertise, working within the framework of the regional Working Party for the Harmonisation of Company Laws, in fact produced a Draft Copyright Act for consideration by member States to achieve a part of this objective. The main point being made here is that while individually the countries might not have the capability to deal with this aspect of technology management, the expertise could be mobilized on a regional basis.

Development of the laws is only one aspect of the legal arrangements for technology management. Implementation of the law will depend on the establishment of appropriately designed and equipped administrative machinery. Given the national and international dimensions of the technology problem, proper administration requires easy access to a range of technical support and to information. It has already been argued that technical support on the range of technological issues will be most effectively provided within the context of regional arrangements which permit specialization and the development of centres of excellence in specific

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7/ Barbados' Advocate News, 28 January 1981.

8/ WIPO has provided assistance to the Governments of Barbados and Trinidad and Tobago for the purpose of revising their laws.

aspects of technology. A similar argument can be made for regional co-operation in the collection and storage of information relating to technology. It would be expensive, and possibly technically and economically unfeasible, for all the countries to set up major technology information systems. It seems very likely that there would be economies from the establishment of a regional technology information system which could tie into various international systems, and the regional "centres of excellence" in technology development for information and into the major user centres at the national level of dissemination. The Caribbean Development Bank has started a technology information system 9/ which could form the nucleus of a regional technology information system.

Technology development is not only a function of the infrastructure for application and commercialization of innovation, but is also a function of basic scientific research and enquiry. Basic research is time consuming and expensive. In fact, most of this scientific research will not yield any technological results and even where it does, many years may elapse before the innovation is commercialized. The infrastructure for such basic research does not exist in most of the CARICOM States. Basic scientific research might be most effectively performed in the CARICOM States in a manner which permits a part of the expense to be written off against the need to teach science and scientific appreciation. The University of the West Indies already undertakes a significant amount of basic scientific research and could, with justification, be encouraged to specialize more in that area. 10/

The main justification for regional co-operation in technology development and management is that it is a sophisticated and costly process for which all the member States lack the capability and resource to be self-sufficient and to operate even at the basic minimum.

Capability for Technology Development and Management

There is a range of activities involved in the process of technology development and management. The minimum process or critical path might be illustrated as follows:

Minimum Prerequisites

Idea (1)	Inventory of Technical Knowledge	Exposure to Technical Environment		Knowledge of Product Characteristics
Research (2)	Research Institutes	Data Banking Facilities (learned groups)		Incentive Programmes
Development (3)	Pilot Projects	Economic Assessment		Technological Assessment
Innovation (4)	Commercialization	Quality Control	Developing Multiple Use	Improvement and Product Development
Diffusion (5)	Management	Cyclical Assessment		

9/ Part of the Technology and Energy Unit (TEU), Caribbean Development Bank. It might be timely to examine this area as CARIRI has installed a system and the Scientific Research Council (SRC) of Jamaica is considering doing the same.

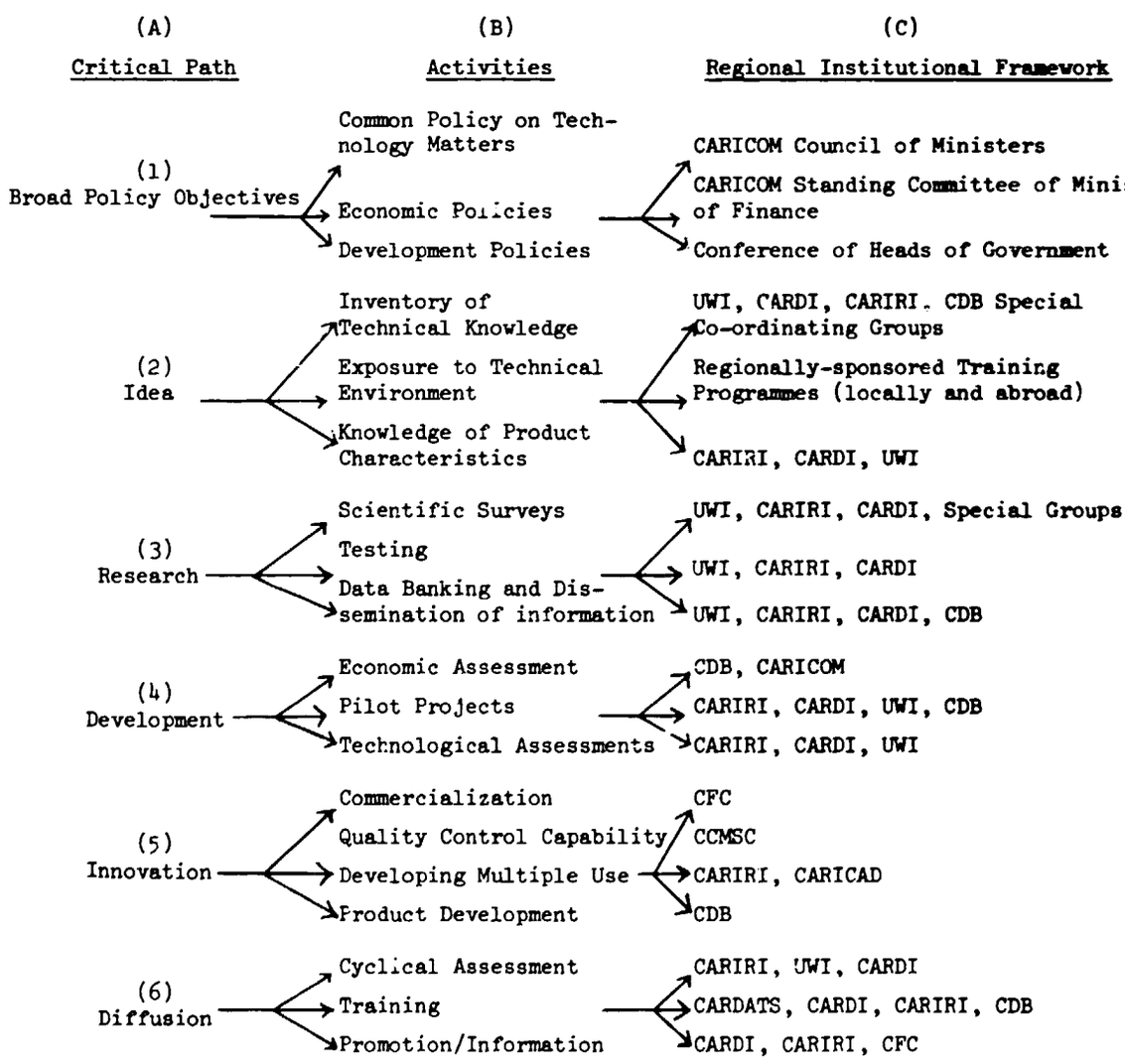
10/ The distinction is being made here between institutions involved in pure science and institutions involved in applied research. The aim is not to create "ivory tower" scientists but rather to ensure that basic science is not totally neglected in the very necessary drive to establish institutions for applied research.

This critical path as has already been argued requires high financial, human, capital and institutional overheads. No single member country has these resources at the required level to invest in these activities. In any event, the size of the national demand would in many cases be too small to economically commercialize the results and there would be in all probability under-utilized facilities.

Some Existing Mechanisms for Technology Management at the Regional Level

A number of mechanisms already exist at the regional level for the development, management and control of technology. Most of these mechanisms which exist for other purposes and so tend to be sectoral. Their activities tend to be unco-ordinated and sometimes duplicative with each spreading its resources to try and cover a range of areas. Further, because of their nature some are often not seen as institutions for technology management. In spite of these factors, it is possible to discern a structure in which there are institutions undertaking activities at all stages along the critical path for technology development and management. The major elements are presented schematically below:

Diagram



Brief of Objectives, Scope and Organizational Structure of Each Institution

Most of the institutional structures are sectoral and to some extent vertical. There is, however, some institutionalization of co-operation between the sectors. They meet through co-ordinating groups, and overall policy groups, for example, the officials of the Common Market Council of Ministers which meets to consider common policies on technology and makes recommendations to the Council for final policy decisions.

The objectives and some of the activities of the major regional sectoral institutions in the field of technology are briefly described in the table attached.

Some Sectoral Institutions in Regional Co-operation in Technology

Sector	Institution	General objectives	Some projects undertaken	Some achievements to date
Agri-culture	Caribbean Agricultural Research and Development Institute (CARDI)	(1) To provide an appropriate research and developmental service to the agricultural sector in member States.	(1) Corn/soya project in Guyana - it is now carrying out work on soil and pest management.	(1) Developed new uses for sugar-cane residues, root crops etc., particularly for annual feeds and fertilizers.
		(2) To provide and extend the application of new technologies in production processing, storage and distribution of agricultural products.	(2) Corn/soya project Belize (infancy stage) will assist with crop management practices.	(2) Improved varieties of crops, livestock and other agricultural activities suitable to local conditions.
		(3) Assessing the present status of commercial practices and research findings for the benefit of extension officers and training institutions.	(3) Seed farm project in Jamaica - consulting in plant protection and breeding.	(3) Pest and disease control.
			(4) Work on varieties, storage, pest management for carrots, onions, Irish potatoes and coffee (berry borer).	
			(5) Development of Calypso tomato, "Laura B" cowpea.	
Industry	Caribbean Industrial Research Institute (CARIRI)	(1) Improve technological capability of Trinidad and Tobago's industrial community.	(1) Design and construction of coconut dehusker.	(1) Production of bay oil by steam distillation, development of dual purpose harvester for pigeon peas and sorrel, development of a coconut dehusker, extraction of cinnamon oil from cinnamon bark, development of pigeon pea shelter.
		(2) Collection and dissemination of technical information including applicable standards, specification and quality control procedures.	(2) Design and construction of bay leaf extracting plant etc.	(2) Continues service to industrial sector on a one to one basis.

(continued)...

Some Sectoral Institutions in Regional Co-operation in Technology (cont'd)

Sector	Institution	General objectives	Some projects undertaken	Some achievements to date
Industry	Caribbean Industrial Research Institute (CARIRI)	(3) To provide engineering services, including assistance with production lines, prototype designs etc.		
		(4) Assist with technology transfer and adaptation assessment.		
		(5) Screen foreign technology to determine adaptability to local conditions.		
Finance	Caribbean Development Bank	(1) Sponsors training in technology.	(1) General services to investors.	(1) On-going.
		(2) Assesses technological suitabilities of projects under review for financing.	(2) Technology Information Systems Project.	(2) Produces newsletter. Provides information on request.
		(3) Carries out comparative cost analysis on technologies.	(3) Work on use of agricultural wastes - corn, banana fibre.	
		(4) Prepare and provide technological information to potential investors.	(4) Upgrading of agricultural laboratories in the least developed countries.	
		(5) Sponsors pilot study of alternative technologies particularly in the energy sector.		
All	Caribbean Common Market Standards Council	(1) Standardize technology to stimulate specialization.	(1) Co-ordinate seminars on metrology and technological implications.	
		(2) Prepare specifications to facilitate technology planning.	(2) Undertake studies pertaining to certain standards and technological implications.	(2) On-going.
		(3) Standardize inputs in order to stimulate regional industrial co-operation.	(3) Prepare specification for oils and fats.	
		(4) Co-ordinate the regional metrology programme (conversion).		
All	CARICOM Secretariat	(1) Assist in policy formulation and policy harmonization of member States.	(1) Harmonization of Company Laws.	(1) Draft Copyright Bill.
		(2) Assist in ensuring that benefits of integration remain in the region.	(2) Regional policy on direct foreign investment and the transfer of technology.	(2) CARICOM Enterprise Régime.
		(3) Harmonization of laws of CARICOM States in the areas such as companies, trade marks, patents, design and copyrights, industrial standards.	(3) Alternative Energy Systems Project.	(3) Status Report on Patent Laws of CARICOM Countries.

(continued)...

Some Sectoral Institutions in Regional Co-operation in Technology (cont'd)

Sector	Institution	General objectives	Some projects undertaken	Some achievements to date
				(1) Draft Code on Direct Foreign Investment and Transfer of Technology. (2) Co-sponsored with the Government of Guyana and the United Nations Centre on Transnational Co-operation Training Course in Negotiations (1977). (3) Co-sponsored with UNESCO and WIPO Seminar on Copyright (1981). (4) Collaborated with Institute of Social and Economic Research, Institute of Development Studies (UG) and IDRC (Canada) on Caribbean Technology Policy Study (1975-1977).
Information Training	University of the West Indies	(1) Undertake research in appropriate technology. (2) Train engineers and other technology personnel. (3) Review and develop science course content to meet regional needs. (4) Operate a core of technology specialists. (5) Operate pilot projects in technology.	(1) Many in the areas of training and research.	(1) Many objectives have been achieved.
Health	Regional Drug Testing Laboratory	Carry out microbiological, pharmacological and bioavailability and related tests on pharmaceutical products and medical devices.	Tests on: (1) Array on antibiotics. (2) Toxicity tests on biologicals e.g. vaccines. (3) Determination of the sterility of intravenous solutions etc. (4) Biological availability of selected drugs. (5) Stability of drugs under condition and storage in the region.	Activities on-going.

(continued)...

Some Sectoral Institutions in Regional Co-operation in Technology (cont'd)

Sector	Institution	General objectives	Some projects undertaken	Some achievements to date
	Regional Pharmaceutical Centre */	(1) Operate an expanded regional pooled procurement system for drugs.		Still in the formation stage.
		(2) Promote industrial co-operation among the countries in the region engaged in pharmaceutical production.		
		(3) Compile a Caribbean Formulary.		
		(4) Disseminate product information through a regional publication.		
		(5) Assist countries in setting up at the national level pooled procurement systems, inventory control etc.		
		(6) Assist countries in revising their patent legislation in the area of pharmaceuticals.		
		(7) Assist local producers of pharmaceuticals in obtaining equipment, technology and other inputs under the best terms and conditions.		
		(8) Organize training at the regional level in international drug procurement, quality control, stores management etc.		
		(9) Explore possibilities of co-operation with other developing countries and regional organizations, for example, with regard to market information, trade, industrial co-operation in the field of transfer of technology etc.		
		(10) Provide a forum for discussion for the regional pharmaceutical producers in order to facilitate the rationalization of production.		

*/ Proposed. Endorsed by the Fourth Ministers of Health Conference, held in Saint Lucia, 1978.

New Possibilities for Increased Regional Co-operation in Technology Development and Management

This analysis has indicated that while there are some institutions for and actual acts of regional co-operation in technology development and management, a full range of possibilities have not been developed and exploited. There are major gaps and areas of under-utilization in the technology chain. The bridging of these gaps and the full utilization of existing technology capabilities provide a range of opportunities for increased regional co-operation. Some of these possibilities are identified in this section.

A major gap in the technology development and management chain lies in the area of policy. No CARICOM country has a policy governing the development, importation or management of technology. 11/ Policy is acknowledged to be necessary but formulation of effective policy in an area as new, involved and dynamic as technology is a complicated task requiring the combined skills of a range of people - technologists, industrialists, lawyers and economists to name a few. Furthermore, any policy in such an area will need to be carefully monitored and modified in line with national priorities and changing strategies of the sellers of technology. Implementation of policies, in particular those areas of policy relating to the importation of foreign technology, is likely to be more effective in an environment where the foreign suppliers are faced with the same requirements in a number of importing countries. The development of policies relating to the importation of technology or even to the development of technology nationally, will in all probability, have an impact on technology development in the partner States of CARICOM. Possible adverse consequences are likely to be minimized in a situation where policies are formulated with a focus on the region rather than just on the national economy. In short, technical manpower requirements, effectiveness with respect to third country suppliers of technology and the potential adverse impact on the technological development of other CARICOM States all combine to suggest that regional co-operation in technology policy - formulation, implementation and modification should be an area of high priority. Co-operation in technology policy could be achieved through the establishment of a Regional Council for Technology. 12/

Policy formulation requires the provision of a range of relevant information. Information is required for instance on present sources and uses of specific technologies, competing alternative technologies, costs and arrangements for technology purchases, available regional technologies, practising technologists in the region, international and relevant third country laws governing technology development and management. It has already been argued that such a data system could hardly be economically implemented by the majority of CARICOM countries. A regional technology information system into which suitably equipped national systems and sub-systems can be plugged could well provide the minimum size at which the system as a whole could be economically and technically feasible. A deliberately structured regional technology information system is another possible area for regional co-operation in technology development and management.

11/ *The Government of Jamaica* has developed Guidelines for the Importation of Technology. This, however, is still limited to the management of the importation of technology and is, in any event, only in the form of guidelines.

12/ The present proposals being developed under the aegis of the Caribbean Development and Co-operation Committee for a Regional Council for Science and Technology could provide the institutional framework for the proposal being made here.

The Patent Laws of all CARICOM States are hopelessly out of date and in need of reform. Some countries have already underlined their lack of national competence to undertake the requisite reform by appealing to WIPO.

A programme of training could be so designed that the existing regional and national training institutions - universities, scientific and technological institutes, technical colleges and scientific research councils and standards bodies - could be structured and equipped to undertake much of the required training. One aspect of such a structuring could be to design courses so that expertise and facilities engaged outside of the training institutions could be used for theoretical as well as on-the-job training.

The need for technology development and management is slowly being recognized by some international and bilateral funding institutions. This trend is best illustrated by the establishment of the United Nations Interim Fund for Science and Technology Development as one of the main practical outcomes of the United Nations sponsored Conference on Science and Technology in Vienna in 1979. In order to make effective use of such resources as well as to support initiatives for other such resources to be made available for this purpose, countries such as those in CARICOM will be under increasing pressure to prepare sound project proposals for funding. These countries will also have to critically evaluate proposals for projects for technology development and management which will be made to them by multilateral and bilateral donors. Given the scarcity of suitably qualified persons in the individual countries to which reference has already been made, it would seem that the CARICOM States would be most effective if they could devise co-operation arrangements for raising funds and for interfacing with certain international organizations for establishing projects for technology development and management. In this regard, the CARICOM States already have institutional arrangements for undertaking these co-operative functions for technology. The precedent has been set in the energy sector where the United States Agency for International Development has developed a regional programme with the Caribbean Development Bank and the CARICOM Secretariat to co-ordinate technological work with respect to the development of alternative sources of energy and the importation of technology for this purpose. This same machinery is being used as part of the co-ordinating process for the interfacing with the United Nations Conference on New and Renewable Sources of Energy.

On the level of general technology development and management, the United Nations Interim Fund for Science and Technology Development (UNIFSTD) has also been discussing its programme for the Region within the context of a regional framework.

In the light of these precedents and the clear need for co-ordination and negotiating strength, it seems that external negotiations for funding and other assistance for technology development is another area for regional co-operation.

OPPORTUNITIES FOR REGIONAL CO-OPERATION AND TECHNOLOGY TRANSFER

MANAGEMENT IN THE CARIBBEAN

11371

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1. Project Preparation and Appraisal

(a) A 10-week course (16 March - 22 May) on Project Preparation and Appraisal is being organized by the Caribbean Development Bank (CDB) in co-operation with UNIDO. Several Guyanese officials have been nominated as participants. This course is especially practical because it includes four or five weeks of field case work.

(b) My colleague Michiko Miyanabe has nearly completed a directory of industrial investment profiles available to project preparers in the Caribbean. This volume will be published shortly, and it will contain about 500 abstracts. It will be distributed throughout the area.

(c) CDB has been working strenuously to expand the scope and capacity of its Industry Division. Under its new head, Sam Singh, the division will be increasing its support services to member countries in the field of project identification, preparation and promotion.

(d) I expect that links now being set up between the Caribbean Centre for Development Administration (CARICAD) (Barbados), the International Centre for Public Enterprises in Developing Countries (ICPE) (Ljubljana) and UNIDO will contribute to further regional action in several fields including management of project activities (Technology Transfer Management).

2. Technological Information

(a) It may be noted that negotiations are underway to link the CDB/TEU information service with INTIB, UNIDO's Industrial and Technological Information Bank. As an example of INTIB service, Mr. Tanaka brought a copy of a reply dated 6 February to a GUYPHARM enquiry dated 20 January requesting information on production of laundry bluing.

(b) In another case I discovered that detailed information on liquid soap production was available from the Scientific Research Council in Jamaica. This had been requested by two different officers at CDB for use in projects for Guyana and Grenada, respectively. It is probable that a systematic polling of Caribbean institutions would reveal a great wealth of information useful in preparing projects.

(c) Further examples of such resources are the egg-washing and brick-making "project profiles" embodied in standards publications available in Guyana at NSRC (Indian Standards). These no doubt represent the "tip of an iceberg" of important dimensions.

3. Technological Consultancy

(a) The CTCS about which I have spoken briefly earlier will hopefully permit a complementary specialization of existing institutions to strengthen regional self-reliance. IAST may deal with mineral products and essential oils, the Caribbean Industrial Research Institute (CARIRI) with electronics, the Barbados Institute of Management and Productivity (BIMAP) with capacity utilization, the Science Research Council (SRC) with building materials

and renewable energy, the Jamaica Bureau of Standards (JBS) with packaging, etc. We hope that an organizing workshop can be held soon to initiate pilot-scale operations with CDB/TEU co-ordination. In many cases a prospectus is available on request.

(b) In the realm of future potential it is worth noting that the Barbados National Standards Institution (BNSI) is hoping to create a design centre, which would surely have regional significance. JBS is now planning the creation of a plastics unit, to complement the very successful Packaging Centre.

4. Investment Promotion

(a) UNIDO has operated an Industrial Investment Promotion Service in New York for about a dozen years. It now has wide support from developing countries and receives funding from UNDP, the World Bank, and OPEC. An annual one-month intensive training programme is followed by one year of residential "coaching" while participants represent their countries and carry out promotional duties for their countries. The system has been very successful, */ and CDB has now arranged a special training programme for Caribbean least developed countries to begin in April.

(b) It is hoped that the Caribbean programme will lead to the establishment of a joint Caribbean promotion office in New York as a Phase II. There is also talk of an investment promotion centre to be set up in the Caribbean with Canadian International Development Agency (CIDA) support.

(c) CDB and UNIDO hope to conduct a Caribbean investment promotion meeting in Barbados in December 1981 at which each country would present projects for consideration by, and private discussion with, overseas investors.

(d) A regional negotiations training session may emerge from a web of linkages involving Antigua, CTC, CIDA, CDB and UNIDO.

5. Bauxite Industry

A project for $900,000 has been approved by the UNIFSTD under which UNIDO will help the Jamaica Bauxite Institute to set up a laboratory production pilot plant. The purpose is to break Jamaica's costly dependency on outside agencies (largely its customers) in determining detailed production processes most suitable for the various available ones. It would be expected that Guyana and Suriname would be accorded full co-operation by JBI to achieve similar objectives.

6. Shipbuilding/Repairing

(a) One of my colleagues assembled a roster of over 30 boat and shipbuilding and repairing facilities in the Caribbean (steel, fibreglass and wood). The units are surprisingly widespread. The survey revealed a strong interest in a proposed joint workshop to foster upgrading of the Caribbean facilities through such techniques as joint purchasing of raw materials, improved designs and processes, subcontracting etc. GNEC is willing to host the workshop. An initial letter was transmitted from UNIDO headquarters, but the follow-up is presently uncertain, since Mr. Carmichael is away on a three months' course.

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*/ Current participants include Kenya, Philippines, Haiti, Dominican Republic, Bangladesh, Sri Lanka, etc.

(b) About six months ago, the press announced a Japanese development of a push-button controlled system for deploying sails (made partly of aluminium) on engine-powered cargo ships. It is stated that the new system reduces fuel requirements by 50 per cent. Such a mechanism could be used readily in the Caribbean where winds are relatively dependable. It was suggested that an existing ship could be retro-fitted with the Japanese technology at GNEC. This may prove somewhat premature, but it should be possible to check potential interest through UNIDO's new investment promotion office in Tokyo.

7. Sugar Industry

(a) Guyana already co-operates with Cuba in sugar technology. A joint Cuban/GEPLACEA/UNIDO regional seminar on rational energy use in the sugar industry led to presentations of innovative techniques which may deserve further attention.

(b) Further development of computer use may also be warranted. A Budapest workshop on use of low-cost computers in industry was organized by UNIDO two years ago. A Cuban engineer described highly progressive gains in sugar yield and fuel efficiency, and reductions in cane transport time (linked to sugar yield). The gains were credited to installation of a three-tiered computer control system beginning with process control at the plant level. It is possible that the plant-level application would be attractive in Guyana, Barbados and Trinidad.

(c) A new and revolutionary microbiological process for converting bagasse to ethanol has been successfully tested at laboratory scale. UNIDO is installing a pilot plant in the Philippines for further testing and commercial evaluation. There is reason to be optimistic that the programme may soon yield a superior alternative to direct burning of bagasse for energy production, or its conversion to paper, chipboard, and the like.

8. Stone Technology

A project based in Haiti is creating a technical library and pilot plant operation. The project leader, an Israeli, has experience concerning use of stone for structural and ornamental purposes. There is a move to broaden the project to give it regional status, taking advantage of the existing investment.

9. Renewable Energy

(a) CDB/TEU in co-operation with the Commonwealth Science Council and others is conducting various energy projects including one in Guyana relating to solar drying of hot peppers.

(b) The activity in Guyana for development of locally-made mini-hydro units has been encouraged by local participation in a UNIDO study tour to China and the Philippines. A regional workshop in Dominica has been scheduled for March by CDB.

10. Regional Meeting on Aspects of Technology Transfer

Finally, the Guyana seminar has been extremely successful and is the first of its kind in the Caribbean. There appears to be considerable interest in organizing a broadly-based regional meeting to inform other countries about the potential gains from technology transfer management. Such a session might best be focused on key areas not yet benefiting from substantial attention in the region. These might be, inter alia:

R + D co-ordination, commercialization;

Decision-making processes (formal versus informal, national profitability);

Incentives and motivation vis-à-vis creativity and effort;

Technical and managerial training for TTM.

The brief examples given above may be useful in stimulating Guyana's full utilization of the opportunities presented for regional co-operation to the benefit of national development.

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HEALTH TECHNOLOGY APPROPRIATE TO THE CARIBBEAN

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Introduction

1. Technology cannot be considered in isolation from the social and economic environment in which it is to function, still less without careful analysis of the health problems that it is intended to solve.

2. The purpose of this paper is simply to put down some of the considerations that should guide us in the Caribbean when we set about programming, as we must, in the area of technology and health.

3. It would be very difficult, even if it were desirable, for me to discuss the whole field of technology in relation to health.

4. To deal with it strictly within the Caribbean context is rational.

I. Definitions

5. First we must define terms. There are innumerable definitions of health technology. It might be incorrectly understood to mean exclusively equipment and devices, perhaps quite sophisticated. It is preferable to adapt Galbraith's definition of a systematic course of action directed towards the solution of health problems, determined by scientific, technical and traditional considerations.

6. But what do we mean by appropriate technology for health? Let us define it simply as a technology which is socially appropriate - specifically, one which is suited in all respects to our Caribbean situation. Thus, appropriate technology in health in this broad sense is the systematic application of knowledge (methods and techniques) in the health sciences (and other related sciences) to the solution of practical problems and tasks, so that it does not have an adverse effect on the society, the economy, the culture or the ecology where it is applied.

7. WHO defines appropriate technology for health as "a wide-ranging set of activities applying skills, knowledge and creativity for inventing or discovering, testing, improving, adapting, applying or using methodologies and techniques, with methods of management for

solving health problems". The word "appropriate" indicates that only those technologies should be applied that are suited in all respects to the local conditions in which they will be used. It means that the technology must not only be effective and safe, but should also have as many as possible of the following features: be acceptable to community, services, and decision-makers alike; fit within local cultures; be capable of being adapted, further developed, and manufactured locally whenever possible at low cost; and be simple in design and execution for local use and maintenance. The Pan American Health Organization (PAHO) has provided us with a more comprehensive listing of criteria, requirements, characteristics and components of appropriate technology for health, and their paper on this subject is circulated separately to participants in the seminar.

8. In the CARICOM Secretariat, we have ventured to prepare a definition of health in the Caribbean context. As this definition is already well known to some of you, it is simply being appended to this paper as an annex.

II. Certain Fundamental Principles

9. What then is our Caribbean situation in health for which the technology must be appropriate?

10. It is first necessary to reaffirm certain fundamental principles, some already well known, which have been adopted by our policy-makers and should therefore guide us in the selection of appropriate technology:

(a) We no longer view the health services as a complex of purely medical measures. They are an essential component of the socio-economic system and combine a number of political, social, economic and other measures which the society is using to protect and improve the health of every individual and of the community as a whole.

(b) The technology of planning is basic. The proposal of solutions for problems before the whole situation has been examined and the problems carefully identified remains a common phenomenon. Plans and programmes should be formulated not for problems seen in isolation but only after judicious determination of priorities, careful definition of objectives, selection of appropriate technology, as simple and as inexpensive as possible, and the creation of adequate systems of information and evaluation.

(c) The ultimate instrument for the delivery of health care is a comprehensive national health system or service. It is for each country to examine for itself whether and to what extent the principle of social security should be applied to the delivery of personal health care. Health being a fundamental right of man, capacity to pay at the time of receiving care should be totally irrelevant.

(d) The promotion of health is dependent in large measure on the more equitable distribution of wealth and food, integrated rural development, general education, appropriate population policy and other social and economic programmes. Since health is so closely linked with social and economic development, we need:

(i) to ensure that health considerations are adequately taken into account - for example, by economic and planning authorities - in programmes of agricultural, industrial and educational development, and

(ii) to provide health care in close association with other community services.

(e) The obstacles to health will, for a long time to come, be economic rather than technical. This has obvious implications for those who operate the health services. It is more than ever necessary to devise programmes and technology that are suited to countries with limited resources, to make more extensive use of community health aides and other auxiliaries. and to pool resources. Some of the health problems contributing most to sickness and death can be prevented and even remedied by simple and inexpensive technology applied through well-managed systems; breast-feeding, immunization and oral rehydration are notable examples.

(f) Adopting the basic objective of expanding the coverage of health services, we consider that the development of primary health care is an essential element in health policy. By such a policy some countries have converted an expensive service for a privileged few into a basic, adequate service for the people as a whole.

(g) Health care for the community includes a wide range of services. We mention only a few: special care for mothers and children, including immunization and family planning, safe drinking water supplies, health education and rehabilitation. Health care of such a varied character requires, besides the doctor, the nurse and the pharmacist, a wide range of workers - the administrator, the environmental engineer, the school teacher, the health aide, and even - until she can be phased out in all the countries - the traditional midwife. Team-work is therefore fundamental, and the new systems of education must prepare doctors and other health workers to be effective members of the team.

(h) The drugs now available for medical care are numerous, complex, powerful and potentially harmful. They take up a large and increasing share of health costs. It is therefore essential to continue to develop and put into effect a pharmaceutical policy and technology that will reduce drug costs while maintaining efficacy.

(i) Health education, with emphasis on the responsibility of the individual and an active community participation, is an indispensable part of the health programme.

(j) Within each country priority should be given to those who are most vulnerable or underserved, namely, those living in the rural areas, the poor, young children and expectant and nursing mothers.

(k) Fundamental changes are needed in the attitudes of doctors and other health workers - attitudes towards service in the Caribbean and especially in the rural areas as well as towards preventive and social action and the solution of the health problems. These changes in attitude require, for their part, fundamental changes in systems of education with respect to relevance to the needs of the health services and of the people of the Community.

III. The Priorities

11. The CARICOM Health Ministers stated in their historic Declaration on Regional Health Policy in 1978:

12. "In determining health priorities for the Caribbean Community, we have adopted as our criteria:

(a) The magnitude of a given problem,

(b) Its social and economic importance;

(c) Its susceptibility to preventive and remedial measures.

13. Applying these criteria, we have arrived at the following determination of the priorities:

(a) The strengthening of management at all levels of the health services, giving priority to primary health care;

(b) The education, training and retention of health personnel and especially those involved in the delivery of primary health care;

(c) The health education of the public, with particular emphasis on the responsibility of the individual and active community involvement;

(d) Environmental health, giving priority to the quantity and quality of drinking water supplies and the sanitary disposal of human excreta;

(e) Food and nutrition, including a programme that makes immediate provision for the needs of the vulnerable groups, namely, children under five years of age, expectant and nursing mothers, and the poor;

(f) The health of mothers and children, with particular emphasis on total coverage of maternal and child health care during pregnancy, childbirth and childhood.

IV. The Regional Approach up to the Present

14. Until recently, in the CARICOM Secretariat we have seen our principal contribution to health technology as the construction of a strategy framework, which, if it does not spell out the details of appropriate technology, certainly gives ample guidelines about relevant technology and has the inestimable advantage of being prepared with the full participation of our own Caribbean specialists.

15. The specific achievements of regional co-operation in this respect may be summarized as follows:

(a) Regional Health Policy

The issue three years ago of a Ministerial Declaration on Regional Health Policy.

(b) Management Development

A three-year Management Development Project, serving the so-called less developed countries and Barbados and providing basic management training to all levels of health staff. Among the managerial issues that we have to tackle in member States are the inclusion of the health component in socio-economic development; a system of close co-operation with other health-related sectors such as agriculture, education, social welfare, planning and finance, and the institutionalization for the Community as a whole of a system of training in health management.

(c) Health Manpower Development

We are in the course of setting up a small health manpower unit in CARICOM.

We must involve both our universities even more actively in the study of the health situation and the strengthening of the health services in member countries, including appropriate technology.

We have achieved more effective co-ordination between the Medical Faculty of the University of the West Indies, which trains doctors, on the one hand, and the Ministries of Health, who employ them on the other.

We should initiate the task of providing orientation in educational techniques to those who are responsible for training health staff, including university faculty members.

We need to promote continuing education for all health staff.

(d) Epidemiological Surveillance

A plan for epidemiological surveillance, which is calculated to provide us with prompt and accurate information about the incidence of disease and the causative factors and which culminated in the establishment of the Caribbean Epidemiology Centre in Trinidad, ably administered, for the time being, by the Pan American Health Organization/World Health Organization. Serious problems remain in the broader area of disease control, for example, an effective immunization programme, control of sexually transmitted disease, leprosy and tuberculosis, and Aedes aegypti eradication.

Diabetes and high blood pressure urgently require a technology for mass control. There are at least 100,000 diabetics and many more hypertensives in the Caribbean Community.

There are about 5,000 new cancer cases a year in the Caribbean Community. Many of them are cases of cancer of the breast and of the cervix (neck of the womb). Many present themselves for attention when they are already far advanced. A control programme has been prepared but awaits implementation; it comprises cancer registries, early detection clinics, cancer education, a department of oncology at the University of the West Indies, and research.

(e) Environmental Health

An Environmental Health Strategy, formulated at a Caribbean multidisciplinary workshop in 1979, dealing with such basic issues as the quantity and quality of drinking water supplies; the disposal of excreta and other waste; industrial and coastal pollution, and pesticide management. A number of important subjects have now been included in the Programme: the safety of food; the health of the Caribbean worker; traffic accidents; disaster preparedness, and modern concepts of human ecology.

(f) Maternal and Child Health Strategy

A comprehensive Maternal and Child Health Strategy, which was prepared at an historic meeting of Caribbean specialists in Antigua in 1975, and which stresses breast-feeding; the feeding of the weaning age group; the expansion of immunization programmes; more definitive programmes in family planning, and more ready access to safe legal abortion.

(g) Food and Nutrition Strategy

The formulation of a Food and Nutrition Strategy, and which was brought to the penultimate stage of preparation at a Caribbean multisectoral meeting in Jamaica in November 1980. The implications for appropriate technology are multisectoral and numerous.

(h) Dental Health Strategy

The Dental Health Strategy, which was prepared by Caribbean dentists convened by the Secretariat, in co-operation with the Pan American Health Organization, in Saint Lucia in 1977 and which lays emphasis on preventive work among children, the use of fluorides, the training and utilization of auxiliaries and the dental health education of the public.

(i) Regional Pharmaceutical Policy

We have begun to prepare a regional pharmaceutical policy and to establish a Caribbean Centre for Pharmaceuticals. Plainly, there are technological issues surrounding the need to protect the people of the Caribbean against unessential, expensive pharmaceuticals without sacrificing efficacy.

(j) Health Education and Community Participation

One of the most serious technological gaps in the Caribbean health system is that related to our responsibility to develop without delay a programme that will help the people of the Caribbean, children as well as adults, to identify for themselves the most important community health problems, to feel responsible for solving these problems, to make the necessary changes in their attitudes, habits and practices, and to make full use of services provided, so that "Health for all by year 2000" is achieved by the actions and efforts of the people themselves.

(k) Mental Health and the Care of Mental Patients

Mental health and the care of mental patients are seriously neglected fields. A large proportion of the hospital beds maintained in the Caribbean Community are for mental patients. It is estimated that approximately half the total volume of illness is of psychological origin. Plainly this state of affairs needs early attention.

(l) Maintenance

The maintenance of hospitals, medical equipment and other health care facilities is a neglected field. The Caribbean has been described as "the graveyard of medical equipment". The total cost of plant is estimated at 1,000 million dollars. A large proportion is at present in disuse because of disrepair. So this is a subject that has economic significance as well as a bearing on the care of patients and the morale of the staff. A regional project to provide expertise and training in this field is at present under consideration by a major international agency.

(m) Laboratory Services

There is urgent need to strengthen diagnostic facilities both for clinical medicine and for community health, including food hygiene and veterinary public health. A survey of laboratory services, with special attention to the less developed countries, was carried out in 1976. The project aimed at carrying out the recommendations of this survey has now been approved for funding by the United Nations Development Programme and is about to be implemented.

(n) Health Information Systems

At its last meeting, the Ministerial Conference stated that it was "convinced of the profound significance of national health information systems as a basis for rational decision-making, planning and evaluation". A more general mandate had been given in the Declaration on Health, which also requested "prompt and systematic annual reporting by each Ministry of Health, utilizing the agreed performa". The Secretariat is now following up the findings of the Workshop that we conducted under the aegis of the Health Management Development Project in Grenada in July 1980 and is implementing its recommendations.

(o) Health Laws

The health laws in the Caribbean countries are out of date. The Secretariat is mandated to reactivate a project for their revision and harmonization.

(p) Research

Research is becoming increasingly relevant to the needs of the people of the Caribbean. The Secretariat's objective is to work closely with the Commonwealth Caribbean Medical Research Council (CCMRC) and promote operational research, research into appropriate technology, new methods of delivery of health care, increased productivity in the health sector, and studies on costs and financing.

V. Future Goal and Objectives

16. Our goal in the CARICOM Secretariat must be to promote Caribbean self-reliance in health technology and to develop a technology designed to deal with the health issues outlined in this paper.

Our intermediate objectives will be:

(i) to stimulate and assist the development in the Caribbean Community of appropriate technology for health;

(ii) to stimulate and help the countries to develop, adapt, test and apply appropriate technology for specific health areas;

(iii) to promote the preparation of comprehensive lists of equipment and supplies, giving priority to Primary Health Care;

(iv) to collaborate closely with other interested agencies, such as the two Universities and the Pan American Health Organization/World Health Organization, the latter already having taken certain global and regional initiatives.

VI. Outline of Regional Action - Programme for the Future

17. We have now to look forward to the early preparation of a CARICOM action programme on appropriate technology for health.

18. We should not now anticipate in too much detail the programme of work that will emerge after consultation with the Governments and with the Caribbean specialists, but we can perhaps assume that it will include at least the following six components:

(i) Promotion - including mechanisms for the exchange of ideas by multidisciplinary groups from health and health-related sectors; teaching the concept in our medical and nursing schools and the Allied Health Training Project; and the building of a technological component into all health and health-related programmes.

(ii) Information - collaboration with the Governments and agencies in the collection and dissemination of information about appropriate technology.

(iii) Development - including the even more precise analysis of priority health needs in the Caribbean; the involvement of behavioural scientists so as to make sure that cultural factors are adequately taken into account, as well as to help us to overcome resistance to change; the preparation of simple guides on Primary Health Care, especially for conditions of major public health importance such as diarrhoeal diseases; and the preparation of manuals on supplies management and the maintenance and repair of equipment.

(iv) Implementation - to stimulate and assist member countries to apply appropriate technology.

(v) Research - promote research for the development of new appropriate technology and identify agencies and individuals to constitute intersectoral task forces for research and development.

(v) Funding - to stimulate and assist member States to find budgetary and extra-budgetary support for appropriate technology for health.

Conclusion

19. Such then is the basis upon which we must now develop a programme of appropriate technology in health for the Caribbean Community.

20. If the considerations have been presented in somewhat telegraphic style, this is because of limitations of time and space, which compel us to deal with the essentials and to eschew the frills.

21. If we were to select the two most important technological issues with which this paper is concerned, they would be, firstly, relevance in education in medicine and the other health sciences. And when we say relevance in this context, we refer particularly to that type of training which produces commitment in the health worker, commitment to serve the people of the Caribbean and to help them to ensure that their health services are truly community oriented.

22. Secondly, the time is plainly ripe for us to develop a technology for involving all the Caribbean people, children as well as adults, in the health activities. This is the greatest public health issue of our time and one which should govern our policy on health technology in the new decade.

23. Specifically, we must develop a programme that will imbue every West Indian with a feeling of personal, individual responsibility for solving the health problems.

Annex 1

WHAT IS HEALTH IN THE CARIBBEAN CONTEXT? */

What is health in the Caribbean context? It is certainly not just the absence of disease. It is much more. It means that working people are fit and productive and able to acquire and use new skills, that school children are fit and able to benefit from their education and that their physical and mental development has not been permanently impaired by malnutrition in infancy. It means that every Caribbean family has the means either to produce or to buy the food that it needs. It means that the serious health hazards of the Caribbean environment and the resulting communicable diseases are brought under control. It means that mothers and children receive special care. It means that the teeth and gums are well looked after. It means that people are emotionally well-adjusted individually, in families and as communities, and free from dependence on alcohol, tobacco or other drugs. It means that health care is delivered by teams of well trained and deeply committed health workers. It means that there is dynamic and creative management of the health services. It means that people have determined for themselves the most important community health problems and are actively involved in the programmes for solving them.

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*/ Excerpt, slightly amended, of a Paper presented by Dr. Philip Boyd at the Medical Convention, Tobago, 17 October 1975.