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APPLIED SCIENCE AND TECHNOLOGY PROGRAM IN EGYPT

Joint Consultative Committee

Program Evaluation Report

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Academy of Scientific Research and Technology, Cairo

National Research Centre, Cairo

U.S. National Academy of Sciences/National Research Council, Washington

U.S. National Science Foundation, Washington

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## FOREWORD

This Program Evaluation Report is submitted to the U.S. AID Mission in Cairo as a background document for Mission consideration in extending the Applied Science and Technology Program (Project 263-0016) for an additional three years (Phase II). The report includes inputs prepared for the 5th Meeting of the Joint Consultative Committee (February 25-27, 1980) by the Academy of Scientific Research and Technology (ASRT), the U.S. National Academy of Sciences/National Research Council (NAS/NRC), and the U.S. National Science Foundation (NSF) together with summary material prepared by the Committee's staff.

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## SUMMARY AND CONCLUSIONS

The Applied Science and Technology Program is a cooperative effort by the Arab Republic of Egypt, through its Academy of Scientific Research and Technology (ASRT), and the United States of America, through its Agency for International Development (AID), to:

- Demonstrate how scientific and technical manpower resources and research institutions can solve Egyptian priority problems of economic and social development;
- Reorient Egyptian research and development management systems to address problems requiring a multi-disciplinary and multi-institutional approach; and
- Strengthen the ASRT, its associated research institutes, and Egyptian universities by providing technical assistance, instrumentation, and access to scientific information resources.

The Program enlisted the U.S. National Science Foundation (NSF) and the U.S. National Academy of Sciences/National Research Council (NAS/NRC) to assist the ASRT in the complex process of program design, implementation, management and evaluation. This document briefly describes the origin and development of the Applied Science and Technology Program since the two governments signed a Program Agreement in March 1977. It also outlines the conclusions of the Joint Consultative Committee (JCC), a continuing group of Egyptian and American scientists and responsible for overseeing the Program, who met in Washington in late February 1980 to assess progress, evaluate program goals and objectives,

and make recommendations to AID for a three-year program continuation from October 1980 through September 1983 (Phase II).

The consensus of the Egyptian and American members of the JCC was that Phase I (March 1977 - September 1980) of this program was highly successful as the initial catalyst to help Egypt in its desire to strengthen its national research and development management capabilities and to use its R&D resources to solve critical economic and social problems. In particular, there was good illumination of the problems that surfaced throughout Phase I and that should be addressed during Phase II of the program.

The JCC members considered the four documents submitted by the ASRT, NSF, NAS/NRC, and AID as basic inputs for the self-evaluation at the February 1980 meeting, and stated the following:

1.1 Demonstration Projects

-- More and Better Food.

Overall progress is evident. Plans to reorient and extend this project to include other representative villages are considered for Phase II of project implementation. The ASRT Council of Food and Agricultural Research will work out details to be submitted to the JCC at its sixth meeting (November 1980).

-- Biogas Technology.

Social aspects of introducing biogas technology in rural areas should be the major thrust during Phase II.

-- **New Crops for Arid and Semi-Arid Zones.**

The project, still at an early stage of development, should emphasize: (a) marginal lands as primary sites for implementation; (b) salt tolerant, drought resistant plants; and (c) optimum utilization of water resources.

1.2 R&D Projects

-- The phosphate ore, corrosion and wool wax projects have developed good linkages between the R&D sector and industry.

-- Economic impact will continue to be stressed in selecting new projects for Phase II.

-- The Red Sea fisheries project, redesigned to focus upon definite goals, shows good prospects for implementation and should be pursued.

1.3 S&T Information

-- Although the start-up time for this project was long, implementation of the survey and design study and in-service training is proceeding intensively.

1.4 Instrumentation Technology

-- There has been success in establishing maintenance and repair (M&K) centers, in training associated personnel, and in procuring equipment. However, the JCC has noted excessive delay in certain aspects of equipment procurement which has been a major constraint in overall program execution. Continued work to improve procurement procedures is essential.

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1.5 Policy, Planning and Management

- Seminars and workshops should continue to take place in Egypt, in order to increase participation of Egyptian personnel.
  
- Recognition was given to the need to institutionalize R&D management training in Egypt.
  
- Follow-up activities might include greater involvement of Egyptian trainees in S&T management aspects of their institutes.

## II

### INTRODUCTION

#### A. Program Origin and Purpose

The Applied Science and Technology Program is a joint endeavor of the United States and Egypt to help orient Egyptian scientific and technical research activities toward solving high priority national development problems. The two countries have long cooperated in research efforts under the PL-480 program; this activity began in 1975, when the Egyptian Academy of Scientific Research and Technology (ASRT), the U.S. National Science Foundation (NSF), and the U.S. National Academy of Sciences/ National Research Council (NAS/NRC) jointly held a workshop on science and technology policy, research management, and planning in Egypt. From that workshop and subsequent studies came a formal agreement in March 1977 between the ASRT and the U.S. Agency for International Development (AID) to enter into a five-year cooperative program for strengthening management and institutional capabilities of Egypt's science and technology community. Both the ASRT and AID invited the NAS/NRC and the NSF to join them in the activity which became known as the "Applied Science and Technology Program" and is designated as Project 263-0016 by the AID Mission in Cairo.

The formal program agreement between the two governments includes six basic elements:

1. Policy planning and management of research and development (R&D);
2. Demonstration projects, multidisciplinary in scope, directed to high priority areas of economic and social development;
3. R&D projects, also directed to specific priority problems faced by "end-users" in agriculture or industry;

4. Scientific and technical information systems;
5. Procurement of scientific instruments and equipment, including improvement of maintenance and repair capabilities; and
6. Planning for years 3, 4, and 5 (Phase II).

A contract between AID and NAS/NRC was signed in December 1977 for implementation of elements 1, 2, and 3. An inter-agency agreement between AID and NSF for elements 4 and 5 was completed in September 1978. All Egyptian and American parties share the responsibility for element 6, Phase II planning. The schedule for Phase I (years 1 and 2) has been continued until October 1, 1980, with U.S.\$8.1 million and Egyptian pounds 895,000 allocated by AID for those activities.

## E. Program Elements

### 1. Policy Planning and Management of R&D

A Joint Consultative Committee (JCC), composed of six members from Egypt and five from the United States, provides policy planning and management oversight for the Program. The JCC has advisory authority rather than direct operational responsibility. Meetings are held twice a year, alternately in Egypt and in the United States, under the permanent chairmanship of the ASRT President.

NAS/NRC advisory panels are appointed to work with each of the specific R&D and demonstration projects described below. An NAS/NRC staff member (Dr. Helmut Weldes) in Cairo serves as a senior resident advisor at the National Research Centre (NRC/Cairo). He works with the NRC/Cairo Director and senior staff in program planning and implementation. As an ex officio member of the JCC, he is the local NAS/NRC representative for all projects

in both technical and administrative matters.

In order to provide specific management training opportunities to the ASRT and NRC/Cairo staff, an R&D management training program was initiated in 1979-1980 under an NAS/NRC subcontract to the Denver Research Institute. The training program consisted of a series of courses in the United States and Egypt emphasizing the following areas: R&D management methods, technology assessment, technical economics, and marketing methods for R&D.

2. Research and Development (R&D) Projects

There are four applied research projects which are included in the Program and receive support in the form of technical assistance, staff training opportunities, and scientific equipment. They are:

- Evaluation of Egyptian Phosphate Ores: (a) R&D on the utilization of extensive low-grade phosphate ore reserves in Egypt for fertilizer manufacture, and (b) engineering design through the pilot plant stage for phosphate fertilizer production.
- Corrosion Causes and Control: Investigation of means to inhibit corrosion of Egyptian steels, particularly with reference to the Egyptian petroleum refining industry by using and adapting existing knowledge of corrosion control.
- Wool Scouring and Utilization of Wool Wax: (a) Adaptation of techniques for scouring raw wool to improve the market acceptability of fibers (wool tops) and, (b) recovery of wool wax, lanolin, and its derivatives from raw wool for use in pharmaceuticals, textiles, and other consumer products.

- Development of Red Sea Fisheries: Survey of the fisheries areas near Foul Bay of the Red Sea, to assess the potential for commercial development and, depending upon the results, to assist in marketing techniques for the catch as a contribution of increasing Egypt's food supply.

### 3. Demonstration Projects

Demonstration projects are broader in objective and complexity than R&D projects; are multidisciplinary in design; and multi-institutional in scope. Demonstration projects address high priority problems identified in the Egyptian national development plan and normally require longer time periods to achieve acceptable solutions.

- More and Better Food: The first of the demonstration projects to be implemented has the following objectives: (a) to improve farm production methods and output of foods produced for local consumption in two selected villages, (b) to assess the nutritional status of the most vulnerable population group (primary school children and nursing mothers) of the two villages, (c) to demonstrate a plan to solve the nutritional deficiencies by using local resources and methods, and (d) to assist Egyptian food industries in solving production and product quality-control problems.

- Development and Application of Biogas Technology in Rural Areas of Egypt: The objective of this project is production and use of methane as a renewable energy source for Egyptian villages by utilizing human, animal, and agricultural wastes.

-- New Crops for Arid and Semiarid Zones: This project investigates agricultural practices and possibilities for nonconventional crops in areas where traditional irrigation practices are not possible. Particular effort is to be directed toward increasing salt tolerance in plants and use of low-quality water.

#### 4. Provision of Scientific Equipment

Equipment for the R&D and Demonstration projects is procured by AID after consultation with the ASRT. Under an AID Participating Agency Service Agreement (PASA) NSF is assisting: (a) AID and ASRT in the specification and procurement of this scientific equipment; and (b) the NRC/SIC, and Universities of Alexandria, Assiut, Cairo, El-Minia, and Tanta in improving their scientific instrumentation maintenance and repair capability. Under contracts with NSF, technical services of a methodological, consultative, and guidance nature are provided by the University of Wisconsin-Madison, Instrumentation Systems Center for (a) and for (b) for the NRC/SIC only; and by the National Institutes of Health-Biomedical Engineering and Instrumentation Branch for (b) for the universities.

#### 5. Scientific and Technical Information

The development of scientific and technical information services to meet information needs of the Egyptian scientific and engineering community is being undertaken through the National Information and Documentation Center (NIDOC) of the ASRT. Under an AID Participating Agency Service Agreement (PASA) the National Science Foundation (NSF) is assisting NIDOC in (a) planning and designing a national information system capable of providing S&T information services to universities, research centers,

and research institutions of various ministries and the private sector, and (b) training key personnel to handle the various functions and operations of such a system. Technical services of a methodological, consultative and guidance nature are provided to NIDOC by the Georgia Institute of Technology for (a) and by the Catholic University of America for (b) under contracts with the NSF.

C. Criteria for Project Selection

The Program Agreement between AID and ASRT provided a framework for selecting specific "demonstration" and "R&D" projects. Problem areas from which R&D projects were to be chosen included: (a) plant production and protection, (b) animal research and fisheries, (c) soil and water resources, (d) medical research, (e) building technology, (f) industrial research, (g) petroleum and mineral resources, (h) energy research, (i) transportation research, and (j) physical and electronics applications. Perhaps the main characteristic of the R&D projects is their emphasis upon "end-users" in the design of the project and their participation in the research.

Demonstration projects were recognized to be of a more comprehensive nature than R&D projects and were to involve multidisciplinary and multi-institutional activities as well as field trials (demonstrations) of experimental results from universities or applied research institutions. One demonstration project, More and Better Food, identified in the original Program Agreement, was assigned to NRC/Cairo as the management agency. The project was to include activities such as food production, harvesting,

preservation, and marketing as well as a nutrition and feeding component focused upon primary school children from two selected Egyptian villages. Another component of More and Better Food consists of NRC/Cairo technical assistance to Egyptian food industries.

A second demonstration project was also to be selected with the assistance of the JCC with the ASRT assigned as its management agency.

The Joint Consultative Committee, during its first meeting (Cairo, May 6-9, 1976), approved the following general criteria for R&D and demonstration projects:

1. Each project must be relevant to critical Egyptian national development priorities (agriculture and rural development, promotion of Egyptian industries, land reclamation, health care, housing, etc.)
2. Project design must be geared toward solving critical development problems.
3. Projects must involve substantial interdisciplinary effort and the mobilization of a variety of scientific specialties and institutions (multidisciplinary participation and cooperation between different research institutions.)
4. Projects must provide an explicit framework within which managerial and technical training and experience can take place, and through which the ASRT can develop recognition of its role as coordinator and stimulator among research and user communities.
5. User participation must be provided for in the process so that practical end-use applications are built into the objectives.

6. Appropriateness of technology must be considered; e.g., labor-intensive adaptation to local materials, applicability to existing skills, etc.

D. JCC Evaluation Process

The Applied Science and Technology Program Agreement between the Government of Egypt and the U.S. AID provides for two evaluations of the Phase I (January 1978 - October 1980) activities prior to initiation of Phase II (October 1980 - October 1983). One was conducted by AID/Cairo in April 1979; a second, external evaluation is being conducted by AID/Cairo through a 5-person contract team visiting Egypt in April 1980. This latter evaluation is designed to assess:

- the ability of the Egyptian organizations participating in the projects to conceptualize, select, and manage goal-oriented research;
- the improved institutional capabilities of the Egyptian scientific and technical community to engage in priority projects related to social-economic development; and
- the validity of recommendations of the Egyptian and U.S. participating groups for continuation of the Applied Science and Technology Program into Phase II.

The Joint Consultative Committee at its Third Meeting agreed to conduct its own "self-evaluation" to: (a) discuss and measure (where feasible) the validity of the overall program concept and approaches taken by the individual project elements, (b) identify changes or actions that could improve efficiency, (c) identify needs outside the program that have not been addressed but should be undertaken to in-

sure that longer-term goals can be reached, and (d) examine both the technical and nontechnical content of the projects in light of the resources made available.

Written reports from the ASRT, the NAS/NRC, NSF, and U.S. AID/Cairo were prepared for the JCC self-evaluation sessions at its February 25-27, 1980 meeting. The reports, discussions, and other background documents, such as the Project Agreement, all constituted the inputs to this JCC Program Evaluation Report.

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PROGRAM REVIEW HIGHLIGHTS

A. Participants in the JCC Program Review

The Program Review (JCC self-evaluation) was held on February 25, 1980, during the 5th Meeting of the Joint Consultative Committee with the following members present:

EGYPTIAN JCC MEMBERS

Dr. Hassan Ismail  
President, Academy of Scientific Research and Technology (ASRT)

Dr. Mostafa Al-Gabaly  
Counsellor, Ministry of Agriculture

Dr. Osama Al-Kholy  
Director, Industrial Development Center for the Arab States

Dr. Ibrahim Helmy Abd El-Rahman  
Counsellor, Office of the Prime Minister

U.S. JCC MEMBERS

Dr. H. Guyford Stever  
Consultant  
Member, National Academy of Sciences and National Academy of Engineering

Dr. George Bugliarello  
President, New York Polytechnic Institute

Dr. Mary E. Carter  
Director, Southern Regional Research Laboratory  
U.S. Department of Agriculture

Dr. James Hillier  
Consultant  
Vice President (retired), RCA Corporation  
Member, National Academy of Engineering

Dr. Gilbert F. White  
Chairman, Commission on National Resources  
National Academy of Sciences

Dr. Helmut Weldes (Ex Officio)  
Senior Staff Officer, Board on Science & Technology for International  
Development (BOSTID)

Others present who were invited to comment on various program elements and join with the JCC members in the evaluation discussions were:

EGYPTIAN ADVISORS

Dr. Mohamed Kamel  
Director, National Research Centre (NCR)

Dr. M. Darwish  
Cultural and Scientific Counsellor  
Embassy of the Arab Republic of Egypt, Washington

Dr. A. S. El-Nockrashy  
Director, Applied Science and Technology Project  
Academy of Scientific Research and Technology

Dr. Osman Galal  
Head, Technical Office, National Research Centre

NATIONAL SCIENCE FOUNDATION

Mr. Roger Doyon  
Section Head, Africa and Asia Section, INT

Dr. Lawrence Edwards  
Program Manager, Africa and Asia Section, INT

Mr. Eugene Fronko  
Senior Program Manager, Africa and Asia Section, INT

NATIONAL ACADEMY OF SCIENCES

Mr. David Williams, Comptroller

Mr. Thomas Gikas  
Office of Contracts and Grants

Dr. Victor Rabinowitch  
Director, Board on Science & Technology for International Development  
(BOSTID)

Mr. Jay Davenport  
Staff Officer, BOSTID

Mr. Augustus Nasmith  
Staff Officer, BOSTID

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INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

Mr. Princeton Lyman  
Special Assistant to the Director

AGENCY FOR INTERNATIONAL DEVELOPMENT

Mr. James Riley  
Director, Industry, Science, and Technology Division  
U.S. AID Mission, Cairo

Mr. Edgar Pike  
Office of Technical Support, Bureau for Near East  
Washington

NATIONAL BUREAU OF STANDARDS

Dr. Kurt Heinrich  
Chief, Office of International Relations

Dr. Sam Chappell  
Senior Standards Specialist, Office of Domestic and International  
Measurement Standards

NATIONAL INSTITUTES OF HEALTH

Mr. Howard Metz  
Biomedical Engineering and Instrumentation Branch

CATHOLIC UNIVERSITY OF AMERICA

Dr. Bahaa El-Hadidy  
Graduate Department of Library and Information Sciences

GEORGIA INSTITUTE OF TECHNOLOGY

Dr. Vladimir Slamecka  
School of Information and Computer Science

UNIVERSITY OF WISCONSIN

Dr. Norman Huston  
Director, Instrumentation Systems Center  
College of Engineering

Mr. Edward Falk  
Instrumentation Systems Center  
College of Engineering

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B. General Discussion Highlights

Mr. James Riley, program officer for technical and administrative direction of the Applied Science and Technology Program for the AID Mission in Cairo, was specifically invited by Dr. Hassan Ismail to comment on the program for the Mission. Mr. Riley first outlined the Mission evaluation process to be as follows:

- specific evaluation of the Applied Science and Technology Program (Project 263-0016) following the guidelines given in the original Program Agreement, and
- a broader evaluation of science policy in Egypt looking at institutional structures and R&D linkages to end-users. This latter review would examine the impact of current science and technology policy on Egyptian economic and social development.

Looking specifically at Phase I, the project identification and initiation aspects as well as the training activities in R&D management and in equipment maintenance and repair, Mr. Riley was asked by the Mission Director, Mr. Donald Brown, to report that:

- U.S. personnel inputs in Phase I seemed "high," and therefore costly. The AID Mission asked the JCC to reduce U.S. personnel inputs in Phase II.
- greater emphasis during Phase II should be directed to economic and social returns of the projects
- greater emphasis should be placed upon science policy formation during Phase II.

The President of the ASRT, Dr. Hassan Ismail, replying to Mr. Riley's remarks, agreed that Phase II should demonstrate a greater degree of

Egyptian management of the projects. One change in the ASRT that Dr. Ismail has already set in motion is a reorganization of Academy Councils as advisory groups to the ASRT President. The Councils will set overall policy guidelines in their respective areas of R&D (agriculture, health, industrial development, manpower and training, etc.) and assist in monitoring projects which are supported by the ASRT grants system. Already, the trend of support is toward applied R&D linked with priority national goals (food production, housing, etc.)

Several JCC members commented upon the AID reference to "high" U.S. (and Egyptian) personnel inputs and stated that:

- it is the diversity of the Applied Science and Technology Program that requires experienced, highly skilled, and broadly representative manpower inputs.
- if one goal is to encourage both multidisciplinary and multi-institutional projects under 263-0016, those activities will naturally require extensive technical and managerial inputs.
- nearly 100 percent of the U.S. manpower inputs on advisory panels, study missions, and on the JCC itself have been given on a pro bono basis.
- the large number of U.S. institutions that have been involved as sites for Egyptian observation and study visits do translate into specific (and heavy) personnel involvement, but these inputs have also been provided on a pro bono basis.

Dr. H. Guyford Stever (U.S. panel) and Drs. Al-Gabaly and Al-Rahman (Egyptian panel) underlined their understanding that the Applied Science

and Technology Program was intended to shift leadership and involvement from U.S. to Egyptian scientists and engineers as the program progressed from Year 1 to Year 5.

The Policy formation emphasis referred to by Mr. Riley was viewed by JCC participants as a "new" concern which could be added during Phase II but would require new resources beyond those which the JCC had already contemplated for the more limited, program-related policy and management functions (Element 1). To differentiate the larger science and technology policy questions from "management policy" issues of the program, the JCC members suggested that an additional program element, hereafter referred to as National Policy Measures for Science and Technology, be added to the Phase II program planning.

C. Evaluation of Demonstration Projects

1. More and Better Food

JCC members remarked that the More and Better Food project is extremely diverse, involving plant and animal production; nutrition studies; medical observation of food-nutrition patterns and their effects upon growth in village children; design, operation, and monitoring a nutrition intervention experiment; and conducting food technology advisory activities for industry. In support of this multifaceted program, Dr. M. Kamel (Director, NRC/Cairo) observed that the More and Better Food Program "demonstrates" exactly the type of activity needed in Egypt--it addresses real problems, it involves villagers as well as a variety of researchers and administrators, it gathers together the experience and skills in many disciplines, it proceeds from "known" information to clearly outlined goals, and it challenges the skills (management as well as technical) of

all involved. Best of all, the More and Better Food Program was "on schedule" in its laboratory support aspects, field data gathering, and advisory services to industry. The major time delaying factor, common to nearly all of the projects, is lengthy equipment procurement procedures and deliveries.

One JCC member observed that the ASRT Agricultural Council was reviewing the More and Better Food Program and might suggest some reorientation to the JCC at its November 1980 meeting. The reorientation might, for example, take the form of recommending a separation of the food technology program aspects (which could then become a "new" R&D project) from the village "demonstration" program activities.

Dr. Stever summarized the consensus of the JCC members by stating that progress is evident and that resources should continue to be made available to the More and Better Food project.

## 2. Biogas Technology for Rural Areas

This demonstration project is managed directly by the ASRT and assigned to the National Research Centre (Pilot Plant Division) for implementation. Dr. Kamal characterized progress during Phase I to be "excellent." The operational philosophy has been to build upon extensive biogas technology and experience by taking advantage of a United Nations training course offered in the People's Republic of China, by visiting operating biogas demonstration projects in Thailand and India, and by utilizing previous experience both in Egypt and in the U.S.A. Testing of a locally constructed digester has begun at the NRC; village selection for field studies is completed; and key persons from the villages are already participating in the technical and social aspects of the Egyptian

program. As in the case of More and Better Food, the biogas project suffers from delays in receiving equipment and instrumentation but the experimental team has been diligent to improvise and move ahead in both the laboratory design and preliminary village implementation stages of the program.

JCC members commended NRC/Cairo and ASRT program management for incorporating social acceptance of biogas technology into the project at its earliest design stage and underlined the importance of good village-level participation in the implementation of biogas digester operation at NRC/Cairo to ease the transition to village testing during Phase II.

### 3. New Crops for Arid Zones

Among some JCC members, the early design emphasis on nonfood crops in this demonstration project continues to be a subject of discussion. Other JCC members observed that the demonstration project should be viewed in the context of overall activities of the Ministry of Agriculture and the National Agricultural Centre; therefore, a modest effort on new "cash" crops for arid zones seems eminently reasonable.

Field activities have not yet begun. Phase I has consisted of bringing together three Egyptian resource groups -- from Ain Shams and Al Ahzar universities and from the Plant Production Department of NRC/Cairo. The project design provides for the use of nonirrigated lands which are not currently thought to be suitable for food production; nevertheless, Dr. Al-Gabaly suggested that the project management committee carefully evaluate: (a) marginal lands as primary sites for implementation and at the same time consider food crops as a part of the overall plan, (b) salt tolerant, drought resistant plants in the choice of crops for the project

D. Evaluation of R&D Projects

During the JCC members' general discussion on R&D projects, attention was directed toward the question of priorities and potential economic/social returns from the individual projects.

With respect to priorities, Dr. Kamel and others reminded the group that the Program Agreement gave a very broad framework of problem areas for project selection (i.e., plant production and protection, animal research and fisheries, soil and water resources, medical research, building technology, industrial research, petroleum and mineral resources, energy research, transportation and physical-electronics applications). The NRC's three R&D projects (phosphate ore beneficiation and fertilizer production, corrosion causes and control, and wool scouring and wool wax utilization) fit well into these guidelines. Furthermore, the R&D methodology is one which emphasizes the participation of end-users at each stage of project design and implementation.

The original idea for many of the R&D projects arose from a joint Egyptian Chemical Society-American Chemical Society symposium held in December 1977 which had an applied problem orientation; moreover, participation in the symposium included significant industrial representation. In the design of the three NRC/Cairo R&D projects, joint NRC/Cairo-industry teams were formed, written agreements of participation were made with the three respective industry sectors (fertilizers, petroleum and textiles) and the work is proceeding both at the Centre and in the industries. This partnership in research with industry is somewhat new in Egypt and is a step in the direction of contract research common to the industrial sector in the USA.

Dr. Gilbert White of the US panel raised a different point. He stated that the coupling of R&D to practical end-use is not easily accomplished, nor are there "sure" mechanisms that work consistently. For example, demonstration projects and R&D projects, when conscientiously conducted often have such intense personnel inputs in the pilot village, or the counterpart industrial laboratory, that it is often difficult to "generalize" the results and adapt them on a broad basis.

Dr. Al Gabaly emphasized a similar theme by stating that the U.S. experience with extension services, particularly in rural areas, is not applicable to Egypt, where agricultural land holdings are small, typically are non-contiguous, and where the education process for the average farm worker is far less formal than in the USA. For all of these reasons, extension services based on the U.S. model have not been effective in Egypt.

Dr. Carter (U.S. panel) added that the ability to grow a crop or produce a manufactured product is far different from the demonstration that the new goods have markets. She recommended that market development studies and promotion activities be incorporated into demonstration and R&D programs.

Assessment of the wool scouring and wool wax project raised questions regarding its priority for Egypt. Drs. Kamel and Weldes replied that (a) the wool processing industry is an export earner for Egypt, (b) the project represents a class of applied research for which there is a good potential market in Egypt if NRC proves its ability to respond promptly and successfully, and (c) the project has particularly good industry-NRC

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linkages. Thus, it is an example of an R&D problem and R&D management method which the Applied Science and Technology Program is designed to promote.

Dr. Hassan Ismail presented a newly revised R&D concept for the Red Sea Fisheries project of the Institute of Oceanography and Fisheries. Four specific activities have been identified: (a) determination of the pelagic (open sea) commercial fisheries potential in the Foul Bay area of the Red Sea; (b) determination of the relative abundance of deep-water shrimp from the Gulf of Suez to the Sudan frontier; (c) identification of the relative abundance of reef fishes in the Foul Bay area; and (d) determination of commercially available spiny lobsters in the coastal reefs. If any or all of the above assessments prove commercially feasible then the questions of fleet size and preservation of catch will be addressed. Results of these surveys could be completed within approximately 18 months if a suitably equipped vessel can be provided for the work. It is believed that a small rented vessel with rather standard fisheries survey equipment can be obtained in 1980. Project principal investigators will be appointed in Egypt and further joint R&D design work will be undertaken prior to the November 1980 JCC meeting.

E. Evaluation of the Science and Technology Information Project (STI)

The STI Project was developed jointly by NSF and the Egyptian National Information and Documentation Centre (NIDOC) and consists of a design study (including a computer accessed information experiment as well

as a current information resources planning inventory) plus an in-service training activity. NSF, with the cooperation and assistance of the ASRT, has selected the Georgia Institute of Technology as contractor for the design study; Catholic University of America was selected for development and direction of an in-service training program for Egyptian information specialists.

The JCC members' consensus was that although the STI Project's start-up time was long, implementation of the design study and in-service training was proceeding intensively by February 1980.

F. Evaluation of Instrumentation Technology (IT)

The IT component is aimed at developing institutional capability to maintain and repair (M&R) scientific instruments for use in ASRT sponsored applied research. The activity is multi-institutional in character with the following organizations actively participating: National Research Centre (NRC/Cairo); Scientific Instruments Centre (SIC); Universities of Alexandria, Assiut, Cairo, El-Minia, and Tanta; University of Wisconsin Instrumentation Systems Center (UW/ISC); and National Institutes of Health Biomedical Engineering and Instrumentation Branch (NIP/BEIB).

M&R facilities are operational at all institutions. Scientific instruments are being repaired by returned trainees at the NRC, Tanta, & El-Minia Universities. Administrative procedures at the M&R facilities are still being developed. Project execution was on schedule until October 1979 when a problem occurred with the second group of trainees. This group of 16 trainees was delayed in order to satisfy USAID English language proficiency requirements. This has now been completed, and

departure scheduled for March 1980. M&R training schedule has therefore been delayed five months.

Alexandria University was added to the original four universities in late 1979. The first trainee from Alexandria was to travel to NIH/BEIB in March, 1980. Planning for the M&R facility at Alexandria has been initiated.

The consensus of the JCC membership is that there has been success and notable progress in establishing M&R centers, in training the associated personnel and in procuring equipment. However, certain aspects of equipment procurement have experienced excessive delays which have been a major constraint in the overall program. Continued work to improve procurement is essential.

#### G. Evaluation of Policy Planning and Management

(The JCC has defined this to involve only policy planning and management at the level of the Applied Science and Technology Program).

A management problem affecting this program and nearly all Egyptian S&T programs is one of personnel loss to countries outside Egypt. This situation arises because Egyptian salaries at all levels in the universities, research institutes and the government are far below the real market value for the services of well-trained persons. The effect is a brain-drain within the region to the oil producing countries, Western Europe and the USA, where salaries are much higher. In addressing this problem, Dr. Hassan Ismail stated it to be "an Egyptian problem" independent of science and technology. The consequences of the brain

drain are such that the government is now addressing the situation and action is expected by 1981.

Dr. Al-Kholy addressed two aspects of the R&D management training component of this program element. He stressed the need to institutionalize management training within Egyptian institutions. Furthermore, he suggested that case studies based upon Egyptian R&D experience need to be prepared as a tool in local management training institutions.

At the level of the specific R&D management workshops conducted by the Denver Research Institute (DRI) there was a discussion of the goal, or objectives of the four programs held in Denver. Dr. Kamel (NRC/Cairo Director) stated that the workshops were originally considered to be broad, in-service type training for high-level, carefully selected Egyptian scientists and engineers who are now involved in R&D management. The courses would examine current methods, information tools and philosophies of management style practiced in the USA and other industrialized countries. There was no thought that short-courses would be able to offer in-depth management training. Courses could be primarily a catalyst for change; one element in a series of management reforms.

Some JCC members approach R&D training from a different point of view. First, they believe that in-depth training is required and that such in-depth training on R&D management must be given in Egypt if it is to be relevant to Egyptian conditions. Further, Egyptian-experience must be the focus of the curriculum rather than experience of the USA, Europe and Japan. These persons also place heavy emphasis upon the creation of an Egyptian institutional base for R&D management training. Thus, one philosophy is

that R&D management skills are acquired by "in-service" experiences supplemented by short-term management-oriented training; the second is a more formal process approach which considers "managers" to be specifically trained for their roles. A definitive resolution of these differing points of view was not made by the JCC members but there was general agreement that the forthcoming DRI workshops in Cairo would be introductory in scope, designed primarily for "in-service" scientists and engineers who have not had extensive or formal management education.