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CLASSIFICATION
PROJECT EVALUATION SUMMARY (PES) - PART I

Report Symbol U-447

1. PROJECT TITLE Development of LDC Industrial Research Institute Effectiveness	2. PROJECT NUMBER 931-0097	3. MISSION/AID/W OFFICE Office of Science and Technology, DSB
	4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) <u>80-44</u> <input checked="" type="checkbox"/> TERMINAL REGULAR EVALUATION <input type="checkbox"/> SPECIAL EVALUATION <u>6/16/80</u>	

5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING		7. PERIOD COVERED BY EVALUATION	
A. First PRO-AG or Equivalent FY <u>1976</u>	B. Final Obligation Expected FY <u>1979</u>	C. Final Input Delivery FY <u>1979</u>	A. Total	\$ <u>1,554,405</u>	From (month/yr.)	<u>June 1976</u>
			B. U.S.	\$ <u>1,554,405</u>	To (month/yr.)	<u>Feb. 1980</u>
					Date of Evaluation Review <u>Nov. 26-30, 1979</u>	

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR and April, 1980

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., telegram, SPAR, PIC, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
<p>This report covers a terminal evaluation for the purpose of assessing the general contractor performance, project implementation design as related to stated goals, and the knowledge added to the body of development expertise.</p> <p>The subject project accomplished its stated goals and purpose. Sufficient information and knowledge was produced by this project to enable the design of a success-or program that would have a high probability of success.</p> <p>The pertinent documents will be widely disseminated to Regional Bureau, selected AID Missions and through the Resources Report. In addition the documents will be made available to the World Association of Industrial and Technological Research Organizations.</p>	<p>R. Moeller, AID/W</p> <p>R. Black, DRI</p>	<p>August 1, 1980</p>

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS <input type="checkbox"/> Project Paper <input type="checkbox"/> Implementation Plan e.g., CPI Network <input type="checkbox"/> Other (Specify) _____ <input type="checkbox"/> Financial Plan <input type="checkbox"/> PIO/T _____ <input type="checkbox"/> Logical Framework <input type="checkbox"/> PIO/C <input type="checkbox"/> Other (Specify) _____ <input type="checkbox"/> Project Agreement <input type="checkbox"/> PIO/P _____	10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT A. <input type="checkbox"/> Continue Project Without Change B. <input type="checkbox"/> Change Project Design and/or <input type="checkbox"/> Change Implementation Plan C. <input type="checkbox"/> Discontinue Project
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11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles) See Attached List of Participants	12. Mission/AID/W Office Director Approval Signature _____ Typed Name <u>William M. Feldman</u>
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Participants

Evaluation Team

Mr. Roger D. Moeller, Project Manager, DS/ST
Ms. Ruth Flynn, DS/ST
Mr. Charles Sewell, AID Consultant

Evaluation Conference Participants, November 27-29, 1979

Evaluation Team Members

Dr. Smith Kamempool, Governor, TTSTR, Bangkok, Thailand
Dr. Abdul Ghani, Chairman, PCSIR, Karachi, Pakistan
Dr. Jaime Ayala R., Director, IIT, Bogota, Colombia
Mr. James P. Blackledge, DRI Consultant (former Director, OIP, DRI)
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Project Evaluation
Development of LDC Industrial Research
Institute Effectiveness
Project No. 931-0097

Introduction

In FY 1976 the project, Development of LDC Industrial Research Institute Effectiveness, was approved and implemented through a contract, AID/ta-C-1337, with Denver Research Institute (DRI). This project is a continuation of two prior contracts with DRI dating from 1973. The prior projects involved a set of assistance mechanisms designed to address the factors which have limited the industrial research institute (IRI) impact on local development problems. This project sought to bring these mechanisms to bear in a comprehensive and responsive manner to test their effectiveness.

This project brought these mechanisms together in three major elements:

1) An institute management program that experimented with various forms of management development workshops seminars and follow-up programs; 2) A linkage program that provided the basis for technical assistance, information services, training, the involvement of women and exchange of personnel programs; and 3) A grants program that focused the R&D capabilities on client needs by supporting projects with high potential for client use.

Summary: The subject project accomplished its stated goals and purpose. In addition, it added sufficient knowledge on mechanisms and techniques for improving LDC applied research effectiveness that it is now possible to design long term projects with a high degree of expected success. Sufficient flexibility was built into the project to allow the implementing participants to test and experiment with different approaches. The use of the linkage framework for implementing purposes was proven to be fruitful. Isolated

small grants did not prove to be worth the effort or cost whereas those associated with linked institutions were, in general, more successful both technically and commercially. Training mechanisms were tried and the most successful parameters identified. A technique for involving women in the technology transfer process using the applied research institutes as an entry point, was developed, tested and is presently in use with local support. Methods for providing technical assistance were tested and used successfully. Additional flexibility to provide more liaison and cross-flow of technical assistance between LDC institutes would have been helpful. Information services were started under the project in a purely support role but were, on the basis of identified need, expanded into a training mode also.

An interesting result of the project, not specifically anticipated in the Project Paper, has been the role of the private commercial sector in making people and facilities available for training and technical assistance as well as their direct involvement using their own resources in several grant projects. The private sector in the LDCs also participated in seminars, workshops and grant projects. The participation of the private sector although not quantifiable, was much larger and broader than originally expected.

Sufficient information and knowledge was produced by this project to enable a successor program to be designed in outline. This can be found under the heading of Lessons Learned.

Methodology: The purpose of this final evaluation of the subject project was to determine the effectiveness of the methods used to reach the project goals and to synthesize these determinations into a more effective project approach for future guidance. The evaluation itself followed an extensive data gathering period, largely performed by DRI. The presentation of the data

was done over the life of the project through periodic reports and annual reviews. The reviews included extensive use of AID personnel as well as outside consultants. Professor James Brian Quinn, Professor of Management, Amos Tuck School of Business Management, Dartmouth College and R. Youngok Ahn, Director of the Chemical Process R&D Laboratory, Korea Institute of Science and Technology participated in the initial review. In addition, Mr. Charles H. Sewell, participated in all of the reviews and this evaluation. A final presentation of the data was undertaken at a three day conference held in Denver, November 27-29, 1979 as proposed in the Project Paper. The participants in the data presentation conference included the evaluation team, DRI staff, the former Director of the Office of International Programs at DRI, the operating heads of the three LDC linked institutes, and three outside experts from UNIDO, the UN Office of Science and Technology, and NSF.

Data was collected through the examination of records and through personal interviews of project participants. The personnel and records of the linked institutes, including DRI and the three LDC institutes, were the major sources of the data on which this evaluation is based.

External Factors: The original project anticipated three LDC institutes linked with DRI, one in Africa, one in Latin America, and one in Asia. When the project was approved the linkages with the Instituto de Investigaciones Technologicas (IIT) in Colombia and with the Pakistan Council of Scientific and Industrial Research (PCSIR) were established. Two linkage attempts in Africa were unsuccessful so a linkage with Thailand Institute of Scientific and Technological Research (TISTR), formerly known as the Applied Scientific Research Corporation of Thailand (ASRCT), was initiated. Some delays and disruptions occurred in Pakistan due to reorganizations and

unsettled political situations, and a delay in implementing the project with IIT was encountered when the Institute Director was changed.

The basic assumptions enumerated in the Project Paper were tested by the project with results as follows:

- 1) That LDCs are interested in upgrading their S&T institutions. This assumption is basically correct but in some LDCs the priority is low and in others the definition of "upgrading" tends to be dissociated from science and technology and more closely associated with political values. In almost all cases the motivations come from a mixture of political and technical drives. Only in very extreme cases of political control was the project implementation severely handicapped.
- 2) That some fraction of the senior staff are amenable to change. This assumption was found to be basically valid but operational changes are required to induce the staff change. For example, pay scales and incentives must be competitive to the user's or personnel will be lost. The opportunity to publish and to participate in the larger technical community must also be afforded. To meet the goals of the project a major change was required in turning from science and technology for the sake of the technical staff to science and technology for the sake of the user of the technology (industry, government, consumer, etc.).
- 3) That external assistance can induce change. This assumption was proven correct. For elaboration of the induced changes under the linkages refer to attachments 1 and 2.
- 4) That the IRIs can be motivated to address the needs perceived by users. This assumption is valid but the techniques for motivating an institution

to be responsive are varied and time consuming. Key personnel in the institution must be convinced that responsiveness to the perceived needs of users is a useful function, will contribute to the institutes and individuals professional continuity and growth, and will add to the institutions and individuals esteem.

5) That the users will recognize the role of appropriate technologies. This is a valid assumption with two possible difficulties. If a particular technology is endowed with perceived prestige this may override other more germane factors; this is more likely to be a problem with the research institute than with the user. The second difficulty stems from possible definitional gaps in what constitutes an appropriate technology.

6) That the assisted IRI's will adapt and adopt U.S. techniques. This assumption is valid but emphasis must be placed on the ability to adapt. In fact, the ability to adapt techniques to specific applications is the heart function of an institute and should be applied to the techniques used by the institute themselves as well as to those used by their clients.

7) That cultural and political differences will not seriously limit the utility of these techniques. This assumption was explicitly tested under this project by introducing similar techniques into three institutions residing in three quite different cultures. If the institute is able and prepared to adapt the techniques this is without question a valid assumption. This was especially affirmed in the efforts to involve women in development by applying a particular technique through the use of the linked institutes. Success was achieved in the quite different cultures of Thailand and Colombia. Other examples can be found in the attached Final Report on the project to support the validity of this assumption.

Inputs: The project paper anticipated inputs of funding from AID in the amount of \$1,445,000 and host country funding and in-kind inputs totaling about \$550,000. AID funding was increased to \$1,554,405 to cover increased overhead and to fund an expanded program to involve women in development. The added overhead was covered by the addition of \$62,870 and the expanded program required an addition of \$46,535. No significant difficulty was encountered in supplying these funds.

Host country inputs were identified to a total of \$178,991; \$75,000 associated with the PCSIR linkage; \$61,357 with the TISTR linkage; and \$42,634 with the IIT linkage. An analysis of the breakdown indicates that in the case of TISTR and IIT insufficient credit was given for counterpart staff time and facilities and equipment use. Also, host country contributions were made outside of the linkages. A reasonable estimate of the total host country contributions in the four areas specified in the project paper (Staff time; Facilities and equipment; Logistical support and local meeting expenses; and Recruitment of new staff.) would probably total \$300-400,000. One detail of the financial plan in Project Paper calls for \$150,000 in host country contributions to the grants program. This was not included in the estimate above. If this item is removed from the total \$550,000 counterpart support expected in the project paper it is clear that the Project Paper expectations were optimistic, but not unreasonably so.

Outputs: Throughout the Project Paper the activities projected for this project are usually referred to as "experimental" activities. The activities are experiments in methodology to attain a desired result. Under these circumstances the desired outputs of this project are primarily qualitative and not quantitative. As an example, four management development workshops were held for the purpose of developing techniques and guidelines that could

be used effectively in training LDC institute managers. The results of these experimental workshops were documented in the Handbook on Management Development for Applied Research Institutes to provide the LDC institutes, governments and implementing institutions with a step-by-step guide on how to organize and conduct a successful and effective management development workshop. The demand for these handbooks was unusually high and additional printings were necessary to meet the demand. The Handbook has been translated into at least one other language.

Quantitatively the Project Paper called for six regional workshops. During the course of the project it was ascertained that the qualitative objective could be met with four workshops and the project was changed accordingly. These four workshops, as described in the attached project Final Report, provided training for about 117 participants for periods of one to two weeks. The Project Paper called for 60 participants for two weeks.

In addition, on-site workshops and seminars were held under the auspices of the individual linkages on topics such as quality control, project management, technology information systems, operations research, involvement of women, marketing, and middle management. These workshops and seminars were related to the activities of a wide selection of industries, from food processing to mineral extractions, as well as to the operations of the institutes themselves. The seminars were largely designed to encourage and promote the out-reach or extension service capabilities of the institutes with respect to potential clients. Between 400 and 500 individuals participated in the seminars while 150 to 200 participants participated in the on-site workshops. Quantitatively this is double the Project Paper estimates.

The Project Paper calls for the establishment of at least three LDC institute linkages. As noted above under External Factors, this was accomplished and provided the basic framework for meeting many of the project goals.

The Project Paper estimated that 25 grants would be awarded to a number of institutes, including but not limited to the linked institutes. The project budgeted about \$400,000 for these awards. Because of competing demands on the budget and a general underestimation of the overall difficulties of initiating grants, only two rounds of five each or a total of 10 were instituted. The major problem in this area stemmed from the very low quality of the proposals submitted by the institutes. A large amount of time was consumed in individual efforts to upgrade the proposal quality. The details concerning the grants are contained in the accompanying project Final Report.

The Project Paper anticipated as much as a 50% "success" rate for the grants. The definition of "success" in this case is a bit illusive. Three categories of results can be established: 1) technically unsuccessful 2) technically successful only 3) technically and commercially successful. Too little time has elapsed to permit a final judgment of commercial success but where active commercial interests have associated with the grant project it is put in category (3). Under these definitions four of the grants must be termed "unsuccessful", three of the grants were technical successes only, and the remaining three grants can be classified as technical and commercial successes.

Besides the annual reports on the project progress, formal reports on specific subjects were produced in whole or part under the project. The aforementioned Handbook on Management Development for Applied Research Institutes was an example of this.

The basic work was performed under this project that led to the production of an Information Service Handbook. This project also produced eight case studies where industrial research institutes were involved in appropriate technology development and dissemination. A series of reports were published based on the effort under this contract to involve women in the development process. These reports cover specific workshops in Thailand and Colombia as well as a general report on the Development Training Forum technique used.

Purpose: The purpose of this project was to assist selected LDC industrial research institutions in improving their organizational management, marketing and technical skills toward increased participation in the development of their country and to disseminate the results to IRIs worldwide. Four End of Project Status items were specified in the project paper as follows:

1. LDC capability for staff training in project selection and management;
2. Operational IRI systems for interfacing with the user community;
3. Demonstrated IRI performance on development problems in selected countries; and
4. Increased government and industry commitment to utilization of IRI resources.

The subjective nature of these End of Project Status items is difficult to quantify statistically. Complete discussions of these subjects can be found in DRI's Final Report and in the report of a conference on Mechanisms for Strengthening Applied Research Institutes in Developing Countries. Both reports are submitted as attachments to this report. There is no question that the three linked institutes attained the End of Project Status envisaged

in the project paper to varying degrees.

An overriding End of Project Status, one not mentioned as such in the project paper, is an increased understanding of useful mechanisms for attaining more effective use of applied research institutes in doing those things specified in the End of Project Status items above. This point is also covered in the reports referred to previously and there is no question that this End of Project Status has also been attained.

Goal/Subgoal: The goal of the project is to improve science and technology institutes in developing countries. The subgoal is to strengthen the capabilities of LDC industrial service institutions to assist local industries in selecting, adapting, and using technologies suited to their circumstances, with special attention to the support of small industries. All three linked institutes have made general and specific progress toward these goals. Details are available from both DRI's and the linked institute's perspectives in the two attached reports referred to above under Purpose.

Beneficiaries: The goals and purposes discussed above lead to improving the viability of the productive sector encompassing small and medium scale industry, as generally noted in the Project Paper. Many analyses performed by individual researchers, the International Labor Organization, The World Bank and others have concluded that expansion of this portion of the industrial sector carries with it the creation of employment opportunities for the poorer and less skilled elements of a society at the least capital cost per employment opportunity created. This is brought about by increasing productivity and markets through management and technical skills upgrading and through the introduction of useful and appropriate technologies.

In designing this project the above stated relationship between employment and small and medium scale industry was accepted as fact and the project was not intended to further verify this relationship. It was assumed that the improvement of the management functions of applied research institutes along with improving and expanding their ability to market and apply their expertise to industry and government clientele would make a positive contribution to industries employment capacity and the host government's effectiveness in country development efforts. The primary beneficiaries of this project have been the people trained in the various workshops, seminars and work experiences as well as the institutes of which they are a part. Insufficient time has passed for quantifiable impact in terms of employment or more effective development programs to become apparent. However, a number of anecdotal examples of the effective application of the enhanced institute effectiveness is contained in the attached reports.

In summary, the direct beneficiaries of this project are the people trained under the project and the institutes whose effectiveness in serving their industrial and governmental clientele has been enhanced. The indirect beneficiaries are the poor who will be the recipients of income from the jobs created by the industries assisted by the institutes and those who benefit from the more effective government development programs.

More detailed discussion of these relationships are contained in the Development Coordinating Committee's Policy Paper on the "Evolution of the BHN Concept" of March 1979 and in the Agency's Policy Paper "A Strategy for a More Effective Bilateral Development Assistance Program" of March 1978.

Unplanned Effects: After the project was well underway it became apparent

that a more directed effort to involve women through the institutes could produce significant results not planned in the project paper. Supplemental funding was provided for the effort in Thailand and Colombia. The details of this approach under the project are contained in the attached Final Report. It is worthy of note that the first tier training involved about 100 participants in each country. Second tier effects, where original trainees use the methods learned in the workshops to train others, were documented in Thailand and Colombia. This effort has shown that LDC applied research institutes can be used effectively as entry points for the involvement of women in the technology transfer aspects of country development.

Lessons Learned: This project, in conjunction with prior projects and work done by other assistance groups, leaves no doubt that viable applied research institutes can play a valuable and probably unique role in a country's development. Most specifically, this project has developed methods and techniques for making the institutes much more effective in this role.

A number of problems occurred in implementing this project. As an example, it was found that workshops where the participants were not professional peers were less effective. Also, basic workshop agenda preparation, when left to the host institute to prepare, tended to result in a narrow range of subject matter based on the experiences of the host institute. It was also found that the grant mechanism, as a means of enhancing the institute/client relationship, generally needed auxiliary assistance that was difficult to provide to unlinked institutes. As a consequence, the grants to linked institutes tended to be most successful. In the initial stages the direct supply of information had problems with request interpretation and the ability of the recipient to translate the information to useful practice. As a result, the project instituted workshops to train the information recipients

in the techniques of acquiring and translating the information into useful form.

A remaining question involves the best design of a project or effort to improve the effectiveness of the institutes. The application of the linkage mechanism in a flexible manner based on common interests and perceived needs could form an effective framework for the systematic use of a number of elements. The linkage arrangement under a project for improving local institute effectiveness should be implemented and supported in three phases. Phase One would be the analytical or evaluative phase where needs are defined and specific solutions are identified. Phase One starts even before the formal linkage to determine the general basis for the linkage and, though it is the main effort at the start of the linkage, it never really stops. Phase Two would be the active implementation of the elements needed to effect the specific solutions identified in Phase One. Phase Three would be a responsive phase characterized by more joint efforts and mutual support roles. Phase Three differs from Phase Two in emphasis, motivation and useful elements.

There could be five elements to the linkage activity in Phases Two and Three.

These are: 1) Training; 2) Information services; 3) Specific technical assistance; 4) Grants program; and 5) Networking. All of these elements may not be useful in each linkage. From the experience in this project and its predecessors, it appears to be desirable for one developed country institute to maintain a number of linkages and for the project to encourage a cross-flow of assistance and training. This, of course, can lead to a form of de facto networking. The length of a particular linkage effort with project support should be about 7 or 8 years. Phase One and Two should involve the first 5 years with Phase Three the last 2 or 3 years. The Phase Three years could, in fact, be budget "weaning" years.

Phase Two of the linkage should be flexible and respond to the demands identified by the analytical phase. However, the training element should start first joined by the information services functioning in both a training and support mode. Specific technical assistance and the grants program should not be implemented until the linked institute has some degree of demonstrated competence as evinced by training and experience. Both specific technical assistance and the grants program should be looked at as elements aimed at specific client-related needs and as "proof of-competence." Only secondarily, although perhaps importantly, should the purpose of these two elements be training. It is particularly necessary that the linked institute have basic support competence in information services before technical assistance or a grants program could be expected to be effective.

Assuming a single developed country institute implementing a linkage program with three or more LDC institutes, a pro-forma budget can be developed. Although the budget can be presented in terms of \$ per element per linkage year, it is predicated on a total of three linkages and the flexibility to place different emphases on different elements. A typical pro-forma budget might be as follows:

	<u>Budget and Project Year</u>	
Phase one (Pre & during linkage)	\$20,000 (1st year);	\$10,000 (next 4 yrs)
Phase Two		
Training	80,000 (each of 5 yrs)	
Information Services	20,000 (1st year);	15,000 (next 4 yrs)
Specific Tech. Assist	30,000 (2nd, 3rd, 4th, & 5th yrs)	
Grants Program	30,000 (3rd, 4th & 5th yrs)	
Networking	10,000 (4th & 5th year)	
Phase Three	75,000 (6th yr)	\$50,000 (7th yr) \$25,000 (8th yr)

An eight year linkage program would cost about \$920,000 in assistance funds. A minimum three linkage program over eight years would cost about \$2,800,000. Host institution contributions could be expected to total about \$600,000 to \$800,000 additional.

In summary, our experience under this project could lead to the following scenario: a follow-on project using the linkage mechanism as an integrating concept; the incorporation of five discrete elements of assistance; the use of a technical assistance and grants program to fill client related needs and "proof-of-competence"; the sequential use of the various elements would be logically phased; and a total program extended for 7 to 8 years per linkage.

Above all, the linkages should be flexible and responsive and should evolve toward a form that would attract varied external as well as internal institute support.

Special Comments: All of the above is potentially useful and germane if the key role that small and medium size industry plays in country development is recognized. This recognition must, in the first instance, be evident through policy and program positions of the assisting agency and, in the second instance, be evident within the government and economic structure of the developing countries. In addition, the fundamental importance of technology and those institutions who use technology, to the equitable provision of income to the poor through the provision of employment opportunities must be generally accepted.

List of Attachments:

- 1) Final Report: LDC Research Institute Effectiveness - Contract No. AID/ta-C-1337.

2) Mechanisms For Strengthening Applied Research Institutes in Developing Countries - Report of a conference supported by Contract No. AID/DSAN-C-0214.

3) Memorandum of Understanding on a Direct Linkage Between the Applied Scientific Research Corporation of Thailand and the Denver Research Institute University of Denver, 24 December 1976.

4) Memorandum Report by Charles Sewell dated December 10, 1979.

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