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INTERNATIONAL CO-OPERATION IN INDUSTRIAL RESEARCH <sup>1/</sup>

The Experience of the Caribbean  
Industrial Research Institute (CARIRI)

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<sup>1/</sup> The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO  
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We regret that some of the pages in the manuscript  
of this report may not be up to the proper  
quality standard even though the best possible  
effort was used in preparing the master tape.

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INTERNATIONAL CO-OPERATION IN INDUSTRIAL RESEARCH  
A HISTORY OF THE CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE  
(CARIRI) 1970-1974

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Geographically located in the Eastern Caribbean between North America and Latin America, the Caribbean Industrial Research Institute (CARIRI) presents an interesting example of the value of international co-operation in the development of industrial research capability in a developing country. Based on recognition by the host country of the need for an IRI, and on the willingness of the country's government to provide the necessary funding and physical facilities, the Institute was established in 1970 with assistance by UNDP/UNIDO in the areas of expert advisers, equipment and training fellowships.

The acceptance by the industrial community of the Institute and the successful execution by UNIDO of the UNDP programme of international technical assistance, have produced a formula for success in the first five years of CARIRI's existence. Since the signing of the Plan of Operation in mid 1970 to the completion of the first phase of the Institute's development at the end of 1974, CARIRI has expanded five-fold and has benefited not only from the equipment and experts provided through international aid, but also from the intellectual interaction produced by both the diversity of sources from which the assistance came, and the quality of that assistance. Through its involvement with UNDP/UNIDO and other international organisations e.g. WAITRO and the OAS, the Institute has had its operations open to critical examination by the international technological community. Itself concerned with the transfer of technology, CARIRI has progressed by a process of selection, sometimes groping, of mechanisms for its own techniques of management of industrial research. The CARIRI experience makes a strong case for the continuation and increased emphasis on international co-operation in industrial research.

## THE COUNTRY

GARIBI is located in the country of Trinidad and Tobago which consists of the two most southerly islands of the West Indian archipelago stretching from Cuba in the north to Trinidad in the south, just 12 kilometres off the coast of Venezuela in South America. Both islands were formerly part of the British West Indies and were a dependency of England. The total area of the two islands is approximately 5,100 square kilometres and the population just over 1 million. The people, particularly those of Trinidad are ethnically cosmopolitan, made up basically of groups of African and East Indian descent with roughly 5 per cent Caucasian, Chinese, Lebanese/Syrian and other groups. The country enjoys a high literacy rate - over 90 per cent. A *per capita* income of US\$970 with a growth rate of 3.6 per cent, and a gross national product in 1972 at market prices of US\$1,020M. The economy is based mainly on oil and sugar - oil being discovered in Trinidad in 1907. The country is a member of the UN, OAS and the Caribbean Common Market (CARICOM) of approximately 4 million people.

The presence of multi-national corporations, particularly in oil, have helped to lay the basis of the technological orientation of the country. The economy is still basically agricultural and there is considerable dependence on secondary industries. Of the agricultural produce, sugar, cocoa, citrus and coconuts, cocoa is not processed to any significant extent but sugar-cane is converted into raw sugar for export and there is an important rum industry based on the utilisation of molasses. The citrus industry produces canned citrus juices for home and export markets while the coconut industry provides edible oils and fats, and laundry soap of high quality some of which are exported to adjacent countries.

The territory's mineral wealth lies chiefly in its petroleum deposits and its natural lake asphalt. Its petroleum oil refineries take care of its own crude production - which is insignificant in international terms - as well as part of the production of other countries, including the Middle East. The famous "pitch lake" is a well-known source of natural asphalt. The resource picture has recently been improved by considerable finds of natural gas.

While the national *per capita* income per annum is higher than most of the region, the principal economic problem is unemployment officially pegged at 15 per cent of the labour force, but perhaps higher in reality.

## 11. THE INSTITUTE

The need for an Industrial Research Institute in Trinidad and Tobago was highlighted as far back as 1975, when the Second Five Year Development Plan for 1965-1968 was published. The plan notes in part "No financial provision was made for such an institution in the programme but taking into account the possibility of securing outside assistance in its establishment and staffing, the Government will keep the matter under review". In the Third Five Year Plan 1969-1973 the intention to establish an Industrial Research Centre - as it was then called - is firmly enunciated. On this subject the document said in part: "The role of Industrial Research Centres in developing countries has been carefully and thoroughly studied and it has been concluded that a Centre with the following broad functions will most suitably meet the needs of Trinidad and Tobago and the Caribbean region.

- (a) Adaptation of technology in the areas of food technology and the use of local raw materials;
- (b) Feasibility studies;
- (c) Laboratory testing for and the development of standards and specifications;
- (d) Dissemination of technical information.

NOTE: A Trinidad and Tobago Standards Bureau was subsequently established in 1974.

On the basis of the intention expressed in the Second Five Year Plan to seek outside assistance for the establishment of the "Centre", a proposal was submitted to the UNDP for assistance in establishing the Centre. A UN Consultant was then hired to investigate the basis on which the request had been made. The UN Consultant's recommendations apparently modified significantly the proposal prepared by the local authorities; on the basis of these recommendations a Plan of Operation for the UNDP's assistance in establishing the Caribbean Industrial Research Institute (CARIRI) was written in 1969, with UNIDO as the Executing Agency.

The first Project Manager was appointed in 1969. It was hoped to have the Plan of Operation signed by the end of 1969. The first Project Manager and Director of the Institute was Mr. Richard B. Westergaard, a veteran of about 20 years with the Centre for Industrial Research (S I) in Oslo. The following quote is taken from the final report of Mr. Westergaard at the end of his mission after two and a half years: "After having studied the Plan of Operation and discussed it with various people from Government and the University of the West Indies, the Project Manager concluded that the Plan of Operation had to be changed. The scope was too small to meet the needs and the proposed Government contribution was deemed absolutely inadequate. More flexibility was also needed and some other changes were proposed. The Government agreed immediately to the proposed revision". This change in the Plan of Operation resulted in a 9-month wait before the Plan of Operation was finally signed. The Plan was signed in August 1970 and the project declared operational on 15 October 1970. CARIRI had however, been functioning with an interim Board of Management and an interim budget of approximately US\$25,000 and recruitment of local staff had already begun, so that at 15 October 1970 there was already a local staff consisting of the Co-Director, Business Manager, four professionals and four support staff.

The interim Board functioned until 5 March 1971 when the first ordinary Board Meeting took place. Appendix 1 shows an extract taken from the Plan of Operation signed between the Government of Trinidad and Tobago and the UNDP for the purpose of establishing CARIRI. CARIRI was established by an Act of Parliament in 1971 as an autonomous institution managed by a Board of Management. This Board comprises:

- 2 members nominated by Government - one of whom is the Chairman
- 3 members from the private sector
- 4 members from the University of the West Indies (UWI)
- 1 member from the National Industrial Development Corporation
- 1 member from the UNDP

The Director of the Institute is a member without voting rights.

In 1970 the Institute was represented at the inaugural meeting of the World Association of Industrial & Technological Research Organisations (WAITRO) and became a founding member.



In 1973 CARIRI and the Research Productivity Council (RPC) of New Brunswick, Canada, began the "Linkage" programme which links the activities of WAITRO where thereby an IRI in a developed country is twinned with an IRI in a developing country "for the promotion of the transfer of technology.... through joint efforts on specified projects". RPC was founded in 1962 and is an Institute similar in purpose and function to CARIRI. The WAITRO linkage programme at CARIRI is supported in part by UNIDO and in part by the Canadian International Development Agency (CIDA). Expenditure under the programme for 1974 was approximately CAN\$20,000 by CIDA, US\$17,000 by UNIDO and US\$10,000 (in kind) by CARIRI. The programme so far has laid the basis for the establishment of testing facilities at CARIRI for ceramic raw materials and the development of a commercial pottery. For the future, the programme has already helped CARIRI in negotiating a food-product development contract with one of the large, local food-manufacturing companies and proposals are being worked up for assistance to the National Fishery Company.

Also in 1973, the Institute launched a project to offer special information services to industry with a grant of US\$5000 from the OAS. This programme has been expanded for the 1974/76 biennium to US\$30,000 and discussions are now being held with a view to extending this service to the Caribbean region.

The Institute over the years and increasingly during the last year has been providing assistance - mainly in technical information but also in some technical evaluation and testing services - to the region, particularly through regional organisations such as the Common Market (CARICOM) Secretariat, and the Caribbean Development Bank.

### III. INPUTS

#### A. Local

For accommodation the Government of Trinidad and Tobago provided CARIRI with two beautiful modern buildings 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.

The two buildings were provided with electrical, air, gas and hot and cold water. Considerable expenditure was made to make them suitable for use as laboratories. The architecture has proved beautiful and expensive although, due to low floor to ceiling which, with the prevailing trade winds, made it essential to keep wind and dust out of the laboratories and offices.

Originally, the buildings provided approximately 1,000 square metres (approximately 10,764 square feet) of space with an 11-metre-high roof. Modifications have increased the available space in the main building to approximately 1,600 square metres. In addition, at the beginning of 1974, 500 additional square metres were rented in another building as temporary accommodation until a proposed new building alongside the existing building is built. The new building is proposed to provide by 1977 a 60 per cent expansion over the 1974 accommodation with an additional 25 per cent increase by 1980.

The following table shows the actual as against the pledged commitment of the Trinidad and Tobago Government to the Institute over its first five years of existence. It will be noted that the total Trinidad and Tobago Government contribution is more than twice its pledged commitment under the Plan of Operation signed with UNDP. This level of contribution has undoubtedly been one of the major factors in whatever success CARIRI now enjoys:

Table 1. Government of T & T Contribution - US\$

	1970	1971	1972	1973	1974	Total
Building	*	118.4	49.1	40.6	63.0	271.1
Equipment	8.5	67.8	49.9	55.0	94.0	275.2
Recurrent expenditure	32.3	158.2	308.3	378.0	562.0	1,438.8
Balance	23.9	80.6	7.7	111.4	281.0	504.6
Total	64.7	425.0	415.0	585.0	1000.0	2,489.7
Plan Op.	199.0	263.9	237.2	220.9	215.0	1,136.0

\*Note: Original building was provided by Trinidad & Tobago Government

Development of the Institute local staff complement is shown in the following Table 2:

Table 2. Local Staff

Local Staff as at December 31	1970	1971	1972	1973	1974
Professional	9	10	10	23	27
Technical	4	8	12	20	28
Support	8	13	25	32	43
<b>TOTAL</b>	<b>21</b>	<b>36</b>	<b>56</b>	<b>75</b>	<b>99</b>

B. UNDP/UNIDO

The following Table 3 summarises the UNDP/UNIDO inputs to the Institute over the first five years, and Appendix 11 lists the international experts which UNIDO has supplied to CARIRI and thus shows the institutions and countries that have contributed to CARIRI's development:

Table 3. UNIDO Contribution 1970-1974 - US\$000's

Personnel	Equipment	Fellowships	Miscellaneous	Total
471.7	157.5	37.1	25.3	689.6

A further three years of assistance to the Institute by UNDP/UNIDO was recently agreed to, during which UNDP will supply approximately US\$315,000 in expert man-months, US\$85,000 for training for local staff, and US\$164,000 in equipment and miscellaneous supplies. The Trinidad and Tobago Government contribution over that same period is expected to be US\$2.8 million, which does not include the new building previously mentioned. This building is estimated to cost approximately US\$3 million at present day prices.

The very high cost of a new building on the present site is a major problem affecting expansion. Reasons for the high cost are that the architecture of the present building, which is part of a complex of buildings, is highly detailed and any external modifications must conform with the aesthetics of the existing architecture and be approved by the University authorities, as part of the University Campus.

The problem of national designs for ICI buildings is one to which UNIDO is addressing itself, and certainly, from similar experience it is an area in which informed assistance can help institute planners to avoid very costly mistakes.

### C. Earned Income

The Institute began charging for its services from the very beginning. A small amount of free consulting is permitted, especially in the Technical Information Service where requests requiring less than two-man-days of work are not charged for. Also, professional staff are allowed to utilise up to four hours per week of the Institute's time to work for approved related institutions, particularly the University of the West Indies and more recently the Standards Bureau.

Over the five years the Institute's fee has been increased twice and its charging policy has also varied. Only professional and technician time is charged; the time of support staff is not. The original charge was US\$6 per professional man-hour and US\$3 per technician man-hour with a 100 per cent overhead whenever it was felt that a client had sufficient financial resources or the work was of a very routine nature. In addition, rates were established for routine laboratory and testing services.

The fees were increased by 50 per cent in 1972 and in early 1975 a new fee structure was devised. Charges are now estimated at US\$22.50 and US\$27.50 per professional man-hour depending on the level of the professional, and US\$15 and US\$10 per technician man-hour.

The policy now is to state the cost to the Client and then:

- (a) if the client is a Government or quasi-Government agency or
- (b) if the project is considered to be of a developmental nature or
- (c) if the client is so small that assistance to him might be considered developmental in terms of assisting in the development of an industrial community,

the bill is reduced by 50 per cent of that original component. On the contract the client sees a cost for the work being done and the fee which he is being asked to pay. This applies as a general rule though in some cases of (c) above even more generous reductions are made.

So far the earned income of the Institute has been put into a reserve fund. Since 1973, approximately 5 per cent of the income earned during the year has been passed to the staff as a Staff Welfare Fund and in 1974 the Board approved some US\$20,000 of the income reserve for additional equipment. The growth of the Institute earned income is shown in Table 4.

Table 4. Net Project and Testing Income US\$000's

	1970	1971	1972	1973	1974	Total
Income	0.85	17.2	35.5	81.9	111.7	247.15
Percentage of operating expenditure (%)	1.5	7.2	11.2	16.8	13.3	-

Note: \*There was an approximate 40% increase in salaries during this year as a result of a new wage contract.

Table 5 shows the dollar volume of contract work for the period in which income was earned.

Table 5. Dollar Volume of External Contracts - US\$000's

	1970	1971	1972	1973	1974	Total	Percentage of total (%)
Private sector	2.5	13.4	27.2	26.9	44.3	114.3	16
Government	18.0	20.5	214.9*	81.8	181.5	586.7	82
International Agencies				5.0	12.2	17.2	2
Total	20.5	33.9	312.1	113.7	238.0	718.2	

Note: \*CARIRI was given contract to establish and operate first Petroleum Testing Laboratory of the Government of Trinidad and Tobago.

D. Other

For the first five years, the Institute received all of CARIRI's operating budget has some financial contribution from the Government of Trinidad and Tobago. In addition, financial contributions have been made to the Institute by private industry, as for instance two contributions amounting to about US\$2,500 towards the purchase of a piece of equipment. Early in 1975 a contract was negotiated with one private sector client for the design of a piece of equipment for their use. The client has agreed that if the design proves to be commercially feasible, the profits accruing from the sales of this item of equipment would be used by them to fund further research at CARIRI.

Other than financial, significant inputs to the Institute have been made by the Members of the Board - particularly from the private sector, and from the University. The members of the first Board of Management were not reimbursed even for their expenses and the private sector members, particularly those in private consulting, certainly have been out of pocket through activities on the CARIRI Board. Members of the University faculty, having overcome an earlier reluctance to work with the Institute, now have a very close working relationship with CARIRI on the basis of individual arrangements, particularly in the faculties of Engineering, Natural Sciences, and Agriculture. The assistance of the University staff to the relatively young staff of the Institute is an intangible input which is nonetheless significant despite the inability to quantify it.

#### IV. DISCUSSION

In reviewing the experience of the first five years of CARIRI's history, the conclusion can be drawn that the exercise has been a successful one. There now exists an Institute of viable size with some noteworthy projects completed and a local staff which is more or less oriented in the concept of what role an Industrial Research Institute can play in the economic development process. In addition the demand for the Institute's services is a clear indication that its place in the community is recognised by its clientele, namely Government and the private sector.

This paper will not deal explicitly with the work of the Institute but an indication of this is given in Appendix III. The Institute cannot be said to be fully developed but the indications are clear that, barring some unforeseen untoward occurrence the Institute will continue to move towards its stated objectives. What are the reasons for this success and what can be learnt from this experience?

Undoubtedly the single greatest factor in influencing CARIRI's achievements has been the enthusiasm of the Government of Trinidad and Tobago for the institute. This can be seen from the very beginning when the original Plan of Operation had to be rewritten, and the Government willingly increased its contribution to make up the difference between what was proposed and what it was felt was needed; this attitude of enthusiasm on Government's part has continued.

The other significant factor has been the receptivity of the industrial community to the institute. This, if one goes by the experience of similar institutions, is not the usual experience. While the largest dollar volume of project work comes from Government agencies, this is from a relatively small number of projects and by far the greatest number of projects come from the private sector. The percentage figures in Table 5 indicate that 82 per cent of the overall contract-dollar volume came from Government. This is influenced somewhat by the 1974 figure when 96 per cent of total contracts came from Government. The reasons for the particularly high figure in 1974 is that the Trinidad Government as a result of the worldwide energy crisis suddenly found itself the recipient of increased revenues from petroleum and in turn emphasised technology in its development programme. CARIRI as a national institution responded to the Government's needs for inputs in this area. Before this the project mix tended to be around 70 per cent Government - 30 per cent private sector, which is more or less the classical sort of distribution for institutes of this kind even in more developed countries.

It is certainly apparent that CARIRI's autonomy was responsible for the receptivity of the private sector. It was also a significant factor in acquiring competent local staff who were at most times loathe to become involved in a Government-type bureaucracy.

This autonomy has its disadvantages because while Government and even shareholder might be prepared to continue to support their own less than successful adjuncts, they are not usually to be charitable to an outside organisation. This has imposed on the staff of CARIRI the obligation to ensure their own security of tenure through their ability to maintain a successful organisation. This obvious insecure position has however, certain advantages:

- (1) as individuals the staff are motivated by their belief in their ability to succeed by dint of their own efforts, and
- (2) as an organisation the institute is motivated to maintain maximum performance; and
- (3) the institute can interact and negotiate both with Government and industry as an impartial third party.

The aim for the future is to have private industry become more involved in influencing the direction of the institute's work through the funding of large programmes of research and development at the institute. It can be argued that it makes good economic sense when large sums of money are invested in importing technology to have some small part of the sums involved set aside towards the development of indigenous know-how, so that when the imported technology becomes outdated and needs to be updated or replaced there is someone with the purchaser's interest at heart who can talk on the same level to the high-pressure salesmen of the technology-exporting countries about the claims that are made as to the inability and suitability of the equipment and technology being touted.

In what ways can international assistance contribute to the development of an industrial research capability?

- (a) In Planning - Certainly from the CARIRI experience the need for adequate preparation of a suitable Plan (p) was demonstrated as was the need for assistance in planning physical facilities, especially the buildings. Since the infra-structural facilities are usually provided for locally the provision of expert assistance in planning these facilities can prevent many extremely costly errors. It is recommended that UNIDO develops its capability in providing this kind of expert assistance.



- (b) In expert assistance - CARIRI was extremely fortunate - to UNIDO's credit - in the kind of expert assistance it received particularly at the Project Management and at the scientific. It would not be an exaggeration to state that the choice of the first two UN Directors of the Institute was critical to the eventual success. The CARIRI experience has indicated - with enough exceptions to prove the rule - that the best transfer of technology through the use of expert assistance takes place between advisers who came from countries not too far in advance of the recipient country. The compatibility of divergent cultures and value systems presents a much less serious problem than that of reaching an understanding of widely separate levels of technological development. The CARIRI experience recommends for the advocacy of technology transfer between developing rather than between developed and developing countries.
- (c) In training - contrary to what is reportedly the African experience, CARIRI has had relatively few problems with the recruitment of qualified staff and the provision of adequate training. There seems to have been enough offers of assistance in this area even though Trinidad and Tobago does not qualify for US aid.
- (d) With equipment - this is an obvious area - both the acquisition and selection - which has been so well treated elsewhere that it is not intended to deal with it here.
- (e) In the establishment of institutional infra-structure - By this is meant the framing of the institutional instruments to ensure that the institute will have the opportunity to function adequately. UNDP/UNIDO Plan Op. refers to these as Prior Obligations. The establishment of CARIRI as an autonomous institution is one such instrument. Another important one is the funding mechanism. CARIRI has had the benefit of enthusiastic government support, but the question of Government enthusiasm or lack of it should not be that crucial to the operation of the institute. The institute must continue to exist after the enthusiasm that motivated the initial support no longer exists.

Is the CARIRI experience has shown that while the continuing support has indeed been the mainstay of the institute's funding most come from Government, the direct transfer of funds from Government or some funding department of Government does not make for the best possible relations between an autonomous institute and its main client (the Government) or for that matter any of its clients. The institute has to be constantly aware of its Governmental client's responsibilities as a fee-paying client is in no way affected by the fact of Government funding of the institute. For these reasons a funding mechanism that can only affect the flow of funds to the institute by an "act of commission" as opposed to an "act of omission" is recommended.

In addition it makes sense that the level of funding of the institute should be tied to the level of technological activity in the country - possibly a fraction of a per cent of GNP, a levy on industrial loans, and industrial development tax or some such similar mechanism. UNDP/UNIDO might consider negotiating this kind of funding mechanism as part of the prior obligations of the local Government for their assistance.

Over the last five years international expertise from diverse parts of the world have contributed - mainly through the instrumentality of UNDP and UNIDO - to the establishment of an Industrial Research Institute in the English-speaking Caribbean. Today there exists a continuing but by no means mature organisation that is accepted by its market as satisfying a real need and is increasingly becoming recognised nationally, regionally, and internationally as a "technological point of contact" not only for the country of Trinidad and Tobago, but for the Caribbean region as well. On this basis it can be stated boldly that the existence of CARIRI in 1975 is a strong recommendation for international cooperation in technology.

APPENDIX I

EXTRACT FROM PLAN OF OPERATION

1. PURPOSE AND DESCRIPTION

- 1.1 The purpose of the Project is to assist the Government of Trinidad and Tobago in establishing the Caribbean Industrial Research Institute (Hereinafter referred to as CARIRI) at the University of the West Indies St. Augustine, Trinidad, to enable it to provide technical and industrial services to the country's industrial enterprises both public and private, assist the Government in the preparation of industrial standards and engage in industrial research programmes related to the needs of the country.
- 1.2 In the course of the five years of the project, the Institute will undertake the following activities :
- 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 analytical 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 Government on the preparation of industrial standards and to carry out associated testing and certifying.

- c. To engage in industrial research programs related to industrial operations in the region. It is expected that such programs 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 the counterpart staff in the abovementioned fields both through fellowships and on the job training by the international experts.

APPENDIX II

UN EXPERTS ATTACHED TO CAHIRE 1970-1971

<u>Name and Country</u>	<u>Expertise</u>	<u>Institution</u>
1. Rich H. Westergaard NORWAY	Project Manager & Director (Chemical Engineer)	Central Institute for Industrial Research Oslo, NORWAY.
2. Alfred Hoffman UNITED KINGDOM	Chemist	Tropical Products Institute U.K.
3. Donald Langmuir U.S.A.	Mechanical Engineer	UNIDO Technical Consultant
4. Eiliv I. Sædahl NORWAY	Project Manager & Director (Mechanical Engineer)	SINTEF, Trondheim, NORWAY.
5. A.K. Bhatnagar INDIA	Chemical Engineer	UNIDO Technical Consultant
6. U.A. Halvorsen NORWAY	Civil Engineer (Construction Materials)	Materials Development Dept CEMENTA AB, Malmö, SWEDEN.
7. C. Lewis Wrenshall U.S.A.	Chief Technical Adviser (Agricultural Chemist)	UNIDO Technical Consultant
8. John E.S. Whitney UNITED KINGDOM	Chemist (Plastics Technology)	UNIDO Technical Consultant
9. Wendell P. Clark U.S.A.	Wood Technologist (Forest Industries)	UNIDO Technical Consultant
10. Mohammed F. Selim EGYPT	Ceramics & Glass	The General Egyptian Organisation for Building Materials & Ceramics, Cairo, EGYPT
11. Clyde Rasmussen U.S.A.	Agro Industrial Marketing	U.S. Department of Agriculture, Western Regional Research Laboratory
12. Major R.N.V. Iyengar INDIA	Food Packaging	Indian Institute of Packaging, Bombay, INDIA.
13. Drinton C. Brown	Mining Engineer	U.S. Bureau of Mines, Washington, D.C.

<u>Name and Country</u>	<u>Discipline</u>	<u>Institution</u>
14. Arnold F. Braun SWITZERLAND	Telecommunication	Siemens-Albis AG, Zurich.
15. Jens A. Rinnan NORWAY	Industrial Engineering	The National Institute of Technology, Oslo

SOME NOTES ON THE WORK OF CARIRI

I. INTRODUCTION

These notes will not deal with the internal administrative structure of CARIRI. For the purposes of understanding the way in which the work is organised it is necessary to say that the Institute is divided into six functional divisions. In forming a team to undertake a project, members are drawn from the various divisions and co-ordinated by a project chief. The six divisions are :

Technical Information Services  
Engineering  
Food and Chemistry  
Materials Technology  
Economics  
Electronics and Instrumentation

II. TECHNICAL SERVICES

The Technical Information Service has been developed in four broad areas.

1. A question-and-answer service for providing specific items of scientific or technical information.
2. An information-retrieval service which provides information literature or references required for the compilation of the bibliographies and the preparation of literature surveys and reports.
3. A seek-and-provide service for obtaining information of the kind that is not well documented and usually has to be sought from individual institutions rather than from the literature.
4. A documentation service for the speedy and efficient supply of information obtained or identified in documentary form. This includes subject to copyright law, the supply of photocopies of printed and the provision of full size copies of material recorded in microforms. TIS also takes part in the

general extension service of the Institute to the industrial community. This is to ensure the proper evaluation and the use of the information and technology supplied to the industry by the Institute. In addition, ICI has responsibility for the technical editing of CARIRI reports and for the handling of all internally generated information for the Institute.

Testing services and back-up services in quality assurance are provided through the chemistry, microbiology, and materials laboratories. The policy here is to assist industry in setting up their own in-house quality assurance systems and providing for them, if they so desire, back-up checking facilities. Testing services have ranged from microbiological evaluation of both raw material and finished goods in industries ranging from food processing to paint manufacture, through the electronics and instrumentation group offering services in the setting up of programmes of preventative maintenance and spare parts procurement, repair and calibration of gas chromatographs, pH metres, spectrophotometers, chart recorders, electronic thermometers, and strain gauges among others, to the materials testing for the construction industry of steel structural sections, steel plates, galvanized products, and tests on products from table cutlery to steel billets.

### III PROJECT ACTIVITY

The following is a listing of the more interesting projects undertaken.

- A project aimed at finding new and profitable uses for less attractive fish species. The products considered were salted shark as a salted-cod substitute, fish fingers and fish sausages, canned tropical herring.
- A project aimed at finding new and profitable uses for Trinidad Lake Asphalt.
- An investigation into materials failure in oil drilling pipe and recommendations for the prevention of its recurrence.



- A study to determine the cost of production of ground Trinidad procellanite rock to be used as an extender and improver for Portland cement concrete.
- Design of a simple press for producing handicraft items out of pewter. An interesting aspect of this project was that by the adaptation of a simple screw press CARIRI was able to produce a design at about one fifth the cost of conventional equipment available for this purpose. This press has been in operation for the last three years.
- A project to study the market with regard to the establishment of an integrated tool industry. This project was started for the national Industrial Development Corporation which in turn developed this into the multimillion-dollar tool-and-die-making company which is now getting started with the assistance of UNDP/UNIDO.
- An investigation into improving the packaging of Trinidad Lake Asphalt for export purposes. The CARIRI professional who developed the packaging method was eventually hired by the client to carry out the technical changes required at the company.
- A project to design facilities for a central slaughter house in Tobago.
- A project designed to establish local blackboard-chalk industry. This project was very small, something in the order of US\$1,500 but provided some most interesting problems. (It was amazing to learn what kind of force was required to remove a stick of chalk that has dried in the mould !)
- A project to provide ongoing consulting service to a food manufacturer.
- Technical assistance in the local lime (citrus) processing industry. An assessment of the processing plant was made and recommendations for upgrading the process and improving the factory made. In addition, a market assessment of export markets for lime products with a view to identifying potential areas for diversification.

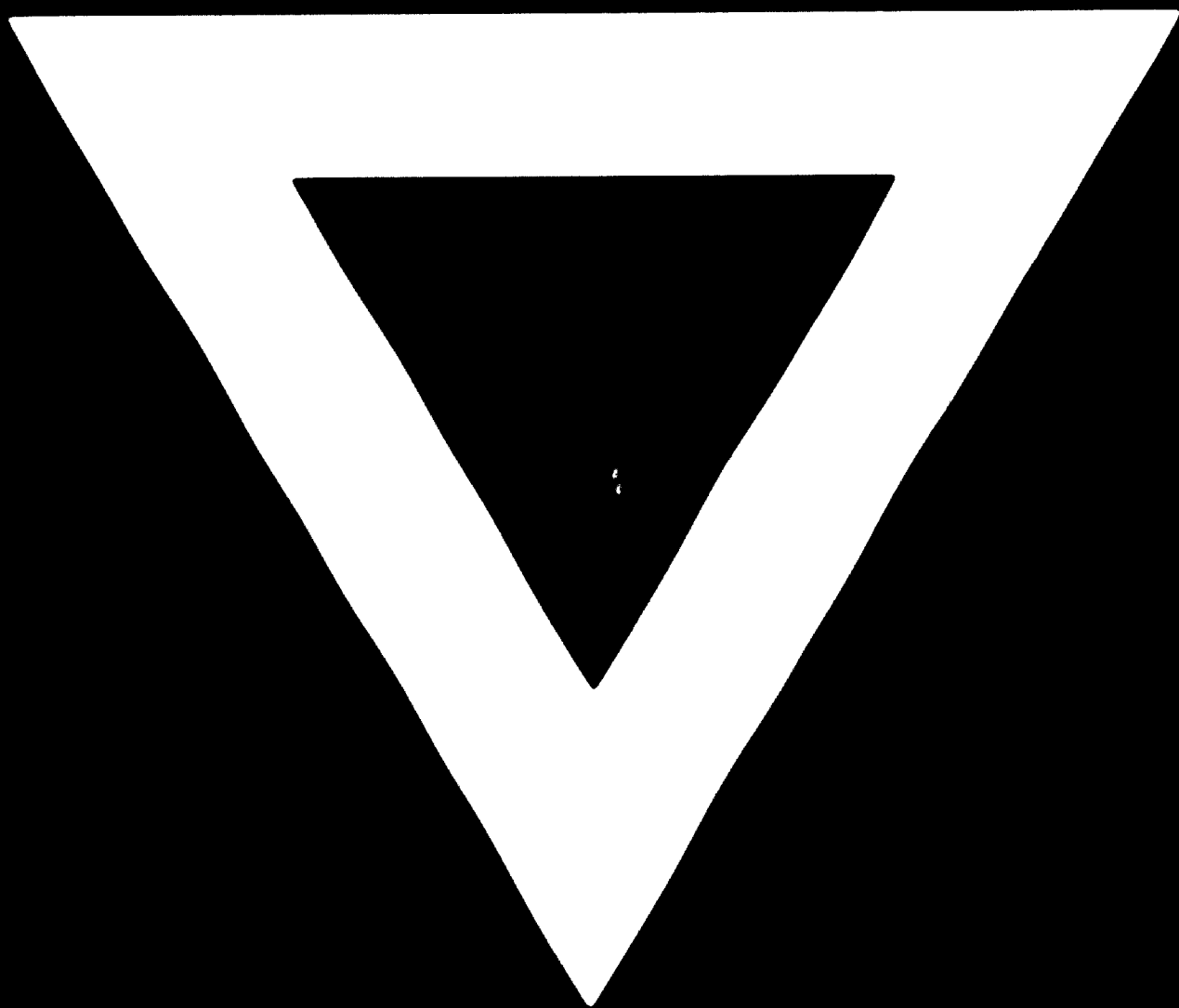
- A project to establish the first Petroleum Testing Laboratory of the Government of Trinidad and Tobago, with the evaluation of local crude oil, royalty samples and manufactured products for taxation purposes. This is the largest project handled by our institute so far, the value of the contract to date being US\$420,000.
- A project to supply process engineering including plant layout, and material specification for a factory to manufacture jams, jellies, marmalade, pickles, and condiments.
- A project aimed at the development of convenience products from chicken.
- Technical investigation into the raw material inputs for the local manufacture of chocolate bars, with the objective of maximizing the content of local ingredients.
- A project to investigate the utilisation of petroleum or other hydrocarbon substrates in the production of single cell protein for use in stock feeds. As a result of this project CARJRI held its first international seminar in 1974 with participants from UNIDO, the United States, the United Kingdom, Japan, Cuba and other countries in the Caribbean region.
- A project to determine the suitability of local clay for ceramic manufacture. This project and one to assist a local pottery manufacturer is being undertaken with the assistance of RPC of New Brunswick, Canada under the WAITRO Linkage Programme.
- Technical investigation into the commercial production of steelband (steel percussion) instruments including research into the development of tuning methods.

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#### Explanatory Note

Steelband instruments are musical instruments which were developed in Trinidad from 55-gallon oil-storage drums. These drums are cut to various sizes and musical notes are hammered out on one of their circular surfaces. This investigation is aimed at producing these instruments from sheet steel of consistent quality and also reducing the amount of manual labour involved in forming and tuning the notes.

- Assistance to a food manufacturer in effecting significant reductions in packaging and shipping cost on one of its export lines.
- A survey of the local cottage food-industry with a view to identifying the problems associated and providing advice. Some of the problems so far handled have dealt with raw materials, formulations, processing, production quality control, packaging, and labelling.
- Investigations into the detection of mycotoxins, mainly aflatoxins, in food and feeding stuffs.
- Assistance to a local light-bulb manufacturer establishing voluntary standards for his products.
- In collaboration with the University, an in-depth study into the construction industry with the aim of determining the existing capacity and the industry's ability to cope with major construction projects in the private and public sectors.
- CARIRI has been involved in one project which has classically demonstrated the interdependent but different roles which the University, the IRI, the Industrial Development Corporation and the private entrepreneur play in the development process. In 1971 one of the University staff of the Chemical Department of the Faculty of Engineering completed some research work he had been doing on the production of concentrate juice from the buds of the roselle plant, known locally as sorrel. He went to the IDC with a request for funds and came to CARIRI with a sketch of the process and a request to build a small pilot plant to try out his process. He estimated that the pilot plant would cost approximately US\$4,000 and the project would last about five months. Three years and some US\$40,000 later CARIRI was able to present the IDC with a proven design for a commercial plant. CARIRI was involved in the design and fabrication, and commissioning of the prototype and have also acted as consultants in the fabrication and commissioning of the commercial plant which has now been installed at an industrial site. This exercise has provided the institute and the IDC with very valuable information as to what is involved in this development process, the time factors, and the cost factors and even more importantly the need to investigate under local circumstances the adaptation of imported technology for use on local raw materials.



**76.01.16**