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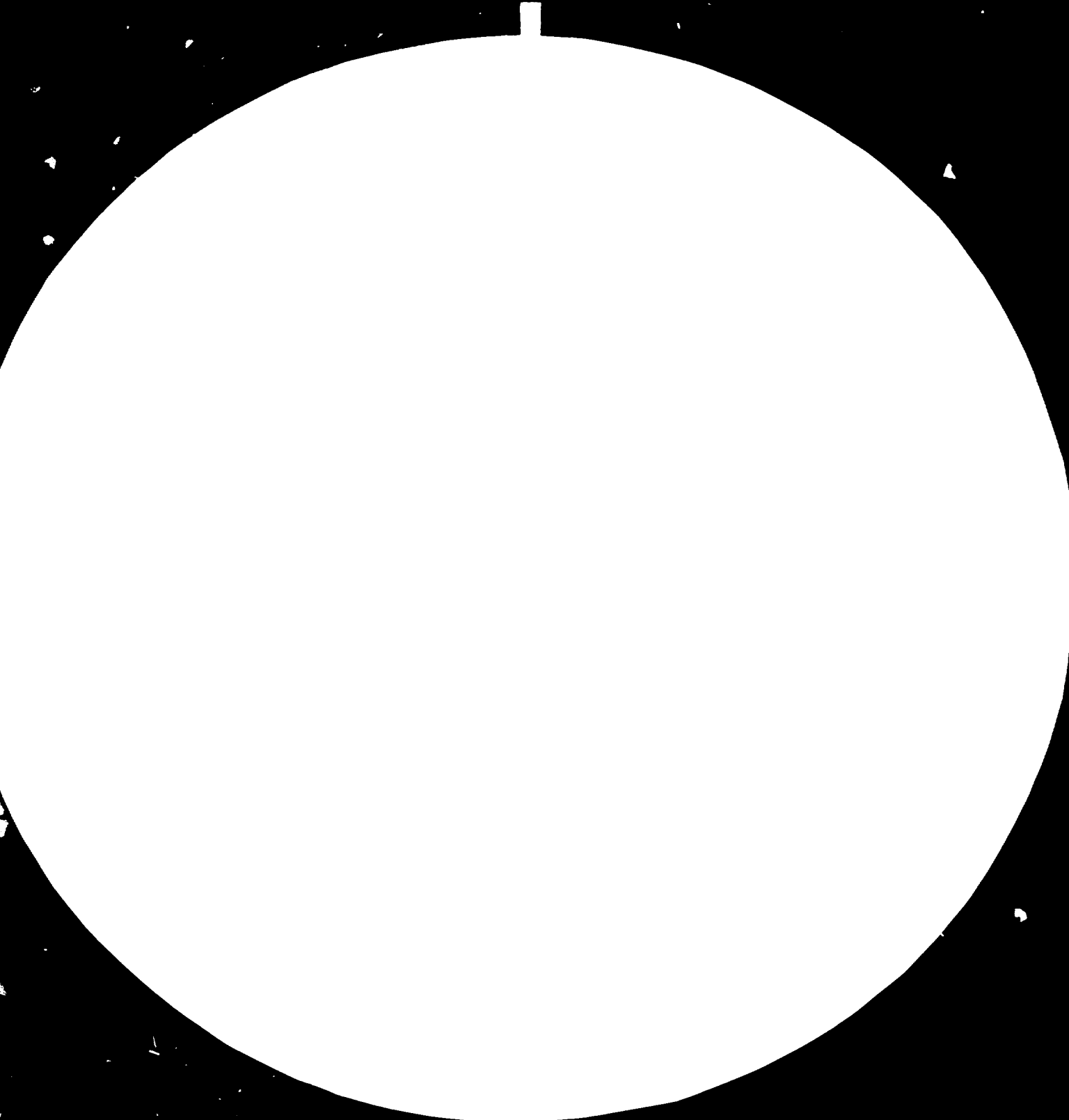
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ASSISTANCE TO  
THE CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI).

PROJECT DP/TRI/69/505

TRINIDAD AND TOBAGO.

Terminal Report prepared

by Mr. Rich. H. Westergaard, Consultant of the  
United Nations Industrial Development Organization (UNIDO).

October 1981

This report has not been cleared with the United Nations Industrial Development Organization which does not therefore necessarily share the views presented.

BASIC DATA

1. Characteristics of the Project

Country:	Trinidad and Tobago
Project Title and No.	Caribbean Industrial Research Institute (CARIRI) DP/TRI/69/505
Type of Institution:	Autonomous, Government sponsored and supported, multipurpose, multidiscipline, multibranch, service and R+D Institute.
Project Function:	"Grass roots" institution building.
Economic Scope:	UN total input up to end of 1980 1,124,731 US\$ .....
	Government total input up to end of 1980 ~ 10 M US\$ .....

#### SUMMARY

CARIRI is a multidiscipline, multi-purpose industrial research and service institute (IRSI). UNIDO has been giving assistance in the planning phase as well as in implementing the plans. It has been a typical institution building project. Phase I started when the first Project Manager was fielded in October 1969. Duration of Phase I was 5 years. It was followed up by Phase II, supposed to last 3 years, until 1978. But implementation in Phase II was inhibited by circumstances beyond UNDP/UNIDO control. The project will be formally terminated before the end of 1981. All components of assistance except 5 man-years of experts have been delivered. The 5 man-years of experts can probably be used in a new Government executed project, now under negotiation.

CARIRI is rather unique among UNIDO assisted IRSIs. The plan of operation secured it a degree of autonomy seldom found in developing countries. The two first project managers also were the responsible directors of the institute. Phase I was delayed about 9 months because the Government and the first project manager insisted on changing the plan of operation more: flexibility, autonomy and government contribution. Otherwise, Phase I went smoothly and the growth of CARIRI soon exceeded the figures in the plan of operation.

Implementation of Phase II was difficult. The main reasons were:

- The UN financial crisis 1976-77
- No Board of Management from February -75 to December -76
- No CTA from June -75 to December -77, and after October -78
- Since 1978, the Trinidad + Tobago Government has made an effort to reshape its research policy and has been reluctant to accept new experts for CARIRI

The question of the future structure of the countries' research coordination and CARIRI's role are still pending. This situation creates an uncertainty for CARIRI, which has been and still is counterproductive to further progress.

CARIRI now has a staff of some 170 and plans have been approved for expanding to 240. It has outgrown its originally very adequate premises, and will in 1982 take into use a second building on a different site.

CARIRI has good equipment, well qualified staff and is recognized by industry for its services. Also Government departments and Government owned industry use CARIRI, the latter not as much as desirable. The output in terms of paid project work peaked in 1976, when CARIRI recovered almost 30% of its operating expenses. Since then, the volume of paid project work has stagnated - despite increased staff. In 1980, less than 10% of the operating expenses were recovered by project income. The same factors which inhibited implementation of the UNIDO assistance have contributed to this disappointing development.

Trinidad is a prosperous country with a rapidly growing industry, including some large scale factories established by the Government. CARIRI ought to have a very good market for its services. It needs re-structuring of its funding system, streamlining of its management routines and more involvement in the Government controlled sector.

Among UNIDO's IRSI building projects, CARIRI is a most successful one, from which much can be learnt.



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ABBREVIATIONS

CARIRI	:	Caribbean Industrial Research Institute
FAO	:	Food and Agriculture Organization
IRSI	:	Industrial Research and Service Institute
RPC	:	Research and Productivity Council (Canada)
UNDP	:	United Nations Development Programme
UNESCO	:	United Nations Educational Social and Cultural Organization
UNIDO	:	United Nations Industrial Development Organization
UWI	:	University of the West Indies (Trinidad and Tobago)
WAITRO	:	World Association of Industrial and Technological Research Organizations
DFC	:	Development Finance Corporation (Trinidad and Tobago)
IDC	:	Industrial Development Corporation (Trinidad and Tobago)
CDB	:	Caribbean Development Bank
NIHE ) NIHERST)	:	National Institute of Higher Education (Research, Science and Technology) (Trinidad and Tobago)

Historical Review of Events

- September 1966 : Preliminary request for assistance
- March 1967 : Preparatory mission - two men
- April 1967 : Preparatory mission - one man -  
resulted in the Plan of Operation  
expected to be signed January 1969.

Project starts unofficially before  
signature of Plan of Operation

- October 1969 : The first UNIDO Project Manager (PM)  
Rich. H. Westergaard, arrived in the  
field.
- 30 December 1969 : Revised Plan of Operation presented  
to the Resident Representative
- 1 February 1970 : First national, professional counterpart  
staff member hired.
- 15 February 1970 : Project Manager, his UN secretary and  
one national staff member moved into  
CARIRI's new premises.
- March 1970 : Temporary Board of Management -  
Prof. K. Julien, Mr. E. Moore and Project  
Manager was formed and a budget of  
\$50,000 made available. A national  
Office Manager and an Accountant were  
recruited and other national staff.  
Some consulting work was started.

Project officially started - Phase I

- 5 August 1970 : The revised Plan of Operation was  
accepted by UNDP/UNIDO and signed for  
Phase I - 5 years duration.
- 15 September 1970 : National Co-Director and counterpart  
to Project Manager - Mr. Hollis Charles -  
joined CARIRI.
- 18 December 1970 : A Board of Management was appointed.
- 5 March 1971 : First Board Meeting
- April 1971 : CARIRI legally established by Act of  
Parliament No. 19 of 1971

June 1971 to October 1973 : Renovation of CARIRI building

31 March 1972 : Second Project Manager, Mr. Eiliv Sødahl, arrives.

April 1973 : Mid-Project Review recommended a 3-year Phase II from 1975 - 1977.

1 July 1973 : Mr. Hollis Charles, Co-Director, is appointed as National Director of CARIRI.

June 1973 : A national Petroleum Testing Laboratory set up.

18 August 1973 : Second Project Manager (Eiliv Sødahl) departs.

4 September 1973 : First Chief Technical Adviser, Mr. C. L. Wrenshall, arrives.

April 1974 to 1977 : Twinning with RPC (Research & Productivity Centre, Canada) starts.

PHASE II

14 April 1975 : Project Document Phase II signed.

4 June 1975 : Chief Technical Adviser (C.L. Wrenshall) departs.

4 June 1975 to 5 February 1977 : No Chief Technical Adviser, at times no long-term experts.

February 1975 to December 1976 : No Board of Management

1976 to 1977 : UN financial crisis

1977 : Government White Paper on NIHE

5 February 1977 : Second Chief Technical Adviser (Prof. G.S. Ramaswamy) arrives

August 1977 : Preliminary draft request for Phase III presented to Resident Representative

1977 : Twinning arrangement ended.

April 1978 : Review Mission headed by H. Fahlstrom.

6 October 1978 : The second and last Chief Technical  
Adviser (Prof. Ramaswamy) left the  
project.

1978 to 1980 : Little or no implementation takes  
place.

May 1979 : Monitoring visit by V. A. Gorbunov

1981 : Implementation of assistance increased  
somewhat, but by 1 July 1981 US\$369,443  
still uncommitted.

October 1981 : Project in the process of being terminated.  
5 man-year experts will not be used under  
this project.

LIST OF UN EXPERTS ATTACHED TO CARIRI

Project Manager ////////

UN EXPERT —————

NAMES	COUNTRY OF ORIGIN	YEARS									
		1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
R.H. Westergaard PROJECT MANAGER/DIRECTOR	NORWAY	<u>////////</u>									
Alfred Hoffman CHEMIST	U.K.		<u>———</u>								
Donald Longmire MECHANICAL ENGINEER	U.S.A.				<u>———</u>						
John E.S. Whitney PLASTICS TECHNOLOGY	U.K.				<u>4 MTHS</u>						
Wendell P. Clark WOOD TECHNOLOGY	U.S.A.				<u>3 MTHS</u>						
Mohammed E. Selim CERAMICS AND GLASS	EGYPT				<u>3 MTHS</u>						
U.A. Halvorsen CIVIL ENGINEER (CONSTR.)	NORWAY				<u>—————</u>						
A.K. Bhatnagar CHEMICAL ENGINEER	INDIA				<u>—————</u>						
Eiliv I. Sodahl PROJECT MANAGER/DIRECTOR	NORWAY				<u>—————</u>						
Hollis Charles DIRECTOR	TRINIDAD AND TOBAGO					<u>////////</u>					
Clyde Rasmussen MARKETING	U.S.A.					<u>6 MTHS</u>					
R.N.V. Iyengar FOOD PACKAGING	INDIA					<u>3 MTHS</u>					
C.L. Wrenshall CHIEF TECHNICAL ADVISER	U.S.A.					<u>—————</u>					
Brinton C Brown MINING ENGINEER	U.S.A.						<u>4 MTHS</u>				
Arnold Braun TELECOMMUNICATIONS	WEST GERMANY						<u>6 MTHS</u>				
Jens A. Rinnan INDUSTRIAL ENGINEER	U.S.A.						<u>6 MTHS</u>		<u>———</u>		
Kaoru Iwasaki LABORATORY	JAPAN								<u>3 MTHS</u>		
A.S. Bhaduri MECHANICAL TESTING	INDIA									<u>———</u>	
H.C. Visvesvaraya R & D MANAGEMENT	INDIA									<u>6 WKS</u>	
G.S. Ramaswamy CHIEF TECHNICAL ADVISER	INDIA									<u>20 MTHS</u>	
		1969	1970	1971	1972	1973	1974	1975	1976	1977	1978

LIST OF DOCUMENTATION

The documents used for making the profile study  
are the following :

UNIDO Registry File No.

(1)	OA 420 TRI (1) Part A	From: December 1967 To : May 1970
(2)	OA 420 TRI (1) Part B	From: June 1970 To : April 1971
(3)	OA 420 TRI (1) Part C	From: May 1971 To : February 1972
(4)	OA 420 TRI (1) Part D	From: March 1972 To : May 1972
(5)	OA 420 TRI (1) Part E	From: June 1972 To : March 1973
(6)	OA 321 TRI (3) Part A	From: April 1973 To : April 1974
(7)	OA 321 TRI (3) Part B	From: May 1974 To : December 1974
(8)	OA 321 TRI (3) Part C	From: January 1975 To : July 1975
(9)	OA 321 TRI (8) Part A	From: February 1975 To : December 1976
(10)	OA 321 TRI (8) Part B	From: January 1977 To : January 1978



LIST OF KEY DOCUMENTS

1. - Plan of Operations Phase I signed 5 August 1970
2. - Project Document Phase II signed 24 April 1975
3. - Preliminary Draft Request for Phase III - August 1977
4. - CARIRI's Annual Reports - 1970 to 1979
5. - White Paper on National Institute of Higher Education (NIHE) (research, science and technology) 1977
6. - Draft Comments by CARIRI on the White Paper on National Institute of Higher Education (NIHE) of April 1978
7. - Joint Evaluation Report of the Third Year Linkage Programme CARIRI/RPC of 5 March 1977
8. - Review Mission by H. Fahlstrom - April 1978
9. - First P.M.'s final report - 19 June 1972
10. - Second P.M.'s final report
11. - First CTA's final report - 10 May 1975
12. - Second CTA's final report - 1 September 1978
13. - Monitoring Mission Report by A. Gorbunov - 28 May 1979
14. - Draft Project Document, new Government executed assistance project - titled: Assistance to CARIRI TRI/79/020/A/G1/99

FOREWORD

UNDP/UNIDO has assisted the Caribbean Industrial Research Institute (CARIRI) since it first started in 1969 (Institute Building Project). Phase I was concluded in 1974. Phase II is now in the process of being terminated.

The present document is the Terminal Report for the entire Project. There is no Terminal Report for Phase I or II, as such, but the Project Manager's and Chief Technical Adviser's Final Reports provide a good deal of the information. The present Terminal Report tries to give a comprehensive review. An effort has been made to keep it short and focus on essentials.

The Report may hopefully be useful for the Government in the revaluation of its research policy now taking place. The report ought to be useful when the question of further assistance to CARIRI is negotiated.

PART I - PHASE I

1. The Plan of Operation

The original concept of CARIRE presented to UNIDO in the first request was by UNIDO considered much too ambitious. Two pre-project missions resulted in a much less ambitious Plan of Operation. This plan had been approved by all three parties (but not signed). When the first Project Manager arrived in the field in October 1969, he soon found that in certain respects the Plan was unsatisfactory:

- The UN Contribution lacked flexibility with respect to experts and fellowships, although it was sufficient in terms of total budget.
- It did not secure the necessary autonomy.
- The Government Contribution needed very considerable expansion.

Against the advice of the UN Resident Representative, the Project Manager, strongly encouraged and supported by the Government, insisted on changing the Plan of Operation and submitted a Revised Plan (30 December 1969).

During the waiting time before signature, useful preparatory work was done. A Counterpart Director and other national staff were recruited and plans for improving the premises were worked out. Actually, the Project Manager was asked to go ahead and not wait for signature of the Plan of Operation. A temporary Board and Budget were arranged. Changing the Plan of Operation did no harm. It delayed the inputs from UNIDO, but it would not have been feasible to implement the assistance before some counterpart staff had been recruited.

2. Land and Buildings

For accommodation the Government of Trinidad and Tobago provided CARIRI with two beautiful modern buildings on the Campus of The University of the West Indies, designed by American architects as part of a US gift to Trinidad and Tobago for use of its territory for Naval and Air Bases during World War II. By the end of 1969, the main building and a pilot plant building were ready and taken over by CARIRI shortly after.

The planners of the building did not know exactly what the future use of the building would be and it proved necessary to make some changes, which the Government accepted and paid for. The building had no windows, only wooden louvres, no air-conditioning and no ladies toilet. Birds were nesting in the laboratories and bugs and dust blew through all rooms. The humidity often exceeded 90%. Full glazing and air conditioning was installed and a new mezzanine floor provided more office space, which was badly needed. After this renovation the premises were very satisfactory until activity increased so much that they became too small.

3. Autonomy

Trinidad and Tobago is a country with a mixed economy. Import is restricted. Foreign investment is welcomed and pioneer privileges are given, but national control is maintained. Besides the Private sector, there is a strong Government-owned Industrial sector. Because of petroleum etc. the economy of Trinidad and Tobago is strong.

In such a context, an IRSI needs to have considerable autonomy. This was secured in the revised Plan of Operation. For example, CARIRI was allowed to pay competitive salaries and was therefore able to attract good people: nationals living abroad and people from private industry, including the large Texaco Oil Refinery.

Government agencies giving projects to CARIRI had to pay for the work and so had most other clients. Project income did not go back to the Government, it came in addition to the normal budget and should be used at the discretion of the Board.

It is very difficult to achieve such a status for a Government Statutory Body such as an IRSI. Other similar institutions and Government Departments can rightly claim to be equally, or more, important and will want the same advantages. It cannot, at least not in the short-term, be claimed that the IRSI is so much more important. On the other hand, without autonomy it would be impossible for it to function on a high professional level.

In the first phase of establishment, the high degree of autonomy was probably the main reason for the exceptionally fast and successful building of this institution. Once well established, continued high autonomy is very desirable and if CARIRI shall be a "Centre of Excellence", it is a necessity. To the extent that CARIRI loses autonomy, it

must be expected to fall behind and lose its momentum and become more of a routine service institution unable to spearhead industrial progress. As could be expected, the autonomy has gradually been reduced and is now in danger of being lost in the process of institutional integration.

4. Staff Recruitment

In the initial phase, professionals of a high standard were reluctant to take up employment at CARIRI, having doubts about its future. But gradually it became evident that the Government sincerely wanted to make the project a success and nationals of Trinidad and Tobago working abroad or for the multinational companies in the Island started to consider CARIRI as a career opportunity. Good salaries and other benefits were offered. The professional staff and also technicians and administrative staff soon reached a satisfactory level. They were enthusiastic and eager.

At that time many UN Project Managers in Trinidad and Tobago had problems with being given local counterparts. CARIRI did not have that problem thanks to the autonomous status and strong support from the Government (executed by Mr. Eugenio Moore and Professor Ken Julien) and the unusual status of the Project Manager : lso being the Director of the Institute. CARIRI recruited the counterparts directly. The National Director, being the counterpart of the Project Manager, was the most important recruitment. Applications were received from people at the UWI and Government institutions with Ph.D's and research background, but it was decided to take a man with an industrial background and Mr. Hollis Charles was appointed. It seems that this was the right decision.

The training of technicians was not well established in Trinidad and Tobago, but despite this satisfactory technicians were found.

5. CARIRI's Policy

The final Plan of Operation of October 1969-1970 says about "Fields of Operation", paragraph 2.1:

- (a) Provide industry with technical services which will include the following:
  - (i) Collection and dissemination of technical information, including applicable standards specifications and quality control procedures;
  - (ii) Chemical analytic work particularly in connection with quality control testing in food industries and other local industries;
  - (iii) Physical (measurement) and material testing;
  - (iv) Engineering services, including assistance with establishing production lines, prototype designs, and maintenance and repair problems;
  - (v) Economic and technical feasibility studies including market surveys with a view to identifying bankable projects.
- (b) Advise the Government on the preparation of industrial standards and to carry out the associated testing and certifying;
- (c) To engage in industrial research programmes relating to industrial operations in the region. It is expected that such programmes will be undertaken as a result of specific contracts on a fee basis from Government and

interested industrial concerns. The Institute is expected to develop its capabilities in this respect on the basis of the technical advisory work undertaken during the earlier years of the project;

- (d) Provide training for counterpart staff in the above mentioned fields both through fellowships and on-the-job training by the international experts."

This plan has been followed except for paragraph (b), since an independent Bureau of Standards has been erected. Testing of petroleum has been added.

In the second Project Manager's memorandum on CARIRI's Policy of 4 July 1972, it is said:

"CARIRI's main purpose is to be a consultant and undertake jobs from the Government and industry on a fee-paying basis. It is strongly stressed that CARIRI shall concentrate on practical engineering work leaving academic or more basic scientific oriented research to other institutions."

The projects can in most cases be classified as belonging to one of the following groups:

- testing and analysing
- feasibility studies
- product or process development
- information services
- trouble shooting

It is necessary to ensure that a satisfactory amount of projects offer to our staff a certain professional challenge and the possibility of broadening their skill and know-how.



6. Growth Strategy

It was intended to start mainly as a service institute and to gradually go into research and development work and process and product development. As long as capabilities were limited, research and development projects would relate to simple processes and products for which engineering could be provided by CARIRI. Gradually more sophisticated work should be undertaken in response to clients needs. CARIRI did not build up its capabilities by doing mainly in-house research but by giving services to industry and the Government from the very beginning. In-house projects were used mainly to explore ideas which had the potential of becoming sponsored projects and to a lesser degree to build up staff capabilities.

Gradually as the industrialization of the country progressed, CARIRI was intended to shed off some activities which ought to have their own institute, as well as routine work when others were ready to take over. Until 1980 this had hardly happened. After 10 years the Government correctly recognized the need to reevaluate CARIRI's role: what CARIRI has to cover and what to assign to other institutions.

7. CARIRI's Subdivision in Sections

After 2 years a need to structure the organization resulted in forming the following sections, each headed by a senior professional:

Engineering and Economics  
Food and Chemistry  
Materials Technology and Testing  
Technical Information Service  
Technical Physics (Electronics)

In 1973, a Petroleum Laboratory became fully operational carrying out evaluations on local crude oils on a regular basis using a double shift system.

In 1975, the Economics Division, which was part of Engineering, became a separate division mainly because of the increased project inputs required. In 1977, it was expanded to include a Systems Research section and renamed Economics and Systems Research.

At present, the Institute is subdivided as follows:

- Food and Chemistry (including the Petroleum Lab.)
- Economics and Systems Research
- Electronics
- Engineering
- Materials Technology
- Technical Information Service
- Technical Services (Workshops, etc.)

8. Relationship with Government

The Government designated the Permanent Secretary, Ministry of Planning and Development to act as Government Project Representative (from 1969 to 1974, Mr. Eugenio Moore). He was responsible for assuring the cooperation of the Government. This was an excellent arrangement. The Government gave the CARIRI Project high priority and always provided the inputs required in the Plan of Operation and respected the autonomous status of CARIRI outlined in the Plan. Actually, the Government inputs soon exceeded the figures in the Plan. The Government had to pay for services from CARIRI and Government Ministries and Departments gave the Institute projects.

9. Relationship with Industry

Trinidad has a considerable industry, private and public, multinational and national. Soon CARIRI's image became one of being able to give useful service at a reasonable (subsidised) price quickly and without bureaucratic procedures. The clients could place confidential projects and have exclusive rights to the results. CARIRI was not considered a Government Agency and the clients felt confident of CARIRI's loyalty. The fact that CARIRI was UN sponsored increased the Institute's respect and credibility.

10. CARIRI as a Regional Institute

In the Plan of Operation, it was envisaged that CARIRI would also serve other countries in the Caribbean region. This is reflected in the name of the Institute. The Plan provided for establishment of an Industrial Research Council with representatives from other Islands. The first Project Manager warned against tying CARIRI to other countries or making it a really regional institution as this could hamper the Institute. The establishment of a Council with representatives from other islands was postponed and finally (on 1st August 1981) the Act of Parliament was amended deleting the demand for a Council but maintaining that "The object of the Institute shall be ...(h) to engage in industrial research programmes related to the needs of Trinidad and Tobago and the Caribbean region."

Projects outside of Trinidad and Tobago need the approval of the Board. Over the years there have been some such projects but work outside of Trinidad and Tobago has never been a significant activity. The demand for such service is not so great, because these countries have little industry.

CARIRI has not made an effort to sell its services outside of Trinidad and Tobago and on a few occasions the Board has turned down projects for other Caribbean islands.

11. CARIRI and the University of the West Indies (UWI)

The CARIRI concept was created at The University of the West Indies and Professor Ken Julien was the prime motivator. Integration into the UWI structure was originally intended, but the UN advisors did not recommend this, fearing CARIRI would become too academic. In the final plans the tie was relatively loose. UWI was represented by four of the eleven Board Members. In 1976, the Board had five UWI people and the Chairman. CARIRI has mainly benefitted from its location on the Campus. It is a pity that it has not been possible to secure land for CARIRI's expansion on the Campus or on the waste land to the west of CARIRI, as this may result in CARIRI having to move out of the UWI Campus.

12. CARIRI and the Bureau of Standards

The original Plan aimed at making CARIRI the National Bureau of Standards. The first Project Manager advised against putting CARIRI in a position where it would have to "police" industry, as this could repel industrial clients. The point was well taken and an independent Bureau of Standards has since been set up. It uses CARIRI's services.

13. Evaluation of Phase I

From an institute-building point of view, the project was certainly very successful, more so than most similar projects in other countries. The reasons for this success are of interest and are suggested below:

- The Government of Trinidad and Tobago gave the project high priority and timely provided all the inputs required, and more.
- The Government allowed CARIRI the autonomy which was necessary for efficient institute-building. (In developing countries such autonomy is very exceptional - also in Trinidad and Tobago).
- The Government, the Board of Management, the Project Manager/Directors and the National Director were all firmly set on serving the Government and Industry in a useful and practical way from the first day; fancy academic research or processes and product development without a sponsor, or undertaking projects for which the Institute was not qualified, was to be avoided.
- Trinidad and Tobago had sufficient industry to provide a market for CARIRI.
- Trinidad and Tobago had an industrial infrastructure thanks to the presence of the Petroleum Industry since the turn of the century and large well-organized multinational companies.
- Trinidad and Tobago had economic resources and educated people.
- UNDP/UNIDO gave not only assistance but also prestige to the project, and Trinidad and Tobago being an attractive place UNIDO had no problems finding good experts.

- The unique position of the Project Manager being simultaneously the Director (he was responsible for Government funds etc.) made it possible to resolve many difficulties which hampered other UN Project Managers in the country.

From a functional point of view, CARIRI must by the end of Phase I in 1974 be said to have been successful and well matched to the needs of the country. A good working relationship had been established with the various relevant Government agencies, industry and the University. Some critique could be heard that it was not so efficient in terms of output and not sufficiently sophisticated in terms of problems dealt with. But it was not fair to hold this against a young IRSI in a developing country.

PART 2 - PHASE II

1. Introduction

Technically speaking, Phase I ended with 1974 and Phase II began when the Project Document for Phase II was signed on 24 April 1975. From an operations point of view, Phase II started when the second Project Manager left CARIRI and Mr. Hollis Charles became Director, 1 July 1973 and the top UNIDO man came as Chief Technical Adviser.

Up to this time, progress had been fast. The first Chief Technical Adviser says in his Final Report:

"...the Project had been evaluated by a Mid-Term Review Mission which gave it an exceptionally favourable assessment. As a result of these factors, a remarkable euphoria was evident in the attitudes of all persons concerned with the Project."

But about this time, as Professor Julien expressed it: "the honeymoon was over". The machinery had been set up, but how well did it function? Did the staff and the organization develop satisfactorily? Was the output adequate? The Chief Technical Adviser, as a newcomer, saw it all with fresh eyes and was rather critical, and some of his critique was justified.

The CTA had come from an 8-year assignment in Thailand where he was Project Manager of a large prestige IRSI and he enjoyed a status there which was more glorious than that of a UNIDO CTA in Trinidad and Tobago. His yardstick of how things ought to be was not very relevant to Trinidad and Tobago and CARIRI and cooperation was difficult.

Nonetheless, important things were achieved. First of all, Phase II was secured and CARIRI continued its quantitative growth. The total staff increased from 75 to 95. In this period, additional space was secured in a nearby house. Better routines were introduced and it must be assumed that the professional standard was improved.

2. The Project Document Phase II - 1975/1978  
(Signed 24 April 1975)

The Project objectives do not deviate significantly from the original Plan of Operation. It was a continuation of inputs from UNIDO: experts, short-term consultants, fellowships and equipment and a carry over of unused inputs from Phase I. The new inputs were 120 man-months of experts and short-term consultants; 66 man-months of fellowships and US\$150,000 for Equipment, as recommended by the Mid-Term Review Mission.

The objectives of further assistance to CARIRI was the belief that CARIRI would thereby become more capable of promoting the industrialization process in Trinidad and Tobago. Assistance to the Less Developed Caribbean Islands is mentioned. Duration of Phase II was to be for 3 years and it was said explicitly that a Phase III was not foreseen.

3. Twining between CARIRI and RPC (Research and Productivity Council of Canada) 1974/1977

This arrangement was a WAITRO pilot project to try out the "twining" idea. The two institutes were of similar size and scope so they could "pass for twins". Actually, it was a linkage, not a twinning; rather a matter of bilateral technical assistance and technology transfer. The project lasted for 3 years and was not extended. It was financed by



bilateral aid from Canada and by UNIDO. It also costed CARIRI a good deal of man-hours. Total costs were:

CIDA	US\$ 37,700
UNIDO	US\$ 16,800
CARIRI	<u>US\$ 16,000</u>
	<u>US\$ 71,500</u>

There was an overspending of the budget of around US\$10,000.

A report of 5 March 1977 (key document 7) gives a good picture of the linkage programme. The arrangement contributed towards CARIRI's development to maturity. It was useful in assisting CARIRI to set up a Ceramics Lab. and in one case a sponsored project benefitted significantly. The project was probably not cost effective. A great deal of time and money had to be spent on travelling. Communication was at times slow and it proved somewhat difficult to find suitable targets for joint efforts. It was found that personal contact at the working level is absolutely essential and mutual staff visits are necessary and thus much travelling is required. One lesson learned was that the top Management of both institutes must carry overall responsibility and take an active interest in the cooperation. Another lesson learned was that a period of getting acquainted is needed before defining specific projects. If a Developed Country intervenes in an ongoing project, this may cause resentment by the staff of the Less Developed Country. New projects are easier in this respect.

4. Chief Technical Adviser Interregnum

The first Chief Technical Adviser, Mr. C.L. Wrenshall, retired on 4 June 1975 and Mr. U.A. Halvorsen, Adviser on Construction Materials then acted as Chief Technical Adviser for a while. The recruitment of a new Chief Technical Adviser was behind schedule. The Job Description is dated 8 September 1975 and Mr. Halvorsen left in September 1975.

In the absence of the CTA from September 1975 to February 1977, the UN administrative functions at CARIRI were carried out by the UN administrative Assistant, Ms. April Jones, who came to CARIRI as the first Project Manager's secretary. During the period, 2 international experts and 3 fellowships were fielded; Purchase Orders for equipment totalling US\$45,455 were placed for the Project and Job Descriptions were prepared in consultation with the Director of CARIRI. Responsibility for all UN equipment housed at CARIRI was handed over to the UNDP Office. In order to ensure unbroken records, semi-annual progress reports were prepared by Ms. Jones and submitted to UNDP, Port-of-Spain and UNIDO, Vienna.

In a letter of 10 November from CARIFI, it appears that the recruitment of the CTA was underway. Prof. G.S. Ramaswamy, whom Mr. Charles had met in India was recommended by him although he was not among the candidates originally submitted by UNIDO. In a letter of 16 March, he was recommended as being the Government's first choice. He was recruited and finally arrived on 5 February 1977.

5. CARIRI Board of Management Interregnum - February 1975 to 28 December 1976

The first Board of CARIRI was appointed on 5 March 1971 for 2 years and was then reappointed for another two years. Its term came to an end in February 1975, and although no new Board had been appointed, it ceased to function. After 20 months, the Government finally appointed a new Board.

It was very difficult for CARIRI to function without a Board and great care had to be exercised by CARIRI and the Permanent Secretary of Finance, Planning and Development to avoid making commitments beyond their legal terms of reference.

6. The period of the second CTA

Professor Ramaswamy, born 1923, had an excellent background in Civil Engineering, Research and UN work as well. He enjoyed a high professional reputation. He held several patents, showing that he was both keen and creative.

Prof. Ramaswamy immediately started to push for involving CARIRI more in building research. He seemed to have been a very active policy maker and very soon made contacts with top people in Government etc. to an extent which probably exceeded his terms of reference.

In his first letter report from the field, dated 15 December 1977, he said that CARIRI is doing well, but:

"the accent has however been on ad hoc studies on problems that are of immediate concern to local industry."

(This is correct and is in agreement with the policy of CARIRI). In a document signed 19 April 1977 in connection with a possible Phase III, he outlines very ambitious plans for CARIRI, proposing that it should deal with:

- problems related to the building industry and mass housing programmes;
- setting up a computer centre and the development of computer software;
- setting up research and development facilities for sugar and sugar by-products;
- development of an environmental engineering section

- electronic instrument and control engineering;
- setting up a centre for science policy, appropriate technology and transfer of technology.

When he arrived early in 1977, the Project was very much behind schedule. The reasons given by CARIRI were: UNDP financial constraints, lack of a CARIRI Board of Management and the absence of a UN CTA since August 1975. A re-scheduling was made.

Also during Prof. Ramaswamy's period, implementation of the UNIDO inputs continued to be unsatisfactory. The main problem was recruitment of experts. The CTA produced job descriptions, UNIDO presented candidates acceptable to CARIRI, but the Government, for reasons not on record, did not finalise the recruitment by clearing the candidates. As can be seen on the List of Directors and UN Experts, Page viii no expert was approved during his period or thereafter.

7 April - 26 April 1978, there was a Review Mission DP/TRI/69/505 led by H. Fahlstrom of UNIDO. A 20- page report gives a favourable description of CARIRI. He regrets not being able to present objective criteria of its contribution to the country. He discusses the plans for a Phase III and the Government's plans for creating a more integrated system for co-ordinating research and higher education (NIHE). At this time, the question of extending Prof. Ramaswamy's contract was being processed. He had indicated interest in being CTA for Phase III, but for reasons not on record UNIDO did not approve an extension despite the Government's request for this. His contract was extended for three more months to complete a Project Document amendment.

From conversations with people in Vienna and Trinidad, it seems that he had severe problems getting along with both UN persons and nationals of CARIRI. This was probably one reason why UNIDO did not want to extend his contract.

The latest monitoring mission was undertaken by Mr. V. Gorbunov in May 1979. He says among other things, on Page 4 of his Mission Report:

"Phase II of the Project Assistance to CARIRI, (DP/TRI/69/505) has been under implementation for the past four years. Just a little more than two years ago it was a very successful project having good relations with both the counterpart institute and the Government. Unfortunately from the time of the beginning of the reconstruction period\*, the project began to deteriorate slowly and for more than one year we were obliged to work without any legal basis, i.e. without a project revision, despite our repeated requests. (Project revision 'L' was submitted by us on 5 January 1977 and only received back in June 1978). In April 1978 a UNDP/UNIDO Review Mission was undertaken. (Mr. Fahlstrom from UNIDO paid a visit to Trinidad and Tobago). The Mission made various recommendations concerning the project, to which we had no reaction from the UNDP Office or the Government until May."

7. PHASE II - Problems

Apart from a delayed start, the Project progressed smoothly up to about 1975, that is to say, throughout Phase I. In Phase II the UN inputs did no longer materialize as planned.

\* Refers to the NIHE concept.

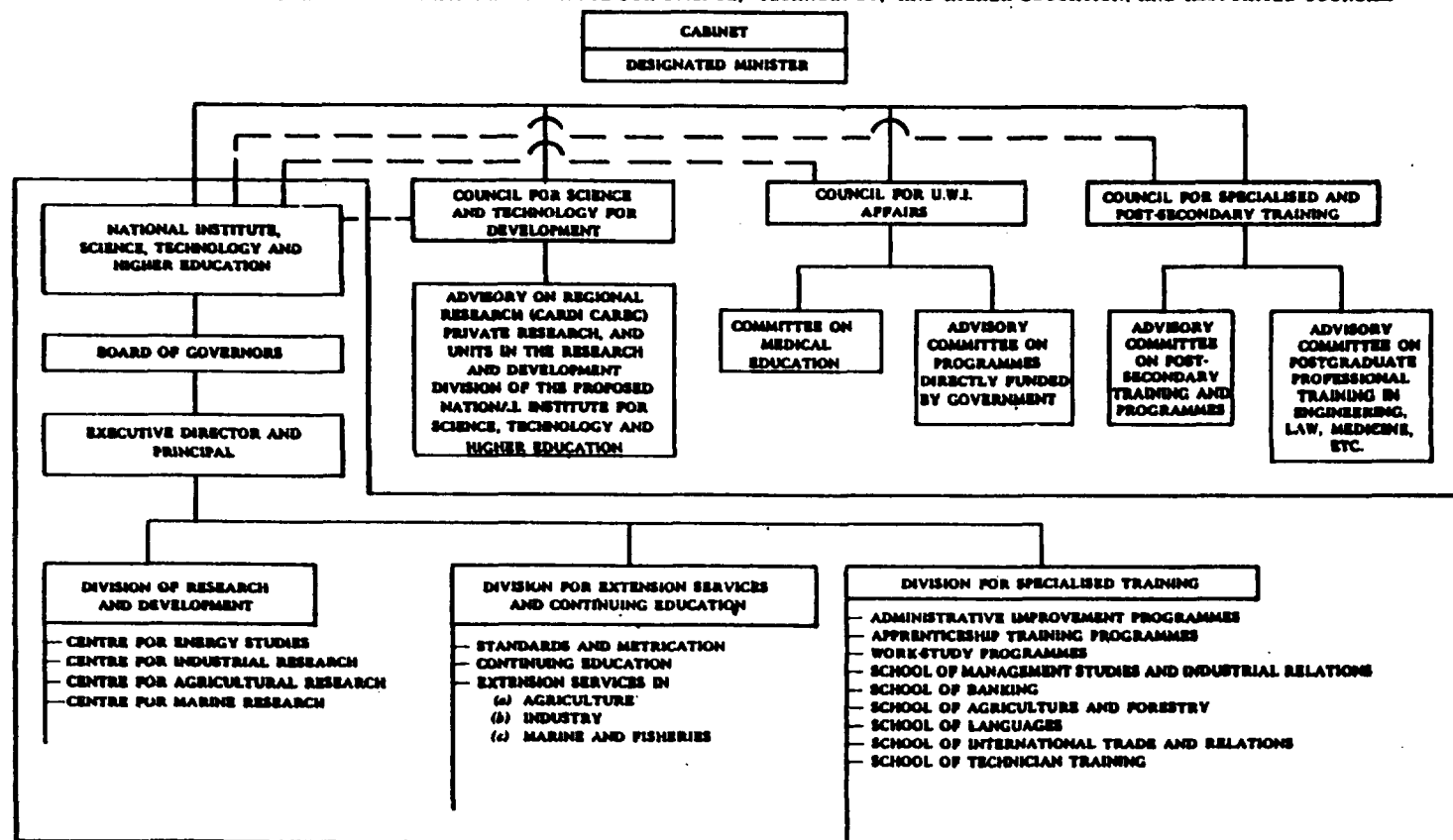
The UN financial crisis in 1976/77 caused delays but also after that and particularly since 1977 it has not been possible for UNIDO to get candidates accepted by the Government. UNIDO has wanted to push things through but has been advised by the Resident Representative not to press the Government for action as this would not help the situation.

The Trinidad and Tobago Government is confronted with some very difficult decisions which UN should not try to rush. The Government's White Paper on the National Institute for Higher Education, (NIHE), (Research, Science and Technology) of 1977 explains the need for better co-ordination and planning and some of the problems which need to be solved. Some actions have already been taken but the basic problem of creating an institutional framework and defining the role of CARIRI within that framework up to now remains unsolved. It is difficult to deal with CARIRI matters in isolation. This has caused postponement of many decisions, e.g. recruitment of experts and plans for further UN assistance. The reproduction of the organization chart for NIHE (page 33) shows that it is a large organization which must take some time to become fully operational. In the meantime, decision-making is restricted.

Some of CARIRI's problems in this connection are briefly mentioned below:

- CARIRI's ties with UWI mean that some of the pending UWI problems affect CARIRI.
- How can CARIRI maintain its autonomous position if other Government statutory bodies in the same organization (NIHE) do not have the same autonomy? If this is not possible, what are the consequences?

**SCHEDULE III—PROPOSED MODEL**  
**ORGANIZATIONAL CHART FOR PROPOSED NATIONAL INSTITUTE FOR SCIENCE, TECHNOLOGY, AND HIGHER EDUCATION, AND ASSOCIATED COUNCILS**



**NATIONAL INSTITUTE OF HIGHER EDUCATION (RESEARCH, SCIENCE AND TECHNOLOGY)**

- Should CARIRI expand into e.g. building research and environmental protection, training, technology transfer and regional activities, or should additional institutions be created or existing ones other than CARIRI be expanded?
  
- Should CARIRI reduce its ad hoc service type of activity and go into more long range research on problems of high national priority?

As long as the NIHE organization exists, but its status still is uncertain and it is not fully operational, CARIRI's position is floating and decision-making within CARIRI and its Board is difficult, particularly decisions that have consequences for the future. This situation is detrimental for CARIRI and its personnel and may have caused increased staff turnover and loss of momentum.

It ought to be possible simultaneously and through a coordinated effort to work out a plan for CARIRI's future: fields of activity and their scope, and for an administrative super-structure which can secure needed coordination and integration. The NIHE concept includes both higher education and research. Education is the domain of UNESCO and assistance from a joint panel of UNESCO and UNIDO experts has been proposed, but not implemented. It would probably make things much simpler if the super-structure covering CARIRI were some sort of Research Council. The existing "Council for Science and Technology for Development" could be developed to have this function. It would only be involved with UWI and higher education in connection with giving research grants. Whatever coordination is needed between research and education may then be secured at Government level.



Until these problems have been sorted out with or without assistance from UNESCO and UNIDO, further UN assistance to CARIRI is somewhat problematic. Priority should be given to solving the structuring problems, since the floating situation with respect to NIHE seems to be a stumbling block for CARIRI's further progress.

8. The latest UNIDO Project position

The situation with respect to UNIDO inputs is that all equipment has been delivered and as soon as the last person on fellowship returns before the end of the year, the training component will also have been delivered.

Due to the problems related to Government clearing of experts, 5 man-years of experts worth US\$292,621 will not be delivered under the present UNIDO project, but can hopefully be transferred to a new assistance project being planned. The project is now in the process of termination and this process will be completed before the end of the year. Thus, the present Terminal Report covers the whole period of UNDP/UNIDO assistance.

9. CARIRI's Status

In October 1981, CARIRI have the following staff:

Professionals	42
Technicians	63
Administrative and Support	<u>60</u>
TOTAL	<u>165</u>

CARIRI has the following amount of Laboratory and Office space:

Present Main Building	2390 m <sup>2</sup>
Carmody Road	500 m <sup>2</sup>

It is expected in the near future to expand by another 340 m<sup>2</sup> at CARIRI.

CARIRI soon gets temporary space on an IDC industrial estate of 1550 m<sup>2</sup>. At that time, Carmody Road will be given up (the lease expires in April 1982).

It is estimated that Government has invested TT\$3.2 million and TT\$19.6 million in recurrent expenses.

10. Funding and Fees Charged

The question of fees charged needs some comment. Most countries spend Government money on industrial research for example by totally financing certain institutes, such as, institutes dealing with defence research, atomic energy, geological surveys, etc. Subsidized fees or free service is often offered, as this is believed in the long term to benefit the country. It was necessary to subsidize heavily the fees charged by CARIRI in the beginning until the Institute had acquired sufficient skill and opened up the market for its services. But subsidized fees, not covering overheads and in some cases, not even the salary component of the professionals, is certainly counter-productive to efficiency. Services offered, which might be highly inefficient, still are attractive for the customer and the pressure to work efficiently is thus reduced.

The success of an institute can be assessed in many ways, one being the degree of self-financing. (CARIRI is only 9.6% self-financing after 12 years. This is definitely low and a gradual increase up to about 40% over the next 5 years is desirable and ought to be possible. Those who need subsidized assistance can still have it at whatever price is decided, but the actual cost must not be disguised, the Government subvention should be visible.

At present, the fees charged are TT\$55/hour for senior professionals and TT\$45/hour for junior professionals, 30 - 25 TT\$ for technicians.<sup>x)</sup> These fees are reduced by 50% to some Government and special development projects and in some cases by 90% (partly paid by the IDC). There are also rules for charges outside of Trinidad and Tobago. These fees have not been raised since March 1975, despite inflation. This is one reason for the reduced degree of self-financing. Consulting fees in the order of TT\$100 to TT\$200 are not uncommon in the country. If CARIRI should be self-financed, it was told that TT\$100-120 would be necessary. The overhead expenses are high, because much too little of the time is used for project work.

It has been argued that Government projects are "paid twice". "First the Government payed for the erection and operation of the Institute and then has to pay a fee in addition." The ideal situation would be if Government paid less money as general subvention of CARIRI and a realistic price for projects, but in practice this could create problems for CARIRI. It will be more difficult to achieve allocation of project money for running apparently expensive projects than voting a lump sum for CARIRI and in addition approve modest project budgets. Today, this component creates

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<sup>x)</sup> 1.0 US\$ = 2.4 TT\$

uncertainty and suffers from the fact that Government Departments do not have proper machinery for placing research projects and implementing the results. The trend now is that this component decreases and is replaced by in-house projects. Subsidized fees and too many in-house projects, which do not require tangible results, make life easy, but take away the need to be efficient, which is most dangerous.

Project income. According to the Plan of Operation, Project In-come should not go back to Government, as it does in some countries. Use of the income money was left to the discretion of the Board. It should be added to the budget and promote expansion and initiative. The first Board agreed that a percentage of this money should be used for the benefit of the staff as an incentive. The new Board took away this system. This move had a negative effect on staff moral and identification with CARIRI.

The Board has been very reluctant to approve use of the income money. It piles up in the Bank and is coming close to TT\$ 3M. It has been suggested that the Board felt that it lacked the legal basis to use this money, since the Council mentioned in the Act of Parliament on CARIRI had not been established (see p. 16). This restriction is now removed and the money should be put to use. A buffer of a certain magnitude should be kept as an emergency fund.

Funding. For 1980, the income of CARIRI - according to the Annual Report - was:

1. Government Contribution	TT\$ 6,950,000
2. Net Income from Projects and Testing (gross income less direct external expenses)	531,436
3. Interest	<u>648,149</u>
TOTAL:	<u>TT\$ 8,129,585</u>

The Government Contribution, exclusive of Government projects, covers  $\frac{6,950,000}{8,129,585} \cdot 100 = 85.5\%$

This funding structure is far from ideal. Direct work for clients, government and private industry should increase in terms of volume and price. Over a period of (say) 5 years, CARIRI ought to become at least 30% self-financed, preferably 50%.

Few of the Government projects relate to the Government's own need. Rather, Government funds some projects believed to have a development effect. In the future, some of this money may come via a Research Council (possibly NIHE).

11. Relationship with IDC and DFC

The Industrial Development Corporation (IDC) and The Development Finance Company (DFC) are two governmental agencies which were established for the purpose of planning and assisting in the financing of industry.

The IDC provides loans for the establishment of industries where the capital investment is less than TT\$250,000 and that for larger amounts. The IDC also spearheads a Small Business Programme which is geared towards the assistance of cottage-type industries. Within this framework, CARIRI provides the technical back-up to most of the projects handled by these agencies. In addition, in the larger programmes such as Rationalisation of local Automobile Assembly Industry, CARIRI has been providing the necessary engineering inputs.

An area of collaboration which is being presently developed is that dealing with the implementation of Research and Development results. At present, three projects are being handled.

There is the need, however, for a closer look at collaboration between these institutions and a more formalised modus operandi.

12. The functioning of the Board of Management

During the first 18 months, from October 1969 until the Board first met on 5 March 1971, CARIRI was operated without a Board. During this period, operation was informal and easy. Mr. E. Moore and Prof. K. Julien made decisions in consultation with CARIRI. Once a Board was appointed, decisions became formalized and the Board sometimes had different views from the Institute Management. The Management wanted the Institute to expand etc. and a Board sometimes has the unpleasant duty of having to apply the brakes.

CARIRI has been a fast growing institution, successfully competing for financial and human resources. This competition has been felt by UWI and others. The UWI Board Members may in some matters have a loyalty conflict. Since they work for UWI they may not always be able to fight for CARIRI. Such conflict of interests can also have affected other Board Members. On the other hand, conflicts of interests need to be sorted out and to do so on the board level may be a good solution.

Very senior and competent people are appointed to serve on the Board, but they seldom have time to attend Board Meetings (or comment on them), and since they do not send a proxy, there has often been a lack of balance in the composition of the Board as most of the UWI Members meet regularly and thus are in the majority.

13. CARIRI's Work

It ought to be useful to take a critical look at what CARIRI is actually doing. Government is the main source of income. It paid for the establishment of CARIRI, it pays towards its continuous operation and expansion.

Government Departments pay for certain projects believed to have developmental effect, but without having clarified exactly when, how and who will use the results. We will call this Preparatory Research and in the case of some projects it can be described as Strategic Research.

Government can also ask CARIRI for assistance in executing Government's work, e.g. by asking for inputs for decision-making or improving its machinery. Unfortunately, there are few such projects for Government. Government-owned and privately-owned enterprises give CARIRI projects. We will term this Consulting.

If many institutions and persons want to use CARIRI for consulting and pay for its services in full, this is an indisputable indication that CARIRI is useful. However Consultancy projects are often short-term projects, utilizing existing knowhow and having only a small research component. Long range development effects, creation of advanced skills and execution of R + D projects which fall in the high risk class, are seldom possible without Government support; either direct project support or via the subvention to CARIRI as in-house projects or external projects not paid for in full. To have the possibility to do "strategic research" is very desirable.

The crucial question is: who shall decide on and control this type of activity? At present, no policy has been spelt out. Government agents, IDC, CDB and others do execute some control functions. Still, it is difficult to steer the projects and to secure application of the results. It has been observed that many of the projects in this category have moved very slowly and have been going on entirely too long, some for over 10 years! When and if a Research Council is established, one of its main functions would be to secure proper steering of "strategic" R + D projects and to secure industry participation.

The Annual Reports of CARIRI lists the projects that CARIRI has handled. Overleaf is an inventory of all on-going projects as per 30 June 1981. Testing income in 1981 up to September is also listed.

The drop in income can partly be explained by the fact that Government paid projects have declined, based on the thinking that when CARIRI is so heavily subsidized, CARIRI should fund such projects from its own budget. But a review of annual project acquisition shows that private sector projects have also declined. Because of inflation combined with no increase in the fees since 1975, the degree of self-financing has gone down.

These results are not very encouraging and call for action. Further expansion of staff and facilities is difficult to justify unless the situation is improved. Provision has already been made to increase the staff to 240 in 1981, and raising the fees is under consideration.



PROJECT INVENTORY AS PER 30 JUNE 1981

Cons. = Consulting projects  
Prep. = Preparatory & Strategic projects, no direct client

PROJECT/DIVISION

PURPOSE & GOAL

ELECTRONICS

LIGHT BULB TESTING  
EL 343. Cons.  
C : \$119,958

To determine the quality of local manufacture of Tungsten Filament Lamps to ensure they meet the required standard.

ACOUSTIC PARTICLE BOARD  
EL 336. Cons.  
C : \$11,068

To provide the Client with information regarding acoustic characteristics of particle board.

ELECTRONICS CALIBRATION  
CENTRE : IL 441. Prep.  
C : \$60,000

The setting up of a Calibration Centre for scientific and industrial instrumentation.

CALIBRATION & REPAIR  
FACILITY AT TELCO :  
EL 464. Cons.  
C : \$15,300

Setting up of a Calibration and Repair facility at Telco. (Training of technicians).

TRANSCEIVER DESIGN &  
DEVELOPMENT : PL 316  
Ph. II. Prep.  
C : \$83,800.

To carry out the second phase of the Transceiver project to build 40 units.

DRYCELL BATTERY TEST :  
EL 467. Cons.  
C : \$50,000.

To carry out testing programme on Dry Cell Batteries.

MICROPROCESSOR APPLICATION :  
Prep.

To design and develop intercoms utilizing processor and UHF technology.

COMPUTERIZED PLANT FOR  
METAL TREATMENT : IL 447  
Prep.

To design and build a computerized  
plant for metal treatment.

INSTRUMENT SERVICE WORK :  
IL 155 Cons.  
C: \$505,338

An on-going project covering all  
work done in area of Instrument  
Servicing, Calibration, Repair  
and Installation for CARIRI's  
instruments and those of external  
clients (charged).

FOOD & CHEMISTRY

PETROLEUM TESTING LAB.  
EF 053. Cons.  
C: \$153,570

To establish and operate a  
Petroleum Testing Laboratory for  
the testing of petroleum products  
supplied by the Ministry.

ASPHALT PLANT POLLUTION  
EF 419. Cons.  
C: \$45,601

To determine the extent of dust  
pollution and to advise on and  
evaluate improved dust collection.

STEROIDS FROM NATURAL  
PRODUCTS : EF 325. Prep.  
C: \$29,712

To carry out a survey of plants  
for steroidal constituents and to  
carry out laboratory exercises  
involving identification of plant  
steroids.

PRESERVATIVES FROM SPICES :  
IF 469. Prep.  
C: \$19,334

A continued investigation of Spice  
extracts with preservative  
properties.

TESTING OF MILK PRODUCTS:  
EF 304. Ph. IV. Cons.  
C: \$12,000

Monthly checks on samples of dairy  
products for microbiological quality

ASSISTANCE :  
EF 472. Cons.  
C: \$17,850

To advise client on selection of  
equipment needed to manufacture and  
package ground coffee and spices.

UPGRADING CHEMISTRY LAB.  
IC 444. Prep.  
C: \$56,000

Upgrading of Chemistry Lab.  
through introduction of new  
or improved techniques and  
equipment with consequent  
improvement of skills of the  
works.

MANUFACTURE OF PUNCH-A-  
CREME : EF 432. Cons.  
C: \$28,000

To reformulate a punch-a-creme  
to design a processing line and  
to advise on packaging.

ASSISTANCE CARIBBEAN  
FOODPLAN : EF 445. Cons.  
C: \$53,475

To assist in developing attractive  
gift packs for spices, jams and  
jellies and marmalade from  
regionally grown spices and fruits.

USE OF X-RAY EQUIPMENT :  
IF 421. Prep.  
C: \$78,000

Commissioning of X-Ray analytical  
equipment, the development of skills  
in its operation and interpretation  
of results.

BAKERS YEAST + VINEGAR :  
EF 406. Cons.  
C: \$86,325

To advise the Client on establishment  
of a Yeast and Vinegar manufacturing  
complex.

FORMULATION SORREL LIQUER :  
EF 440. Cons.  
C: \$46,650

To attempt the preparation of a  
liqueur based on Sorrel.

CONSUMER GROCERY PACKAGING :  
EF 480. Cons.  
C: \$12,587

To assist in selection of appropriate  
equipment for packaging free and non-  
free flowing solids and also to locate  
a supplier of packaging material suitable  
for packaging of above products.

ENGINEERING

BAY OIL PROJECT : EN011, Ph. II. <u>Prep.</u> C: \$169,000	To design, fabricate, install and commission a Bay Oil Pilot Plant.
DUAL PURPOSE HARVESTER : EN 326. <u>Prep.</u> C: \$131,600	To investigate the design and development of a commercial dual purpose harvester for harvesting pigeon peas and sorrel.
EXTRACTION ESSENTIAL OILS/ OLEORESINS : IN 438. <u>Prep.</u> C: \$45,000	To assist in the creation of a pool of indigenous expertise in the extraction of essential oils and oleoresins from natural resources.
ALUMINIUM FOIL + CONTAINER MANUFACTURE : EN 436. <u>Cons.</u> C: \$19,000	To determine the feasibility of locally manufactured aluminium foil and containers.
RICE THRESHER INVESTIGATION : IN 463. <u>Prep.</u> C: \$104,950	To fabricate a rice thresher using an established design (Filipino), evaluate its performance locally and determine production costs for local manufacture.
POLYMER COATED FABRICS EN 449. <u>Cons.</u> C: \$19,000	To determine the feasibility of local manufacture of polymer coated fabrics.
GRANULAR FERTILISER STUDY EN 455. <u>Cons.</u> C: \$32,000	To advise on the technical viability of constructing in Trinidad a 20,000 tonnes per year fertilizer ammoniation/ granulation plant.
FJLP + PAPER LAB. : IN 369. <u>Prep.</u> C: \$11,749	To provide the Board of CARIRI with sufficient information to enable a decision to be made on the proposed involvement in the area of pulp and paper.

CANNING CANE JUICE  
PN 452 Prep.  
C: \$2,000

To determine whether the technology exists for the canning on a commercial scale, of freshly produced sugarcane juice.

CEMENT-BASED PRODUCTS  
EN 483 Cons.  
C: \$6,000

To enable the Client to set up facilities for production of (a) a sand-cement mortar dry mix; (b) a decorative facing stone.

MATERIALS TECHNOLOGY

STEELBAND RESEARCH PH. II :  
EM 099. Prep.

To investigate the constraints that now hinder developments with a view to ensure that the Steelband Movement benefits from research.

LIMESTONE AS AN AGGREGATE  
FOR CONCRETE : EM 322  
Cons.  
C: \$88,600

To identify the physical, mechanical and chemical properties of Northern Range Limestone and to determine the optimum combinations of commercially produced limestone.

FUNICULAR PRECAST SHELLS  
IM 381. Prep.  
C: \$86,294

To implement locally the technology of precast funicular shells.

CLAY BLOCK FLUORINE  
EMISSION CONTROL : EM 478.  
Cons.  
C: \$5,600

To investigate effect of calcium oxide on fluoride emissions from clay blocks during firing.

ECONOMICS  
PROCESSING OF LOCAL FRUITS:  
EF 312, Ph. II : Prep.  
C: \$154,825

Pilot plant production and economic analysis of processing of local fruits by osmotic dehydration.

RESOURCE DIRECTORY CARIRI :  
IC 439. Prep.  
C: \$2,000

To prepare a directory listing the manpower resources available at the Institute.

Activity of the Divisions. Each month a Summary of Time Utilization is prepared. From this it can be seen how individuals and divisions utilize their time. Below is a brief summary on each division based on the list of projects for June 30, 1981 and time sheet summary for June 1981.

Electronics

STAFF: 7 professionals, 3 technicians.

4 Consulting projects worth	TT\$ 246,226
3 Preparatory " "	489,198
Testing (for Sept. 1981)	707,200
Preparatory/Consulting ratio	<u>0.67</u>

Professionals time utilization (June 1981):

External projects	5% )	41% project work.
Internal projects	36% )	
No Pay functions	59%	
Time off	13%	

FOOD & CHEMISTRY

STAFF: 9 professionals, 12 technicians.

9 Consulting projects worth	TT\$ 456,058
4 Preparatory " "	183,046
Testing (for Sept. 1981)	326,280
Preparatory/Consulting ratio	<u>0.29</u>

Professionals time utilization (June 1981):

External projects	47% )	57% project work.
Internal projects	10% )	
No Pay functions	43%	
Time off	3%	

Engineering

STAFF: 10 professionals, 1 technician

4 Consulting projects worth	TT\$ 38,038
6 Preparatory projects worth	419,344
Testing	50,000
Preparatory/Consulting ratio	<u>0.92</u>

Professionals time utilization:

External work	18% )	28% project work
Internal work	10% )	
No Pay functions	72%	
Time off	10%	

Materials Technology

STAFF: 4 professionals, 15 technicians

2 Consulting projects worth	TT\$ 94,200
1 Preparatory " "	36,294
Testing	120,888
Preparatory/Consulting ratio	<u>0.48</u>

Professionals time utilization:

External	25% )	33% project work
Internal	8% )	
No Pay functions	67%	
Time off	3%	

Technician's time utilization:

External	27% )	32% project work
Internal	5% )	
No pay functions	68%	
Time off	7%	

Economics + Systems Research

STAFF: 5 professionals

3 Consulting projects worth	TT\$	86.562
2 Preparatory " "		156,825
Preparatory/Consulting ratio		<u>0.64</u>

Professionals time utilization:

External	11% )	
Internal	14% )	25% project work
No Pay functions	75%	
Time off	2%	

On average, the professionals devote 36% of their time to projects and 63% to No Pay Functions.

In successful IRSI's in developed countries, there would be 60 - 70% project work. The present staff has the potential to double its output! The fees charged are much too low. If the hourly prices were doubled and the output doubled, CARIRI would be 40% self-financed which would be a respectable figure.

Little of the Preparatory work is judged to have great scope in terms of future production value, nor in terms of acquiring new, high level, useful skills, and can therefore only to a limited extent be termed strategic.

CARIRI's total project income including Testing and its ability to cover operating expenses has developed as follows:

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	
0.85	17.2	35.5	81.9	111.7	155.6	240	225	213	191.7	221.4	1000 \$
2.6	10.6	7	20.4	18.7	21.2	27.6	20	15.2	11	9	%



1976 was the best year both relatively and in terms of absolute income. It is seen, that the income stagnated after 1976. On the other hand, the number of staff has been steadily increasing, as can be seen from the schedule below:

LOCAL STAFF

	70	71	72	73	74	75	76	77	78	79	80
Professionals:	9	15	19	23	28	29	30	34	31	37	46
Technical:	4	8	12	20	28	21	28	24	30	49	40
Support:	8	13	25	32	43	59	55	62	64	68	88
TOTAL:	21	36	56	75	99	109	113	120	125	154	174

It is remarkable that in 1976, CARIRI made

\$240,000/113 = 2,120\$/staff; in 1980, only

\$221,400/174 = 1270\$/staff.

14. CARIRI and the large Government industries

In Trinidad and Tobago there has been a significant establishment of new large-scale industries owned by the Government. These industries are spearheading Trinidad's development towards an industrialized society. If CARIRI can contribute to this development, it can really become an important growth factor in the country's economy.

So far, these enterprises have not used CARIRI's services to any large extent and not for handling important questions. There seems to be a tendency not to recognize CARIRI as a member of the family of Government-established enterprises. This situation should somehow be changed. To achieve full acceptance of CARIRI by these enterprises is considered to be a most important challenge: to CARIRI's staff, its Board and the Government policymakers. The matter should be taken very seriously. Unless these industries use CARIRI, CARIRI is likely to become a second class institution of more or less marginal importance to the development of the country.

If CARIRI is going to give substantial services to the large scale national industries, it must be strengthened and expanded considerably over the next 5 years. A new location with sufficient space etc. is in this case a condition.

The establishment of the large scale Government owned industry has widened the potential scope for CARIRI tremendously and a strong effort needs to be made so that CARIRI can become more involved with these companies directly, not only the downstream activity. It remains to find out how this can be achieved.

15. Evaluation of CARIRI

CARIRI is considered successful by most people who have knowledge of CARIRI and of IRSI's in other developing countries. The real yardstick of success ought to be this: has the money put into CARIRI been a good investment for Trinidad and Tobago, or could the same resources used in other ways have benefitted the nation more? Even if up to now the return on investment may have been too low, it is still possible that sufficient advantage will accrue at a later date. The rise in industrial production in Trinidad and Tobago from 1970 to 1980 has been formidable, but no one can say how much CARIRI attributed. There are examples where CARIRI at small cost, has saved the Government or Private Industry from spending considerable amounts of money.

CARIRI is still young and has only been fully operational for about 6 years. It has mainly done ad-hoc research and development of small projects and given various technical services; made feasibility studies and provided information services. The cost to the Government for this has been quite high (in the order of TT\$23 M. ), also human resources have been tied up. It is not possible to calculate the cost effectiveness of alternative uses of the same resources, and compare with CARIRI. Only in the case of IRSI's which are financially self-supported, can it be proved beyond doubt that the operation is cost effective. Unfortunately CARIRI is now less than 10% self-financed in terms of recurrent annual budget.

When most people think CARIRI is a success, they go by the following facts:

- The Institute has been successfully established in a relatively short time;
- It attracts projects from industry and Government;

- It is quite well reputed for its services.

While the first two Project Managers were content with CARIRI, the following two Advisers were more critical. They complained that the projects were small, ad hoc projects, trouble shooting and routine services. No important national needs had found their solution through CARIRI. But to demand that CARIRI should have solved major national problems during its first 5-6 years is simply not realistic. But it can, and has, contributed towards this. All IRSI's which have had the ambitions to solve big problems on their own have failed. An IRSI can supplement industry with crucial inputs, but should not as a rule try to create new products or processes themselves, only assist existing industry to do so. It is often overlooked that institute in R + D is only a small, although sometimes essential, component in the industrialization process and the fight for economic independence.

It is believed that CARIRI has in many direct and indirect ways contributed to the industrial growth and to the raising standards in Trinidad and Tobago. The intangible benefits are normally more important than direct contributions towards new products: people who leave CARIRI for jobs in the Private or Government sector of Trinidad and Tobago are not lost. They have hopefully received valuable training and experience. CARIRI has in some cases reversed the "braindrain". The mere existence of CARIRI and its ability to reveal inferior products tend to upgrade the standard. Good advice or crucial information can often save large amounts of money. By repairing or calibrating control instruments, degradation of valuable investment is prevented and so on.

CARIRI has up to now been balancing well between the desire to do ambitious projects and to give down to earth services. In other words, CARIRI's policy has (in the author's judgement) been sound in the past. CARIRI should be given credit for having resisted attempts to take off from the ground and to go into large unrealistic undertakings. On the other hand, the time may now have come when it will be right to look for more challenging activities.

On the negative side, it must be admitted that the project income is much too small and the staff spends entirely too much of its time to "no pay functions". There is also a tendency to spread out too thinly in many fields. At least some fields should be developed more in depth. CARIRI has not succeeded in being sufficiently used by Government Agencies and the Government owned industry.

Although an effort has been made to produce a 5 year plan, there is a need for more thorough planning of CARIRI's future.

From UNIDO/UNDP point of view, CARIRI must be said to have been a success. CARIRI is one of the few IRSIs where UNIDO has played a major part as institution builder, starting from scratch. The assistance has been satisfactory. The delays in Phase II and the inability to deliver 5 man-years of experts were caused by circumstances beyond the control of UNIDO/UNDP.

16. CARIRI's Future

CARIRI's immediate plans are to occupy new premises at Trincity in 1982 and to expand its staff up to about 240. In the long term, CARIRI hopes to move into new location having 20 acres of land. Detailed planning is not possible before the Government's research policy has been decided.

On this future compound, several smaller institutions can be located and can benefit from the services of CARIRI.

CARIRI has withdrawn the proposal for a Phase III UNIDO Project and is instead proposing a Government executed Project drawing on the resources of UNIDO, UNESCO and FAO. This proposal has been submitted to the Government. The proposal is to spend US\$ 1,146,400 over 3 years: Experts US\$ 887,499; Training US\$ 144,000; Equipment US\$ 100,000.

Even if CARIRI grows to 600 persons, it is not necessarily too large. There are many institutes with several thousand people. Large institutes have their pros and cons. The main pros are:

- They can have well established services of many kinds which smaller institutes cannot have;
- they can cover more disciplines and can cope with larger projects;

The cons are mainly:

- they tend to be too bureaucratic and formal and unable to make quick moves;
- the distance between management and the researchers becomes too great;
- people no longer know one another and an impersonal atmosphere prevails;

If CARIRI is going to expand further, proper delegation of authority will need much attention.

The time will soon come when CARIRI ought to stop expanding mainly by taking up new fields of work and disciplines. Expansion should take place by going deeper into certain activities, maybe: petroleum reservoir technology; computer application (modelling, software, data bases etc.); building research and transfer of technology. Careful studies are needed before deciding.

The author of this report would suggest that an independent Building Research Institute should be set up in the course of 3 - 5 years by CARIRI (possibly by UWI or jointly with CARIRI) and then become autonomous. CARIRI's role with respect to Environmental Protection needs careful analysis before a policy should be decided upon.

17. Some suggestions for consideration

The terms of reference to write the Terminal Report on CARIRI do not require any recommendations for the future handling of CARIRI questions. However, some brief comments may be useful.

Today, CARIRI is only to a small degree involved in Government institutions and the large scale Government industries. It is considered one of the most challenging problems facing CARIRI to improve this situation.

In the near future, it must be decided what future role CARIRI shall play and what kind of machinery the Government needs for the purpose of coordinating the nation's activity.

The suggestions presented below are based on previous experience in other countries and impressions received during the preparation of this report on CARIRI.

National Coordination of Research. There is a need for creating an organization, which on behalf of the Government, can deal with research related to industry and natural science. Most countries have one or more Research Councils. Trinidad may find an expansion of the Council for Science and Technology for Development to be a good solution. To put also Higher Education etc. under the same umbrella (NIHERST) appears to create more problems than it solves.

Most countries have found that industrial research mainly should be controlled by the various sectors of users with only a modest component of centralized control.

Institutional Framework. The question of having few large institutions or many smaller ones is fundamental, and a policy is needed. A good model may be to have one large Central Institute (which would be CARIRI) being multipurpose and multidisciplinary, and around it to have a number of more specialized (mono purpose) institutes, which can draw on the resources of the Central Institute in order to avoid unnecessary duplication of facilities and skills. Geographic closeness between the Central Institute and the specialized one will be an advantage.





