

**EVALUATION REPORT\***

**APPLIED SCIENCE AND TECHNOLOGY RESEARCH**

**AID/Cairo Project 263-0016**

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**by**

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**\* This report arises from a study during March and April 1980 by the four-member panel appointed to review the Applied Science and Technology Research Program funded by the Government of Egypt and the U.S. Agency for International Development. Inputs were received from the four principal operating groups: (a) Academy of Scientific Research and Technology (Cairo), (b) National Research Centre (Cairo), (c) U.S. National Science Foundation, and (d) U.S. National Academy of Sciences/ National Research Council.**

## APPLIED SCIENCE AND TECHNOLOGY RESEARCH

### PREFACE

The Applied Science and Technology Research Program\* has a broad and ambitious purpose -- "To improve the institutional capability of the Egyptian science and technology community to develop and manage research programs to solve priority development problems." The program seeks to achieve that purpose largely through a set of research, development and demonstration projects each a learning device with specific goals and objectives. Overlying these projects is a management structure which views both the broad program purpose and the components which comprise the program.

The evaluation team (Attachment 1) wishes to acknowledge with deep thanks the many Egyptians who responded openly and patiently to the numerous questions posed by the team. We would like especially to recognize the time made available by Dr. Hassan Ismail, Dr. Mohamed Kamel, Dr. A. S. El-Nockrasy and Dr. Osman Galal. Project personnel participating in our discussions are noted in the project reviews. Our task would have been impossible without their support and contributions. The USAID/Cairo Science and Technology Office has generously provided information and assistance for which the team is duly grateful.

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\* The organizational descriptors program, project and sub-project, as used herein, are not consistent with AID terminology but provide a useful hierarchy for this report. Attachment A provides definitions and a glossary of acronyms.

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## APPLIED SCIENCE AND TECHNOLOGY RESEARCH

### EVALUATION REPORT

#### Introduction

This report is addressed to five audiences, each having a particular frame of reference and set of interests in the program; USAID/Cairo and AID/W, the Joint Consultative Committee which has had a key role in shaping the program, the Academy for Scientific Research and Technology and the Egyptian program managers, the National Research Center, and finally the project directors and staff from whom the research results must flow. This introduction points up some important features of applied science and technology, the institutional setting for applied research and development, program goals, factors and criteria used in this evaluation and the relationship of program phasing to the evaluation. The report then discusses, in turn, issues, recommendations for Phase II and major observations. A final section discusses each project and sub-project including points emerging from the review. Attachment C is an overview of Phase II budgets.

Science and technology (S&T) share characteristics with other development sectors. The societal and economic impact of S&T, both basic and applied, results largely from incremental and often interconnected advances in knowledge and practice. The cumulative, longer term effects, either good or bad, of S&T programs are not easily forecast quantitatively. This is due, in great measure, to the unpredictable nature of the interchange and use of knowledge and of the applications which may result. The choice of and support for specific research and development (R&D) sectors, provision for an active interchange of knowledge, ideas and experience, objective evaluations of progress, and a setting which encourages and rewards success are tools available to manage investments in S&T. Steps can also be taken to enhance the likelihood for adoption of applied research results. Careful selection and definition of the problem to be solved, analysis of the constraints and economic/social returns accompanying successful implementation and design of projects to minimize user risk are among the steps which, done in concert with the intended user, are very important to research utilization.

The Project Paper states that Phase I is intended to provide measurable impact on the solution of key development problems and to design a long-term project aimed at improving the institutional capability to develop and manage research on priority development problems. Project documents suggest that participants did not always share this view. An implicit objective was an evaluation of the effectiveness of the Academy for Scientific Research and Technology (ASRT) and the National Research Center (NRC) in organizing, managing and implementing an applied research program. Delays in the development and approval of project plans and in the delivery of supporting materials and services have restricted program progress. This evaluation attempts to view the achievements to date in the context of those restrictions.

The major factors/criteria used to judge both program and project progress were the;

- o Clarity of concept, sense of purpose and relevance to Egyptian development.
- o Effectiveness of organization and the management of resources and problems.
- o Appropriateness of the institutional settings to applied science and technology.
- o Technical quality of the human and material resources employed.
- o Degree of interaction with the intended users and beneficiaries of research as well as among research colleagues.
- o Quantitative and qualitative progress to date.

Phase I and Phase II are useful distinctions for AID programming but they do not coincide with decision points in the progress of individual projects or sub-projects. The team has assumed that the commitment implied by the approval of three and five year project plans will be honored unless project performance falls below acceptable standards.

### Issues

Issues which should be addressed in the design of Phase II and in consideration of the relationship of this program to national science and technology policy are:

- o Is the proper focus for Phase II a continuation of the program as presently implemented with emphasis on one institution and two broad sectors or should the program broaden the institutional base and/or the sectoral coverage?

- o Should the AID/S&T strategy be to support a larger, more diffuse and widespread effort to introduce effective applied research or to limit support to a more narrowly targeted demonstration?
- o What should be the role of the S&T projects and institutions in large scale implementation of successful research? The relationship between projects and anticipated users has evolved satisfactorily in the early stages of research. The transition to implementation on a larger scale is a major task and the program should seek to better define the role(s) it intends to play in this transition.
- o Do mechanisms exist for the support of projects with planned duration beyond Phase II? Project starts make little sense if there is no prospect for completion. New crops for Arid and Semi-Arid Lands is an illustrative example.
- o Do project leaders have sufficient knowledge and control of project resources (tangible equipment, facilities, personnel and finances; and intangible concepts and ideas, relationships with ASRT, and relationships with outside organizations) to fulfill their responsibilities under the project?
- o Is the present AID position on incentive payments consistent with its expectations for end of program status? Mechanisms for multiple sources of compensation are an integral part of Egyptian society and the S&T community in particular and unlikely to change within program time frames. Transfer of the salary incentive burden to Egypt without compensatory adjustments in the fraction of resources which flow to ASRT should be regarded as a negative input.

### Recommendations

The evaluation team wishes to make the following recommendations to AID and to ASRT:

- o The program has established a pattern of progress and should be extended with the addition of adequate resources for the future expansion of successful projects. Wool scouring, cottonseed oil, cheese manufacture and biogas are examples of projects which show promise of early positive returns.
- o The program continues its focus on the sectors and institutions presently involved with the judicious addition within these sectors and institutions of projects with prospect either for completion within the program time frame or continued support beyond the life of program.
- o Program and project management be strengthened by: clarifying individual responsibilities for project performance, supervision, reporting and resource management; increasing opportunities for professional interchange and the cross fertilization of ideas among individual project leaders; and increasing the awareness and use of relevant management principles and practices, perhaps by appropriate and carefully focused training.

- o Greater attention be given to the inclusion of social science analyses in projects which now have a predominantly technological orientation.

### Evaluation Observations

Increased Egyptian capability to develop and manage applied research programs is already observable and this program has the potential for continued and greater contributions to that goal. Program progress is commendable. Ten projects (including seven sub-projects) have been identified and all but two have been underway for some time. The effort expended in clarifying and improving the project designs has been an educational investment important to the program purpose. The evidence is that applied research is increasingly understood and is gaining acceptance as an institutional and personal goal. Project and sub-project performance, although variable, must be considered excellent given the delays both in project initiation and in the provision of certain inputs. There has been active interaction with the users and potential beneficiaries of research. However, the truly difficult challenges lie ahead for all projects.

The technical competence and commitment of the project staff is generally high and has contributed greatly to the rate of progress. The number of experienced and highly trained scientists or engineers may, in some cases be larger than necessary with the potential for underutilization and decreased job satisfaction, however. Most projects are making good use of existing equipment and facilities in the absence of the new items to be provided by the program.

Presently approved projects have often been the subject of prior Egyptian research and/or some form of Egyptian/U.S. collaboration. The current investigations can be broadly classified as industrial or food related. The selection appears to have been based upon probable success as well as developmental significance; wisely so since early project success is important to institutional and attitudinal change. The mechanism for soliciting and choosing future (Phase II) projects needs a more directed approach which recognizes the goals and objectives of Phase II. The role of this program and of ASRT in addressing development problems which affect multiple sectors and which cross organizational lines deserves continued attention and emphasis.

The majority of Phase I projects and inputs were designed to involve primarily the NRC. Ain Shams University, the National Information and Documentation Center (NIDOC), Cairo University and the Institute of Oceans and Fisheries each lead a project or sub-project activity. In addition, as shown in Table 1, there are 21 cooperating institutions ranging from villages to industries and include associated organizations such as the Scientific Instrumentation Center (SIC). The concentration of activities at NRC provides an institutional recognition and focus for applied research which may initially facilitate the spread of the philosophy of relevant research. The applied projects at NRC have also benefited from strong, top management support which seems to be reflected in staff attitudes toward applied research. By the same token, emphasis on NRC has served to limit the number of institutions influenced by the program.

The U.S. advisors to the program have consistently been of high quality and their contributions to Egyptian awareness of current technical practice, to project design and to equipment selection is judged valuable by the Egyptians and the evaluation team. The timely availability of advisors and the continuity of their participation could have been improved in a number of cases. The National Academy of Sciences (NAS) may wish to consider rejuvenating some advisory groups and assessing group composition as projects enter the implementation or technology transfer phase. A few projects could benefit from skills and experience not resident in the U.S. Access to this expertise through travel of Egyptian scientists and in-country visits by third country experts on a selected basis is encouraged.

The ability of AID, NAS and NSF to deal with the contractual, procurement and decision processes has been disappointing in the short term. Steps have been taken to remedy some of these shortcomings but a much closer examination of both U.S. and Egyptian decision and approval chains is in order. A more effective system with maximum delegation should be possible within the procedural and legal constraints and is an opportunity to teach management by example. It is unfortunate that this program, a major S&T effort, has had to be an educational experience for the assisting agencies and institutions.

TABLE 1  
STRUCTURE OF THE APPLIED SCIENCE AND TECHNOLOGY RESEARCH PROGRAM

(SUB)PROJECT	LEAD INSTITUTION/PROJECT LEADER	COOPERATORS
Instrumentation	NRC/M. Kassen; SIC/Eng. El-Alaily	Cairo, Assiut, Tanta, El-Minya and Alexandria Universities
S&T Information	NIDOC/A. Gad	
Management Training	ASRT/A. El-Nockrashy	
Phosphate Ore Utilization	NRC/A. Yousef	Societe Financere et Industrielle d'Egypte; Kafr El-Zayat Fertilizer Company
Wool Scouring	NRC/A. Kantouch	Misr Beida Dyers
Corrosion	NRC/A. El-Azim	Petroleum Institute; C.M.R.D.I.; Suez Petroleum Company
Red Seas Fisheries	Inst. Ocean.&Fisheries/A. Bayoumi	
Biogas Technology	NRC/M. El-Halwagi	Soc.&Criminological R&D Center
More & Better Foods-Exec.Comm.	Cairo University/B. Ahmed	
Cottseed Oil	NRC/A. El-Nockrashy, F. Osman	Al-Badrasheen Company
Cheese Making	NRC/M. Hussein	Misr Milk & Food Company
Supramine	NRC/S. Hegazi	El-Nil Pharmaceutical Company
Nutritional Monitoring	NRC/O. Galal	Villages of Kafr Al-Khadra & Omar Makram; Org. for Recon. & Devel. of Egyptian Villages; Ministries of Land Reclamation, Agriculture & Social Affairs; Local Health Boards
Food Processing, Villages	NRC/I. Rifaat	
Livestock & Poultry	NRC/M. Nawato, H. Ali	
Plant Production, Protect.	NRC/H.S. Abdel Rahman	
New Crops	Ain Shams University/A. El-Beltagy	Al-Azhar University

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Linkages among the projects are weak. The team often observed a vague understanding of the other projects by staff members. While the projects differ in topic and scope there are many opportunities for useful interchange. For example, commonalities exist in pilot plant problems, in problems of effluent reduction, in industrial interactions and in technoeconomic analysis. Technical seminars, problem discussion groups and other interactive mechanisms could help to stimulate the flow of ideas and expand the use of available information from other research and demonstration organizations.

The inclusion of the cottonseed oil, cheese making and Supramine sub-projects in More and Better Foods is puzzling. These activities do not have the diffuse user groups which characterize the village efforts, rather the interface is with industries. The work being carried out seems nearer to R&D than demonstration. Management may wish to review this organization.

Additional efforts should be devoted to "marketing" the information coming out of project activities through farmers' associations, industrial associations, professional societies, local government councils, rural and commercial banks, cooperatives, and formal extension services as appropriate. Brochures, periodical documents summarizing program achievements, popular articles, seminars and short training courses are mechanisms that come to mind. Program funds should be made available to assist these activities.

If a portion of the science and technology community is to engage in applied research programs for development, the personal and institutional rewards both psychic and monetary must compete with alternative career choices. One stimulus which this program can provide is the reward of success in achieving project goals and objectives. Recognition, project expansion, and greater responsibility should accrue to groups and individuals which perform above standard. Younger staff members should be encouraged to actively participate and be given outlets for their opinions and creative ideas. The change which this program seeks to accomplish must involve all levels within an institution or societal group if it is to become widespread and lasting.

## INSTRUMENTATION TECHNOLOGY

### Introduction

The Instrumentation Technology project is an infrastructure activity aimed at 1) building up the capacity within Egyptian institutions for the repair and maintenance (R&M) of scientific equipment; and 2) providing advisory services for the procurement of equipment under the overall Applied Science and Technology Program.

The National Science Foundation (NSF) is under a Participating Agency Service Agreement (PASA) with the Agency for International Development (AID) for the management and implementation of the Instrumentation Technology project. NSF has sub-contracted with the University of Wisconsin and the U.S. National Institutes of Health within this project. The Scientific Instrumentation Center (SIC), the NRC and other units of ASRT, the universities of Alexandria, Assiut, Cairo, El-Minya, and Tanta; and several participating industrial corporations are involved in either the repair and maintenance aspects or the equipment procurement aspects of this project.

Representatives of the evaluation team met with Engineer M. El-Alaily and Dr. M. Ghobashy of the SIC, with Dr. S. El-Sobky of Cairo University, with Drs. F. Hanna, M. Kassim and N. Saleh of the NRC, for specific discussions on this project. Additional general discussions were held with Eugene Pronko, NSF, with Drs. M. Kamel and O. Galal of NRC, and with Dr. S. Arif of USAID/Cairo. Project files and documents were made available by all participating parties. In addition, the analyses of other project instrumentation requests provided a further base of information.

### Project Summary

On the Egyptian side, SIC was established as a national level organization for the repair and maintenance of scientific equipment. Its emphasis is on major repairs, calibration and standardization. It is said that SIC is the only Egyptian institution with capabilities for R&M in optics, and one of the few in glass blowing and fine mechanics. So-called "satellite" R&M centers (R&MCs) are being established and/or developed at NRC and at the universities of Alexandria, Assiut, Cairo,

El-Minya and Tanta. These satellite R&MCs are intended to deal with (all but major repairs in) the electronic aspects of scientific instruments, although Alexandria and Cairo Universities are said to have a capacity in fine mechanics, and some are said also to have a capacity in glass blowing.

On the U.S. side, NSF manages the Instrumentation Technology project. Under sub-contract with NSF, the University of Wisconsin's Instrumentation Systems Center trains the R&M personnel of SIC and NRC, and also helps develop the R&M capability of these organizations. Under its sub-contract with NSF, the Biomedical Engineering and Instrumentation Branch of the National Institutes of Health performs comparable services for the five universities. The University of Wisconsin participates in the procurement of R&M equipment for SIC and the satellite R&MCs, although initial emphasis in procurement was on units at NRC and Assiut, Cairo, EL-Minya and Tanta universities.

A several-stage procedure has been established and justified for the procurement of scientific instruments and equipment under all projects (research and development, demonstration, and infrastructure) of the overall Applied Science and Technology Program. It typically goes as follows (quoted from an AID document entitled "Mechanism for the Selection and Procurement of Equipment for Projects in 263-0016 Applied Science and Technology Project" dated June 27, 1979):

1. Egyptian project scientists prepare a list of equipment to accomplish the objectives of a particular research project.
2. Equipment list sent to the University of Wisconsin/ISC, after approval by ASRT/NRC/Cairo and a copy of the same sent to NAS, NSF and AID/Cairo.
3. University of Wisconsin prepares specifications and estimated prices and sends to ASRT/NRC/Cairo, AID/Cairo and AID/Washington.
4. ASRT/NRC approves and contacts AID/Cairo for concurrence.
5. AID/Cairo authorizes AID/Washington to amend or issue new PIO/C for procurement of equipment making AAPC the authorized agent for procurement. A copy of procurement order sent to University of Wisconsin/ISC.
6. AAPC contacts University of Wisconsin when needed during procurement process."

Because of the warranty terms of much, if not most of the equipment procured, it is project practice that the items received in Egypt be

unpacked, examined and tested under the supervision of a University of Wisconsin staff member. Occasionally, a manufacturer's representative performs this function. Damages and deficiencies are reported and corrected under pre-negotiated terms of the procurements, in most cases.

The ASRT has established an Instrumentation Committee chaired by the head of SIC and made up of nine other personnel, two others from SIC, three from NRC, and four from universities. There is an effort to strengthen the role of the committee. Under this effort, the committee may hold monthly meetings, add a fifth university to its membership, and possibly play a part in instrument specification for the procurement process. In the past, U.S. advisors often assisted in the initial specification of requested project instruments.

The NRC has established a Core Equipment Laboratory which exists, organizationally, in addition to its R&MC. This laboratory is comprised of materials testing equipment for pharmaceuticals, textiles, paper and pulp, ceramics and polymers. It is said that the Core Equipment Laboratory will become the principal medium for the NRC's services to industry, and possibly universities, in instrumentation training, materials testing, and the like. NRC's interest in up-grading the equipment of its physics laboratory is tied to this orientation towards industrial service.

Following a relatively long period of discussion, negotiation and deliberation, the NSF and other interested parties apparently have agreed to place a resident expatriate specialist, with an Egyptian technical counterpart, in Cairo to serve as a focal point for this project.

#### Conclusions and Points for Consideration

- o Initially, there seem to have been problems in the selection and preparation of candidates for training as repair and maintenance technicians, but this appears to have been improved.
- o Apparently there is difficulty in getting trainees to follow through over the long term on the objectives of the training program. Once trained, viable employment alternatives exist and may be taken advantage of by trainees following their return to Egypt.
- o One result of the lengthy equipment procurement process is a distinct time lag in the arrival of necessary equipment for the start-up of individual projects. Many projects are now

well into Phase I without the tools with which to work.

- o It is evident that the general procurement process can be shortened. The project files contain some examples. Further, the proposal that the Instrumentation Committee play an early positive role in assisting Egyptian scientists to be more precise and specific in their equipment requests does not appear to have been seriously considered and evaluated.
- o It would appear to be a valuable step to combine the NRC physics laboratory directly with the NRC Core Equipment Laboratory, rather than to upgrade it as a semi-detached unit.
- o Egyptian authorities appear to be responding actively and positively to earlier questions raised about the means by which procured equipment and trained personnel are to be placed and used within the organizations participating in the Applied Science and Technology Program.
- o The U.S. side of the Instrumentation Technology project, after some delays, appears to have made significant progress in organizing improved communication and coordination of the project, particularly through the placement of personnel on site. The communication between the sub-contractors and the Egyptian participating organizations in the two separate areas of responsibility is improving, it seems, but could be improved further.

## SCIENCE AND TECHNOLOGY INFORMATION

### Introduction

The Science and Technology Information Project is an infrastructure component of the Applied Science and Technology program. It has two major components: 1) a design study for a national system of science and technology information services (which is envisioned to include a computer-accessed information delivery service and a more traditional service for the supply of journals, reports and other documents); and 2) the training of information specialists in a selection of skills important to the process of information handling.

NSF is under a PASA with AID for the management and implementation of the Science and Technology Information Project. NSF has sub-contracted with the Georgia Institute of Technology for the design study and with Catholic University for the training of information specialists. On the Egyptian side, NIDOC of the ASRT is the principal organization involved.

Representatives of the evaluation team met with Dr. B. El-Hadidy at Catholic University; with Dr. A.M. Gad and Mr. A. El-Dewany at NIDOC; and with Dr. M. Madkour at the Microfilming and Documentation Center at Al-Ahram for specific discussions on this project. Additional general discussions were held with Eugene Pronko of NSF. NSF and USAID/Cairo documentation and project files were made available to the evaluation team.

### Project Summary

An eight-person steering committee, chaired by the NIDOC Director has been organized, including membership from NRC, Cairo University and other external organizations. Four task groups have been organized 1) to collect information on pertinent past surveys; 2) to compile a descriptive assessment of NIDOC itself; 3) to inventory personnel resources; and 4) to begin identifying issues in need of resolution before a national information policy and plan can be formulated. Informal indications are that several other similar preparatory studies are also under way. Three of the four identified studies were said to be in draft form at the time of the evaluation team's visit.

A major survey of 1) on-going research on the topic of "information"; 2) the available information resources and services; and 3) the information requirements of Egyptian specialists in all scientific and technical fields had just gotten under way during the period of the evaluation team's visit. Some 400 organizations and 1,200 professionals (academic, scientific, governmental, and industrial) are being involved in the second and third parts of the survey (being conducted on contract by an experienced Egyptian organization). The survey should be completed within approximately three months. NIDOC with the help of additional statistical resources is conducting the inventory of on-going research. Two NIDOC staff members have been sent to the U.S. for a four-week program focused on the preparation of profiles of information user needs. They will train some 150 others in the technique following their return to Egypt.

Twelve specialists were to have received a specialized training program in indexing and abstracting, duplication and reproduction, and other related information skills. Five were screened initially and sent to Catholic University. Skpticism on the Egyptian side led to a delay in selecting, preparing and sending the remaining seven until the first five had returned and their experience could be evaluated. Language ability, the complexities of arrangements for specially designed programs conducted partly in different locations, and costs per trainee (approximately U.S. \$30,000 each for nine months) all seem to have entered the decision to hold back on the group of seven.

Initially, technical and coordinative inputs stemmed from what appears to have been a careful program plan prepared by the U.S. sub-contractor in the design study components. The in-service training aspect was a single free-standing component that was not programmatically coordinated with the design study. The steering committee's role was adjudged by project personnel to be fairly well completed by early 1980 when the work plan had won approval, the identified reports were being prepared, the major survey of resources and needs was negotiated, and electronic processing of the data had been arranged. However, a need for an on-site coordinator was generally perceived. Negotiations were conducted to recruit a qualified Egyptian specialist for that role.

## Conclusions and Points for Consideration

- o Active, positive steps are being taken to fulfill sub-project objectives even though there have been a number of problems and delays during the initial stages.
- o Project personnel mention a lack of sensitivity to information among Egyptian scientists and other specialists, and attribute this to deficiencies in the educational system, or in the system of motivations and rewards for scientific and technical personnel. While this may be true, project leaders may also want to examine the accuracy, rigor, relevance and utility of information being put into the system.
- o As a national information policy is developed, it will be important to take into account the non-information factors that will help promote the implementation of the policy.
- o A number of the delays in the early phases of this project and some of its continuing problems may be attributable to the inexperience of some U.S. institutions in overseas operations in developing countries.

## MANAGEMENT TRAINING

### Introduction

The management training courses conducted by Denver Research Institute (DRI) under a subcontract from the National Academy of Sciences (NAS) were particularly difficult to evaluate. No training was in progress during the evaluation period nor was there adequate time to survey participants in the four courses given at Denver and the survey course presented in Cairo.

The evaluation team reviewed prior monitoring and assessment reports by John Hurley (NAS Memorandum 2/25/80) and Dr. A. S. El-Nockrasy (ASRT Report 2/6/80), considered the background and responsibilities of the 111 attendees, discussed the utility of the training with a small number of participants, and assessed the management needs of ongoing research and demonstration projects. The following discussion should be read with these limitations in mind.

### Project Summary

The management of science, technology, applied research and development is a matter of importance to industrial and developing countries alike. As with other forms of management, the practice is a mixture of art and science not easily conveyed through written materials alone. Applied R&D has special management considerations which distinguish it from more basic science. Economic concerns, shorter time horizons, linkages with users, the interdependence between project elements, and often the scale of activities require systems of organization, information flow, direction and dynamic response designed to meet individual project needs. The DRI in-service courses covered topics important to institutions engaged in or making the transition to applied research. Case studies using developing country information and settings were an important but under-utilized tool. The participants expressed a desire for greater use of cases relevant to their situations. Problems of scheduling, support facilities and time for interaction which were encountered have been noted in the reports referenced above.

Careful definition of the research problem and a work plan calculated to maximize success probabilities within constraints of time and money are key to effective applied research. Flexible response to new information and

to unpredicted opportunities is also important. The evaluation team believes that increased emphasis on technoeconomics and project feasibility analysis would be of benefit to staff members of ongoing and future projects. The team recognizes the desire to introduce management principles to NRC broadly and to the larger Egyptian S&T community. However, success of the initial projects is vital to the program goals and the team feels that a larger number of project persons should have attended the courses given in Denver. The translation of management principles into practice is not always easy for technically trained people and the team suggests that mechanisms are needed to assist this process until effective R&D management is well established both in the program and its projects.

The plans to establish management courses within NRC merit program support. The intent regarding additional DRI inputs is not clear. However, careful coordination between the NRC and DRI would be beneficial to both if a DRI continuation is implemented. Short term improvement in project management should be a priority objective of all subsequent management training and a subject included in project monitoring.

#### Summation

The evaluation team believes that:

- o The Applied Science and Technology Program has recognized the value of effective R&D management and taken steps to introduce and implement appropriate management techniques.
- o The important role of management in the success of initial and future projects warrants additional training inputs.

Program leadership may wish to consider:

- o Additional management training for several levels of personnel within the existing program and projects. Greater emphasis should be placed on feasibility and economic analyses as guides to project design, evaluating tradeoffs and decision making.
- o Expanding use of case studies and practical exercises with consideration given to use of ongoing projects as the basis for some case material and group study.
- o Including relevant practical experience from Egypt and other countries in the Egyptian course being developed.
- o Providing project and sub-project managers with guidance and assistance, as required, to help implement management principles and techniques in their R&D activities.

## PHOSPHATE ORE UTILIZATION

### Introduction

Egypt possesses large reserves of low-grade phosphate ores containing types and forms of impurities not easily removed. These are used to produce marketable phosphate for fertilizers and industrial chemicals. A project was initiated in November 1978 with three sub-topics; pilot plant studies of ore beneficiation, laboratory and pilot scale studies on the chemical processing of phosphoconcentrates to produce fertilizers and chemicals, and agronomic assessments of fertilizers. Phase I of the project is a three-year effort. A letter offering industrial cooperation was received from Societe Financiere et Industrielle d'Egypte in late September 1979.

Interviews were held with Dr. A. Yousef, Dr. S. El-Nizahi and Eng. R. Salama. A visit was made to the beneficiation pilot plant at El-Tibbeen, not yet in operation due to construction delays. As with all projects, the NRC/NAS and AID files were examined.

### Project Summary

The International Fertilizer Development Center and the Tennessee Valley Authority have provided extended training on chemical processing for two NRC staff members and have assisted in formulating equipment lists for bench scale processing. The final list was submitted in March, 1980. Substantive further progress in this area awaits receipt of the equipment.

Ore beneficiation studies have been carried out by NRC for some time and equipment is available to devote to phosphate beneficiation work. The pilot plant equipment is located in a new facility still under construction and has been arranged to accommodate process flow schemes for the three ore types prevalent in Egypt. Startup awaits completion of electrical service to the pilot plant bay. Testing should be able to begin no later than May 1980.

Agronomic studies are planned using small test plots but data from these studies are not yet available. Similar studies are being carried out as part of the biogas project and both activities might benefit from the sharing of methodologies, data and conclusions.

The project has proceeded through the early formative stage but an additional 12-18 months of effort seems necessary to see whether substantial progress toward better utilization of Egyptian phosphate ores can take place.

#### Summary

The evaluation team feels that:

- o The project addresses an important subject and is proceeding well at this early point in the research plan.
- o More attention should be given to the water and energy costs of process schemes under study as well as the costs of environmentally sound handling of effluents. In addition, there is an expressed need for increased capabilities in technoeconomics, agronomy, and marketing.
- o A review of progress, future plans and resource requirements will be needed in 1981.

## WOOL SCOURING AND WAX RECOVERY

### Introduction

Misr Beida Dyers Company, Alexandria is the only Egyptian firm currently processing raw wool for domestic and export markets. The company scours, cards and strands imported wool into tops for sale to textile firms. The value added is in the range LE 5-7 million per year. The objective of the joint NRC/Beida Dyers R&D project is the improvement of the classical scouring and wool wax (lanolin) recovery processes now employed. This is likely to lead to increased economic return to the company.

Members of the evaluation team reviewed NRC/NAS and AID project files, discussed the project with Drs. M. Kantouch and A. Bendak, toured the NRC textile laboratories and visited the Beida Dyers plant in Alexandria. More general discussions with Drs. N. Saleh, M. Kassem and S. Harif included equipment and instrumentation for this project.

### Project Summary

The wool project had its genesis in the December 1977 American Chemical Society meeting with Egyptian scientists and engineers in Cairo and was one of two projects selected by the JCC in March 1979 from a larger list of Society suggestions. Work began April 1 on a three-year project plan. Dr. A. Borai, Chairman of Beida Dyers, was officially requested, in a June 2 letter, to approve company participation in the R&D project and to head a project steering committee. His acceptance is dated July 5, 1979.

The first project year just ended has resulted in measurable progress. A literature search was conducted as preparation for a subsequent trip to the U.S. and the U.K. The two-person trip provided a general view of modern, commercial wool processing and, importantly, knowledge of specific processes which could be incorporated in the Beida Dyers scouring system with nominal investment:

A small laboratory performing routine production line measurements has been established at the Alexandria plant. The result has been better understanding of the existing scouring process which already has led to improved process control, reduced chemical consumption and increased wool

quality. Simultaneously, laboratory work at NRC has provided evidence that centrifugation can be a practical approach to improving both the fraction and quality of wax recovered. This appears to be superior to the alternative process of solvent extraction. Work at NRC continues on wax extraction and purification methods to obtain the high quality which is in international demand according to the market survey carried out by the project. The evaluation team noted the close working relationship between the NRC and Beida Dyers in the execution of this project.

The original project plan called for pilot tests of centrifugal wax separation of a scale larger than possible with existing laboratory equipment but smaller than production quantities. It has become evident that the requested centrifuge would have to be specially manufactured with an inherent delay and added expense. The decision has been made to order a larger, standard unit which can be incorporated in one of the four Beida Dyer production lines. This entails a programmed shutdown of the line, alteration of the system piping and installation of the new equipment; clearly a major input on the part of the company. These changes could be initiated after the equipment has arrived to ensure minimum downtime and lost production but this would add measurably to the delay in pilot testing.

The order for this equipment is being held by USAID/Cairo pending resolution of legitimate questions about a major instrument included in the same total order but for another project. The scheduling of equipment delivery apparently cannot be made with sufficient reliable, prior notice to permit the start of plant modifications in advance of centrifuge availability. The unavoidable delays already incurred are likely to be extended with probable loss of project momentum.

The original economic justification for this project was based upon an increase in the amount and the quality of wool wax recovered from the scouring process. It appears that the prospects for reasonable return on investment through wool wax recovery remain good. However, it has become evident that incremental gains in wool quality, decreases in inputs of process chemicals and de-ionized water, reductions in effluent pollution factors, dryer efficiencies and other as yet unspecified areas may yield economic returns in excess of those forecast for wax recovery alone. The project staff is aware of these possibilities and expressed a willingness to

pursue them over time. The team did not see evidence that alternative project plans were being considered on the basis of a technoeconomic analysis of the tradeoffs among the opportunities which accompany a broader view of wool scouring economics.

#### Summation

The evaluation team concludes that:

- o The wool scouring and wax recovery project has established an effective working relationship between NRC and Beida Dyers Company and that measurable progress toward the project goals has been made.
- o Opportunities for unforeseen benefits exist which could greatly increase the resultant economic return and foreign exchange earnings.

It is suggested that:

- o AID and NSF make a special effort to facilitate equipment procurement and delivery for this project.
- o Provisions be made for the appropriate use of third country advisors to take advantage of expertise not available in the U.S.
- o Application of return on investment, present cash value of future benefits, least cost and/or similar project evaluation technique could be very useful in guiding both shorter term and long range project activities.

## CORROSION IN THE PETROLEUM INDUSTRY

### Introduction

Corrosion research was one of the topics suggested for implementation during the 1977 American Chemical Society meeting and approved by the JCC in November 1978. There had been a prior collaborative program between NRC and Ohio State University supported by NSF. A preliminary NRC proposal on corrosion was reviewed by a U.S. advisory panel January 1979 and after further discussions with the NAS/NRC advisor, the three-year project was initiated in August 1979. A letter had been sent to the Suez Petroleum Company in May of that year requesting company participation and cooperation. This resulted in an affirmative response dated September 6, 1979.

In reviewing the corrosion project, member of the evaluation team met with Drs. A. Azim, V. Gouda, F. Saad, T. Saber, F. El-Wahab, M. Khedr, T. Hanna, S. Mustafa, M. Badran, A. El-Hosary, and R. Saleh. The project files, including Dr. Snaveley's report on his February 1980 visit to Cairo, were also of assistance to the team.

### Project Summary

The Egyptian petroleum refining industry, along with other industrial sectors, continues to have serious corrosion problems with frequent shutdowns from corrosion-induced failures. The Suez Refinery, refurbished in 1977 after a ten-year shutdown, has been selected as the site for cooperative activities. Other petroleum companies were to be invited to observe project progress and results. Travel time to the Suez facility (1.5 hours) has led to a 2 day bi-weekly interaction schedule.

The project has six elements. Corrosion monitoring and corrosion protection are directed to shorter term solutions of industry problems. Research on corrosion inhibitors derived from indigenous plants and materials might produce results in the 2-5 year time frame. Studies of galvanic and pitting corrosion, problems common to industry, are more fundamental efforts to increase understanding of the phenomena. Establishing a well-equipped corrosion laboratory is the final element of the project. This stratified approach provides a solid foundation for continued corrosion research but the team wonders if the resource allocation to the individual elements is consistent with the program goals.

Progress on corrosion monitoring is inhibited by lack of instrumentation and the need for staff training in techniques for in-plant monitoring. Procurement procedures and unbudgeted training expense issues appear likely to delay monitoring activities by six or more months. Timely corrosion monitoring is important to the NRC linkage with the Suez Petroleum Company.

### Conclusions

The evaluation team believes that:

- o Staff capability and interest are high and, as the February 1980 advisory report points out, progress has been made toward project objectives. The return of the original project leader may further stimulate the rate of progress.
- o Some combination of NAS, NSF and AID should act to shortcut procurement procedures for the few items of monitoring equipment requested.
- o Action should also be taken to select a training mechanism and provide timely funding.
- o A review of the emphasis on and support for the project elements should be made in the fall of 1980.

## RED SEA FISHERIES

### Introduction

In 1976 the total fisheries production of Egypt was 158 thousand metric tons. Fish consumption in Egypt is said to average about half of world levels on a per person basis. The major aquatic food sources in Egypt include the northern delta lakes (34 percent), the inland lakes (11 percent), the Nile River (17 percent), the Mediterranean coastal zone (13 percent), the high seas (10 percent), fish farming (7 percent) and the Red Sea (8 percent). Specialists in the subject feel that the Red Sea fisheries resources need to be better understood, and that their output on a sustained basis could be more than doubled over the next several years. Other significant efforts, such as in aquaculture and mariculture are being made in Egypt to develop the other aquatic food resources.

Members of the evaluation team reviewed NRC/NAS and USAID/Cairo files, and discussed the details of the Red Sea Fisheries R&D project principally with Dr. A. R. Bayoumi of the Institute of Oceanography and Fisheries of ASRT. More general discussions were conducted with other staff.

### Project Summary

Project documents indicate that the Red Sea Fisheries project was originally proposed in May 1978 and tentatively approved (in revised form) in November of that year. As of April 1980, the project was still in a state of planning, consultation and review, although the deliberations at the fifth meeting of the JCC seem to have resolved many of the previously unsettled points that had held up implementation. These points appeared to relate mostly to the need for greater specificity in the project's four components.

The Red Sea Fisheries R&D project has four components: 1) pelagic schooled fish; 2) deep water shrimp; 3) reef fishes; and 4) lobster. Six months of preparation time is envisioned for the first year of research work for a total of 18 months. Emphasis is on the collection of statistics on species' availability and distribution; and on the development of improved equipment and techniques for commercial exploitation.

A proposal has been made for the use of remote sensing to prepare topographic charts of the coastal area south of the Gulf of Suez, and to test and demonstrate low light level fish detection. This is under active discussion with the Remote Sensing Center of the ASRT.

#### Conclusions and Points for Consideration

- o Because the Red Sea fisheries R&D project's first phase is on the threshold of being carried out and has been the subject of extended review by Egyptian and U.S. specialists, the evaluation team supports the launching of this work. The first phase is projected for an 18 month period, and the second phase for 2-3 years (for a total of 3.5 - 4.5 years from the point of initiation). The evaluation team believes that the impact of this R&D project on the availability of total food supplies from aquatic resources may be quite modest, although positive.
- o The project documents indicate that numerous questions and issues have been raised and responses seem adequate at the planning level.
- o There seems to be little attention given to studying the institutional aspects of fisheries exploitation. This includes the organization, functioning and management of harvesting enterprises; the storage, processing, transportation and other aspects of output distribution; and the economic management of such inputs as labor force, production equipment and supplies.
- o Project documents seem to make assumptions or assertions about the probable impact of the R&D work in areas such as the growth of the fishing industry in the Red Sea area, the growth in employment, and the improvement in individual levels of fish consumption that are apparently not being monitored or tested by project activities. The importance of responsibilities for organization, leadership, communication, and coordination are recognized in the project documents but it is not clear to whom they are eventually to be allocated.
- o In addition to the scientific and technical emphasis being given to varying aspects of the Red Sea Fisheries R&D project, the evaluation team feels the project leadership may wish to consider further attention be given to the population dynamics of aquatic species, the technology and economics of production enterprise management (especially where sizeable units of equipment are involved), and market institutions and economics. Although commendable attention is given to the need for data, careful attention will have to be given to the accuracy and relevance of the information collected.

## BIOGAS TECHNOLOGY

### Introduction

Early Egyptian interest in energy from biomass was further stimulated in 1978 by a Canadian sponsored workshop. NRC proposed a five-year biogas project in late 1978 and a revised proposal was the basis for project initiation in March 1979. Comments by U.S. advisors emphasized the need for sociological analyses and careful planning for village demonstrations.

Members of the evaluation team met with Drs. M. El-Helwagi, A. El-Dayem, and H. Megahed for project discussions and visited the prototype biogas digester facility on the NRC campus. The project files were reviewed and, during village visits to Omar Makram and Kafr Al-Khadra, impressions were formed on some factors pertinent to biogas implementation.

### Report Summary

The project has made substantial progress in the first year and is organized for information exchange among the many staff members. A notable achievement has been the successful transfer of Chinese technology for the construction of domed, underground biogas digesters. The supportive laboratory studies underway and planned appear to be carefully thought out and will be essential to successful demonstration and large scale implementation of biogas technology in Egypt. Similarly, the engineering studies and prototype construction of various system designs should provide valuable input to the project.

Preliminary surveys of physical conditions in four villages have been completed but the report was not available for review. The project staff indicated an awareness of the many factors impinging on village biogas demonstrations and the complex interactions among these factors. Social and economic considerations are thought to underlie the limited acceptance of biogas technology to date. Economics, waste availability, digester siting, gas utilization appliances, ownership, and manure/slurry handling problems are a few of the numerous topics which should be understood and incorporated into the demonstration design.

Biogas demonstrations have often failed to document carefully the setting and the externalities which accompanied the project. Understanding of the biogas role in energy generation for Egypt and elsewhere could benefit from carefully designed and documented pre-demonstration activities, data acquisition, analysis and evaluation that have not characterized biogas programs elsewhere.

### Conclusions

Our review has led to the conclusions that:

- o There is reasonable prospect for the application of biogas technology in Egypt.
- o The project has made substantial progress to date and has a sound technical plan.
- o Successful demonstration of biogas technology in Egypt could be jeopardized without early attention to, analysis of and planning for all aspects of the demonstration.

The evaluation team suggests that the project staff evaluate the desirability of:

- o Convening with an advisory group of U.S. and third country experts to develop a detailed schedule of pre-demonstration activities and demonstration plan. The project might wish to accelerate the acquisition of background data to better support such an advisory group.
- o Increasing the number of demonstration villages (presuming the existence of an adequate plan) to three or four of those identified, adding to the key variables to be tested and the confidence level of results.
- o Holding seminars and discussions with interested community groups not directly involved in the demonstration to increase interest in biogas and to obtain an understanding of attitudes toward the technology.

## MORE AND BETTER FOODS

### Project Overview

The More and Better Foods Project is made up of three components: food technology, nutrition and farm systems. The components include application of research data to food plants and village level activities. The village level activities (touching on food processing, livestock productivity and crop management, and nutritional monitoring) are led by a coordinated team of NRC specialists. They apparently have maintained effective communications with each other, with participating farmers and with members of the village council as well as other local leaders. There was some evidence of interaction with other activities being carried out in the villages by the governate and the Ministry of Agriculture. The NRC team generally makes weekly visits to Kafr al-Khadra and Omar Makram, the two villages involved in this work. Additional workers are brought in as needed.

The provision of economic incentives in the form of materials, equipment or seed, for example, combined with reasonably consistent repayment or cost sharing by the villagers from realized profits seems to have been useful in achieving effective participation. A portion of increased profits are returned to the village council to be used in stimulating broader participation. Efforts to engage a larger fraction of the local population merit close attention since they bear heavily on questions of larger scale implementation.

In many respects, the various village activities (sub-projects) are sufficiently well coordinated that they, in fact, constitute a definable, single sub-project. More formal recognition of this de facto organization might assist linkages with village socio-economic data gathering, the documentation of successes and failures with their causes, the improved targeting of new interventions and the planning of similar projects at new locations.

The industrial demonstrations (Cottonseed Oil Refining, Industrial Cheese Making and Supramine) are undertaken separately from the village demonstrations and from each other. These are discussed one-by-one in the following sub-project analyses.

The evaluation team spent considerable time with the More and Better Foods Project because of the extensive network of sub-projects, personnel and cooperators. Files were reviewed at USAID/Cairo and NAS/NRC. Visits were made to the old village, Kafr al-Khadra and the new village, Omar Makram, which were chosen for this demonstration. Local personnel cooperating with this program were interviewed and farmer meetings attended in both villages. Work underway in each village was inspected.

Interviews were held with Drs. M. Kamal, A. El-Nockrashy, and N. Saleh, and the following investigators: Drs. O. Galal, F. Osman, N. Ahmed, M. Abd El-Salam, I. Rifat, A. Abdel-Dayem, H. Salama, H. Al-Nomany, H. Ali, M. Effat, A. El-Nimr, M. El-Beltagy and B. Ahmed. An evaluation report on More and Better Foods by Dr. C. O. Chichester dated 2/27/80 was noted by the evaluation team.

## Cottonseed Oil Refining

### Introduction

Cotton is the most important agricultural crop for export in Egypt. By-products of cotton production are edible oil and cottonseed cake or meal. Of the 950,000 tons of cotton seed produced annually, 700,000 tons are expelled or extracted, producing about 90,000 tons of edible oil.

The extraction process by which oil is separated from gossypol-containing seed results in a crude oil that is highly colored and difficult to process or refine.

This food technology sub-project has been designed to prevent color fixation of cottonseed oil and to improve refinement procedures for oil already color-fixed. The sub-project goal is to produce high quality refined oil with minimum oil loss and a low processing costs.

Researchers at NRC have joined with personnel from the Al-Badrasheen Oil and Soap Factory to design and conduct laboratory and pilot scale studies on processing treatments to accomplish the above objectives. Pilot scale kettles were designed, built, installed at NRC, and used for the study. Research started June 1978.

### Sub-Project Review

A number of experimental treatments have been tried in order to improve oil quality and yield. Some of these are applicable as improved processing steps for industrial use. It is apparent that both NRC and industry have provided inputs to planning, research, sample and data analysis, and establishing a scenario to apply results at a factory level. Pilot scale studies were done on oil from the factory in quantities from 1 to 50 kilograms. Remaining steps are to finish in exact detail all process changes and transfer the technology to a plant scale with batch quantities of 16 tons.

The prospect of industry adapting process treatments developed under this project appear to be good. The treatments reduce costs and improve product quality, possibly to the extent of eliminating an oil bleaching step which is now routine in edible oil refineries. It is important that NRC personnel adhere to present plans of making process changes in Al-Badrasheen factory within 3-6 months.

The sub-project leader attended a marketing seminar under the training program and one team member visited plants in the U.S. Team work with industry representatives is evident among NRC workers. Also encouraging is associated research on other problems in edible oils not directly supported by this project. Work is being done on the quality of hexane (used for solvent extraction), the quality of soybean cake for feeding purposes, stabilization of rice bran oil, and deodorization of soybean oil.

This sub-project has the capability of contributing to the expansion of edible oil processing within Egypt so that an increasing percentage of the 400,000 tons of edible oil imported annually might be refined domestically. If so, added product value, along with equipment, personnel and supply costs, could accrue to Egypt.

### Conclusions and Recommendations

The evaluation team concludes that:

- o Researchers at NRC have made measurable progress in improving cottonseed oil quality by changes in processing steps at laboratory and pilot scale levels.

- o Participation by industry personnel is evident and indications are that process improvements will be incorporated into industry practice.
- o This sub-project has potential for providing a data base needed for expansion of refining capacity of crude edible oil.

We recommend that:

- o Full support of this sub-project continue and that results be applied at an industry level very soon.
- o Processing studies related to refining such as extraction, expelling, and quality of hexane be kept as a part of this study.
- o Personnel widen industry contacts, particularly in other countries.

## Industrial Cheese Making

### Introduction

The production of soft white cheese, Domiati, consumes over one-third of the milk produced in Egypt. Domiati cheese is produced by a number of dairy plants. Only the production of butter oil (ghee) consumes more milk than the cheese process. As milk production and demand change, fluid milk is either less available or more expensive for use in the production of cheese. Milk costs, as a percent of cheese production costs, have been increasing for the past few years and now constitute 75-80 percent of the cost of producing cheese.

The volume of dairy products imported into Egypt is increasing each year, including both white cheese and dried skim milk (DSM). A study was approved, as part of the More and Better Foods Project, on the use of DSM as a partial replacement for milk in cheese production. This has been expanded to study a number of ingredients that could decrease production costs by reducing whole milk requirements.

### Sub-Project Review and Evaluation

Work conducted under this sub-project includes an extensive literature review, laboratory-scale formulations and analysis at NRC, pilot-scale production at Misr Milk and Food Company in Domiati, and evaluation of formulation changes by research and industry personnel.

Product formulation changes included substitution of DSM for whole milk, adding lipase enzyme for flavor development, and adding butter milk powder and milk fat. After assessing the acceptability of these formula changes, data were subjected to economic evaluation to determine the effect of formula changes on product cost. Although cheese produced by substitution of DSM for whole milk altered product quality, methods were studied to correct any quality problems and the final product was fairly similar to that produced by whole milk.

Apparently a working relationship exists between NRC and personnel in the cheese industry in preparing and evaluating alternate formulations. The continued cooperation of companies such as Misr Milk and Food Company will ensure both technical input by industry and acceptance of research results.

Since DSM and butter oil are products of the dairy industry, world prices on these items eventually follow milk prices and these products may not remain as viable substitutes for milk in soft cheese manufacture. If other items such as vegetable proteins could be used that are native to Egypt, or could be produced domestically, cash flow for inputs could be reduced.

Of particular interest to the evaluation team was reference to studies being started on growing single cell proteins (SCP) from high-salt whey which is a by-product of soft cheese manufacture. SCP will then be dried and used as an ingredient in poultry feeds. About one million tons of high-salt whey is presently produced each year in Egypt, and the SCP produced has a ready market in poultry and livestock feeds.

#### Conclusions and Recommendations

The evaluation team concludes and recommends that:

- o Considerable progress has been made on studying alternate formulas for making Domiati cheese and that savings could be affected by instituting these formula changes.
- o Adequate attention has been given to economic impact of cheese formula changes but attention could be directed toward market acceptability of products with different formulas.
- o Further work is warranted on this sub-project particularly in view of village level milk processing studies that could conceivably reduce milk available for Domiati cheese production.

- o Market acceptability tests should be conducted on new cheese formulations so that results are readily applicable in industry.
- o Continued research on formulation for soft cheese is desirable, possibly looking toward the use of vegetable proteins that possess the needed nutritional and functional properties.

## Supramine

### Introduction

Supramine, a weaning food for infants, is produced by the El-Nil Pharmaceutical Company in Cairo. Ingredients used are chick peas (38 percent), hard wheat (28 percent), lentils (18 percent), skim milk (10 percent), sucrose (5 percent), and a mixture of calcium carbonate and vitamins A, E and B (1 percent).

This food was developed about 18 years ago for use in Algeria and was based on fairly cheap ingredients. It has been used in Egypt for about ten years but with limited success. Ingredients are now more expensive, acceptability is poor even though price is cheap, equipment to produce the product is fairly old and worn, and problems exist with shelf life, package quality and insect infestation. Research is aimed at improving formulation, processing, and packaging in order to obtain a cheaper and more acceptable product.

### Sub-Project Review and Evaluation

Reports covered, and interviews with sub-project leaders, confirmed that different formulations have been made on a laboratory scale, and that a cheaper and more acceptable product will be produced in pilot scale quantities. Part of the acceptability and quality related problems have been solved by use of enzymes and pre-cooking some of the major ingredients such as chick peas and lentils, and then mixing the final product in dry form. One cause for alarm in adapting this process was that microbial analysis of ingredients showed some dried milk samples to be contaminated with Salmonella. Perhaps closer attention to overall packaging methodology and ingredient quality will need to be considered if dry mixing is adapted as a commercial practice.

Products sold in competition with Supramine are apparently well accepted even at much higher prices and with much less nutrition. Perhaps a study of these formulas would be useful in order to determine their overall acceptability.

The distribution and utilization of foods for weaning infants and growing children is of concern particularly with families in outlying villages. Maybe a marketing specialist would be of benefit in determining the best methods for distributing and utilizing Supramine.

The possibility was mentioned of producing products for infants and young children from locally grown items incorporated into foods acceptable to particular rural populations. If this idea is pursued further, an important goal of researchers is to ensure that adequate nutrition, safety, and quality are built into the products.

Nutritional data indicate the need for more effective nutritional programs from the time of weaning to at least six year of age. Considerable technical progress has been made to improve Supramine for this purpose. If these improvements can be incorporated into a weaning and child food that can be distributed and utilized successfully, this technical progress will be worthwhile and should serve as a base for improving overall nutritional levels. Certainly the interface for adopting new ideas and practices has been established in the two villages. Hopefully this can be expanded to other villages and used as a base for effective distribution of Supramine type products.

#### Conclusions and Recommendations

The evaluation team concludes that:

- o There is a definite need for improvements in weaning and child foods in Egypt in order to obtain acceptability, quality and nutrition, and definite progress has been made in improving Supramine for this purpose.
- o Research and development efforts should continue on infant and child foods, and more attention needs to be given to marketing and other aspects of product distribution systems and training methods to obtain product acceptance.
- o Production on pilot scale levels be instituted with improved formulations, and data on acceptability collected from mothers purchasing the product.

- o Data from other countries on similar products be reviewed, related to Egyptian conditions, and additional related sociological data gathered as needed.

## Nutritional Monitoring

### Introduction

Nutritional Monitoring is associated with the village demonstration activities of the More and Better Foods Project. It is a straight-forward attempt to obtain inexpensive, easy-to-administer measures of trends in nutritional status. It is the belief of the sub-project leaders that body weight (in relation to age) is a logically dependable index of about 80 percent of the information needed by the project regarding the status of individual health with respect to protein-energy nutrition. The reasoning is that the food and agriculture demonstration activities in the village are likely to have an impact on the nutritional status of its population. It is expected that the year-to-year trends in average body weight for different age groups will reflect this impact.

### Sub-Project Summary

Birth weights of children born in the village are taken by the official health worker attending the delivery. An information sheet with the identification of the child, its weight and its date of birth (among other information) is prepared and kept on file at the village health unit. Sub-project personnel indicated that a duplicate of this information was prepared and retained at NRC. The "Gomez Classification" is used which separates weight/age ratios into categories of first, second and third degree malnutrition. If shifts occur over time in the distribution of new born children among these categories, sub-project leaders believe that this will be (at least to some significant degree) due to changes induced in the village by the sub-project.

Weight measures are also taken of children at other ages (predominantly in the pre-school years). These occur as opportunities permit (such as a visit to the village health center for other reasons) and records are maintained on each.

Anemia is another nutritional status index which is the subject of testing and development at the village level. A simple color comparison method is used in which a drop of blood drawn from a subject's finger is compared with a standardized color chart.

Additional measures such as breast feeding time, infant mortality rates, and height are also being explored for use as inexpensive and effective indicators of physical quality of life with a demonstrable connection to nutrition.

### Conclusions and Points for Consideration

- o The measures being used and tested are admittedly rough approximations. However, this is in keeping with the diffuse nature of the sub-project's intervention in the two villages. The sub-project is not targeted on any defined segment of the village population, nor is it calibrated for a specific nutritional impact.
- o Village-level nutritional monitoring is still in the development stages and should be further refined. Some of the problems appear to include winning the support and commitment of village level staff, and maintaining the continuity and intensity of personnel application.
- o Possibly at a later stage, when and if the sub-projects of the More and Better Foods Project become more finely tuned to the needs of specific segments within the populations of the two villages, it might become important to refine the sensitivity of measures of nutritional status to these differences.

## Village Food Processing

### Introduction

The objective of this sub-project is to extend and improve preservation, processing, packaging and marketing methodology for agricultural products at the village level.

### Review and Evaluation

Products mentioned for preservation studies include vegetables such as turnips, carrots, peppers, tomatoes, and cucumbers, apricots, citrus, fish and peanuts. Solar drying and pickling were mentioned as preservation methods as well as expelling oil from peanuts to produce a cocoa butter

substitute. The expeller cake would be used for feed purposes. To our knowledge, only pickling has been done thus far but with success at the village level.

Two associated studies were mentioned under this topic, one on producing butter and low fat cheese (qareesh) from locally produced milk, and the other on the culture of fish in a lake formed from canals. The cheese and butter study was underway, and plans were being made for the fish production study in the old village.

This sub-project has potential for helping villages to utilize foods more efficiently, waste less food, extend the food supply over more months of the year, and to generate extra income. However, close attention must be given to the safety of preservation methods, and full consideration must be given to processes and products that are familiar and acceptable to villagers. In the case of peanuts, establishing an orderly marketing system to existing industries expelling and extracting oil might be preferable to small-scale processing at the village level.

#### Conclusions and Recommendations

The evaluation team feels that:

- o This sub-project is fairly broad and too general in nature, but progress is being made in specific areas such as pickling and cheese making. Considerable feedback from villagers on product ideas would be desirable.
- o Opportunity exists for local processing of agricultural products, but payback, improved nutrition, and better utilization of local products must be realized.
- o Adequate attention be given to safety and acceptability of products and processes, and more consideration be given to centralized processing facilities at the village level where villagers could process their own products under the direction of trained technicians.

#### Livestock and Poultry

##### Introduction

The purpose of this sub-project is to demonstrate the production of meat, poultry, milk and eggs; to conduct studies where necessary to provide

solutions to relevant problems; and most importantly, to help apply existing knowledge in poultry and livestock production at the village level in order to increase productivity.

#### Sub-Project Review and Evaluation

Recognition of the problems facing expanded numbers and/or productivity of livestock seems to be apparent among all personnel contributing to this sub-project. Sub-project leaders listed the following problems that exist at the village level: drain on feedstuffs to sustain livestock, unevenness of feed supply and imbalance of nutrition during each year, low productivity of meat and milk by native breeds, use of animals for draught purposes, and problems with disease, parasites and reproduction. Also, the lack of a solid data base on actual production of meat and milk, the economy of this production, and composition of products being produced are recognized as problems and are being addressed. These data are useful in this sub-project as well as in contributing to a nutritional data base for villages.

Research reported on prevalent diseases and parasites affecting livestock seems to be complete and thorough. The information should be used as quickly as possible to correct problems and increase productivity. Progress is being made on detection, condemnation and destruction of animals affected with tuberculosis and brucellosis. However, in the treatment of controllable diseases, storage of vaccines requiring refrigeration is a problem in villages as interruption of electrical service is frequent and unpredictable.

A number of ideas for improvement of animal nutrition were discussed, part of which are already being implemented. Examples are extending protein available during the winter from berseem clover by interplanting winter annuals such as ryegrass and elephant grass, and weaning and fattening of young calves on a cooperative basis. Also, the use of artificial insemination is being practiced and superior meat and milk breeds are being introduced in cooperation with an existing breed evaluation program of the Ministry of Agriculture and Cairo University.

Programs to improve and expand production of poultry meat and eggs are underway. Villagers have been selected for demonstration programs in

chicken broiler growing with the program supplying baby chicks, feed, equipment, medication and technical advice. Cost will generally be borne by the grower and marketing will be locally in the villages. Expertise is available to ensure success of the first stages of this program but expansion will require coordination through an extension service, cooperative or commercial company

An overriding problem common to livestock and poultry production is the availability to farmers of better balanced feeds, particularly concentrates for use with locally grown feed ingredients, and the maintenance of an analysis and feed formulation program to allow preparation of balanced diets throughout the year. Consideration should be given to provide grinding, chopping and mixing equipment to both villages for the purpose of providing feeds or concentrates for demonstration projects in livestock and poultry. If provided by outside funds, repayment should be required, as is done with the poultry program.

#### Conclusions and Recommendations

The evaluation team feels that:

- o This sub-project has the potential of improving livestock, poultry and associated cropping practices in the demonstration villages, and should be continued.
- o Considerable "extension-type" effort and service work by veterinarians, researchers and technicians is required to improve livestock and poultry productivity.
- o Attention be directed toward specifying and purchasing equipment for village use to grind, chop and mix locally produced feed ingredients.
- o Special attention be given to effective storage and use of vaccine and medicines for disease and parasite control of livestock and poultry.
- o Maximum use be made of existing genetic stock at the village level.

#### **Plant Production, Protection and Soil Analysis**

##### Introduction

The purpose of this sub-project is the demonstration in the two villages of new technology aimed at increasing food production, and evaluating

its success by the degree of farmer acceptance, increased farm income, increased food supply, and improved human and animal nutrition. These objectives would be reached by new crop variety introduction, new cropping practices, improved control of pests and improved soil fertility management.

#### Sub-Project Summary

The adoption of a system of growing tomatoes on wires gave a yield increase up to 15 tons per acre in the villages, with a low cost investment. Nearby markets are said to be able to absorb up to ten times the present production if it were available, especially if a redder tomato variety was used.

A start has been made in the introduction of improved crop varieties. Examples include a new export onion variety, Giza 20, and two new varieties of wheat (Giza 155 and Giza 157) which show promise of superior yields. We believe there is need to introduce or develop still more improved crops.

A new practice introduced was the intercropping of onions with soybeans, thus saving land preparation costs. Other new cropping practices initiated in the villages include: 1) inoculation of clover seed with nitrogen-fixing bacteria; 2) planting a mixture of berseem clover and ryegrass thus giving an improved balance of protein and carbohydrates for livestock feeding; 3) increasing the planting of potatoes, a crop which gives the highest yields of food calories per acre among all agricultural crops; and 4) foliar feeding of wheat. The team noted the acceptance by the villagers of these new and improved methods and techniques. As inducements to the farmers, NRC supplied the necessary seed, plants, wire and chemicals with the understanding that repayment would be made from increased profits. In addition, the village council retains a small amount of the profits to be used for adding more farmers to the program.

Progress has been made in the identification and characterization of an unusually large number of plant pests. Personnel in the sub-project are now planning to add new methods of practical pest and disease control, especially by non-chemical means.

It was found that Oronbanche, a plant parasitic on broad beans, did not grow near fennugreek plants. Using this observation, the project has introduced

the practice of mixed plantings of broad beans and fennugreek. When this is done, Oronbanche is controlled and both plants mature normal crops. Research is planned to isolate, characterize, and eventually synthesize the root exudate which inhibits germination of Oronbanche seed as a means of control. Evidence was seen of losses of crops to plant pathogens.

Soil samples have been taken, and analyzed. The initial findings should now be used to develop useful fertilizer recommendations in the village. Consideration has already been given to plant tissue analysis which provides even more specific information on plant nutrient needs. Some of the soils in the village are becoming water logged because of improper water management.

Honey production and silk production are being introduced as auxiliary programs to augment income, making use of more or less spare time and otherwise unused land.

#### Conclusions

The evaluation team concludes and suggests that:

- o This sub-project appears to be making a start in providing a valuable link in agricultural extension. Therefore, the team believes the project should continue along these same lines, but should increase the number of farmers involved.
- o That an evaluation be made for expanded research opportunities to develop research programs in non-chemical methods of pest control, especially in control of soil-borne pests. Crop improvement and crop nutrition efforts should be expanded, and that steps be taken to transfer presently-known technology to correct improper irrigation practices now being used.
- o Soil test results and other findings should be reported to the villagers as soon as practicable.

## NEW CROPS FOR ARID AND SEMI-ARID LANDS

### Introduction

Members of the evaluation team reviewed the NAS files on this project and discussed the project with Dr. El-Beltagy the principal investigator. No site visit was made because the site has not been developed.

### Project Summary

Although this project was given favorable consideration by the JCC in November 1978, it has been slow in developing since that time. The delay came as a result of a disagreement on the nature and scope of the project. We understand the problem has now been resolved. However, as a result of this problem progress was slowed. A final project plan was approved in January 1980.

Soil and water surveys have been done on the site for the project at Kom Oshein in Fayoum Governorate. Site preparation has been delayed because of the lack of field equipment. Another constraint on progress in the project has been the lack of seed in sufficient quantity to start initial nursery plantings.

Some progress has been made in growing about 400 seedlings of jojoba at Al-Azhar University (seed sent by a cooperator in the U.S.) and a start was made on determining cultural needs of lima beans and winged bean at Ain Shams University. The principal investigator on a trip to the U.S. has developed the possibility of future cooperation with the Firestone Rubber Company.

### Observations

- o The present plan has been carefully worked out and the project has made a start in its implementation. However, given current progress, it is unlikely the planned objectives can be reached by 1983. The team believes the mid-range (5-years) and long range (10-years) objectives of the project are valid, but special consideration must be given to the means by which this project could be continued beyond Phase II.
- o Steps should be taken to speed up procurement of the critical equipment needed to start work on site preparation and crop establishment on the site. Specifically, arrangements should be made to provide a system of seed procurement which would ensure delivery at the earliest possible time.
- o An economic feasibility study should be made of this project to estimate its potential for bringing desert land into profitable agricultural use and in developing new industrial enterprises.

## ATTACHMENT A

### Definitions and Acronyms

- Program** - The totality of activities under Applied Science and Technology Research - AID Project No. 263-0016.
- Project** - An infrastructure, research or demonstration effort approved and funded under the program.
- Sub-Project** - A separately managed activity within a project.

AID	Agency for International Development
AID/W	Agency for International Development - Washington
ASRT	Academy of Scientific Research and Technology
DRI	Denver Research Institute
DSM	Dried Skim Milk
JCC	Joint Consulative Committee
NAS	National Academy of Sciences
NIDOC	National Information Documentation Center
NSF	National Science Foundation
NRC	National Research Center
PASA	Participating Agency Service Agreement
R&D	Research and Development
R&M	Repair and Maintenance
R&MC	Repair and Maintenance Center
SIC	Scientific Information Center
USAID	AID Field Mission

ATTACHMENT B

EVALUATION TEAM

August E. Kehr

Received doctorate at Cornell University of Genetics, plant pathology and cytology. Formerly in charge of a national program in crops research in the U.S. Department of Agriculture. Participated in 1975 U.S.D.A. Ministry of Agriculture study of Constraints to Agriculture Production in Egypt. Presently retired.

Nicolaas Luykx

Ph.D. agricultural economics (Cornell 1962). Served since July 1978 as the senior specialist for agriculture, food and rural development in the planning of the Institute for Scientific and Technological Cooperation (ISTC). Served previously in AID's Washington-based Bureau for Development Support as Deputy Director for Title XII and University Coordination, and as Director of the Office of Development Administration. Was previously (1970-76) founding Director of the Food Institute at the East-West Center in Hawaii, and (1966-68) Senior Advisor to the Academy for Rural Development in Comilla (Bangladesh). Has served on the faculties at the University of Hawaii (1970-76), Michigan State University (1966-70) and Cornell (1961-66).

James E. Marion

Ph.D. in Nutrition and Biochemistry, Director of Research, Gold Kist Inc., Atlanta, Georgia. Formerly Head of Food Science Department, Georgia Agricultural Experiment Station at Griffin. Background in research administration and research studies related to the food technology aspects of agricultural commodities produced in the southeast section of the United States.

Clinton A. Stone

M.S. in Engineering Physics, Senior Scientist, International Programs Division, Georgia Institute of Technology. Senior specialist to the Planning Office, Institute for Scientific and Technological Cooperation (1978-79), AID Office of Science and Technology (1974-77) and Director, Physics Research, IIT Research Institute (1974-).

## ATTACHMENT C

### Phase II Budgeting

The evaluation team was not able to make a detailed review of each line item in the maintenance and optimum phase II budgets considered by JCC-5. There are several general observations which can be made, however.

This evaluation report recommends that the demonstration projects devote more effort to data acquisition, sociological studies, economics and planning for new demonstrations as well as for the transition to wider scale implementation. If implemented, the recommendation would require added project funding. We estimate that \$0.5 million would provide the necessary supplies, services and technical assistance.

Neither budget allows for the expansion of successful ongoing projects. This perhaps could be achieved by adjustments between line items which reflect the progress and potential for each project. Project evaluations over the coming nine to 18 months could provide the basis for such adjustments. Another alternative is the setting of more modest goals for the Scientific and Technical Information Project. Parenthetically, the team was not able to rationalize the proposed Scientific and Technical Information expenditures for consultants/educators given the suggested training investment. Further discussions on this point seem advisable.

The suggested \$4 million increase in equipment expenditures in an optimum budget seems out of proportion. New projects, including Standards and Measurements, total only \$3.3 million which includes some provisions for equipment. The nature of the new projects will, to some degree, determine the necessary equipment. However, one would hope that Phase II maintenance budget for instrumentation could support more new project activity than envisioned.

In summary, the maintenance budget seems barely adequate with the proviso that line item adjustments are possible. An additional \$0.5 million should be made available for sociological, economic and planning inputs to demonstration projects either through item adjustments or added funding. The distribution of funds in the optimum budget merits further discussion and justification.

**THE NATIONAL STI SYSTEM OF EGYPT**

**Report of an Evaluation Team**

**F. Karl Willenbrock  
Chairman**

**March 31, 1982**

**NSF - 82-SP-0648  
USAID PASA MF/EGY 0016-7-77**

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## EXECUTIVE SUMMARY

This Report gives the results of the study by an Evaluation Team of four Egyptian and three international experts of the proposed design of an information system to provide information services of importance in science, technology and national development (STI). The plan has been developed over a period of two years under the technical direction of Dr. V. Slamecka of the Georgia Institute of Technology with U.S. Agency for International Development funding under a contract administered by the U.S. National Science Foundation and with the guidance of professional personnel from the Egyptian Academy of Scientific Research and Technology and related Egyptian institutions.

The proposed national STI System for Egypt is primarily described in four reports (listed in reference 2) which were issued during the past several months. These reports cover a national policy for STI, the design of the proposed system, an implementation plan, and a manpower development plan. These reports were preceded by several documents reporting the results of extensive, nationwide surveys of the information resources of Egypt. The Evaluation Team examined the reports, was briefed by the contractor, deliberated during an intensive six-day meeting in Cairo, and produced this unanimous report.

The report is structured into a series of general and specific findings and recommendations. The major general findings are that:

- + Egypt could increase its rate of national development with the proposed national STI System.
- + The proposed design, implementation, and manpower development plans are sound and are compatible with the Egyptian environment.

The major specific findings are that the proposed information resources and services systems should be an open-ended network of six nodes devoted to specific technical areas, that an active clientele development program should be initiated, and that a document delivery service be offered as proposed in the four reports. Technologically, the proposed system architecture, the plan to maintain hardware and software compatibility at all the nodes, and the proposed tie to international packet-switching networks are appropriate. The proposed crash training program for professional and paraprofessional information specialists is the most cost-effective approach in the manpower development. In the management and governance area, there is a need for a strong central project directorate which carries out a number of technological tasks such as monitoring of activity at the nodes, technical support, and the development of hardware and software standards, and other functions associated with a national focal point for STI.

The major general recommendations are that the results of the initial phase of the project should be accepted by the Egyptian and USAID authorities and that the detailed design and implementation phase scheduled to take three years should start as soon as possible. Also systematic effort should be made to identify the most

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important user communities and have their representatives participate actively in the detailed design and implementation phases. In addition a responsive project leadership and an effective decision-making mechanism should be developed.

The major specific recommendations made by the Team include greater emphasis being given to the use of the Arabic language in software development and that greater use be made of the experiences of other developing countries in the STI area. In addition to the crash training program which should be an integral part of the responsibility of the project directorate, efforts should be made to strengthen the information science-related academic progress in Egyptian universities. In most cases training should be accomplished in Egypt to reduce costs. A national policy statement with respect to STI should be formulated and an effort be made to include this statement in the Egyptian National Plan for Socioeconomic Development.

The Evaluation Team also reviewed a separate but simultaneous training program for Egyptian librarians and information specialists carried out by the Catholic University of America in Washington, D.C. which trained fifteen Egyptians who are part of the available human resources in Egypt.

The estimated cost of the implementation phase, if funded by the Egyptian government and the USAID according to present plans appears to be adequate to launch an effective national STI System for Egypt in three years.

## PREFACE

It is a pleasure to acknowledge on behalf of the Evaluation Team (members listed in Appendix A) the many courtesies and substantial assistance provided the team during the six-day working period from March 15 to 21, 1982 in Cairo.

Dr. I. Badran, President of Egyptian Academy of Scientific Research and Technology, met with the external members of the team and graciously hosted a luncheon for the entire group. Unfortunately, his busy schedule precluded his taking a more active role in the Team's work.

Dr. Eng. M. Hallouda provided the Team excellent logistical support and participated in the Team meetings on several occasions. He provided active guidance to the Team and made several crucial contributions to the team's developing understanding of the Egyptian environment. His hospitality and innumerable courtesies gave the Team a feeling that they were valued as individuals as well as a group.

Dr. Mohamad Madkour served in a dual role. He was a gracious host for a Team luncheon and also participated as an active Team member. Through his role as Egyptian project manager during the first phase (Phase I) of the project, he had a detailed background of the project's history and development which he shared with the group.

The Team is grateful also to Dr. Vladimir Siamecka, the principal initiator of the STI System Design and Implementation Plan and the main author of the documents which the Team studied and examined. He briefed the Team on the project, worked with the Team's Task Forces at their request, and responded to innumerable questions. His availability whenever needed during the first five days of the working period facilitated the Team's understanding of the project's detailed structure.

The Team also benefited from a briefing by Dr. Bahaa El-Hadidy, the principal investigator of a training program undertaken at Catholic University in Washington, D.C. simultaneously with the STI System project. Dr. Hadidy participated in the roundtable meeting on the 4th day of the working period when the Team presented its preliminary results to the Executive Committee for the Project whose members are also listed in Appendix A.

The role and assistance of the U.S. National Science Foundation's (NSF) program manager, Mr. Eugene Pronko, is also gratefully acknowledged. He provided the Team's international members with valuable information and much travel assistance which greatly facilitated their work. The Evaluation Team operated under NSF project NSF - 82 - SP - 0648.

Also of great help to the Evaluation Team, particularly the international members, were Ms. Janice Weber and Mr. James Riley of U.S. Agency for International Development (AID) Mission in Cairo. Their efficient administrative help saved the Team much time and effort.

As chairman I should like to thank the individual members of the Team for their willingness to put in long hours of effort during six consecutive working days. Not only did they work hard, but they worked together so effectively that this final report has their unanimous concurrence. In view of the wide diversity of backgrounds of the team members, it is a tribute to their intellectual capabilities and spirit of cooperation that such a major undertaking was completed in such a short time.

F. Karl Willenbrock, Chairman  
Evaluation Team

## I. INTRODUCTION

In November 1976, a proposal for an Egyptian National Scientific and Technical Information (STI) System<sup>1</sup> was put forth. This proposal was followed by a series of agreements between the Government of Egypt and the United States Agency for International Development (AID) which resulted in the development of a plan for a National STI System. This plan is documented in a series of reports<sup>2</sup> by a United States contractor, the Georgia Institute of Technology, with Dr. Vladimir Slamecka as the principal author.

An Evaluation Team whose members are listed in Appendix A was organized in early 1982 to evaluate this proposed STI System. It was composed of Egyptian and international STI experts who met in Cairo from March 15-21, 1982. This report is the result of the Team's work and includes its findings and recommendations. It is directed to both the Egyptian authorities responsible for the project as well as the USAID which funded a major part of the work done on this project.

In addition to the four Egyptian members and three international members of the Team, there were four Egyptian observers listed in Appendix A who served as members of the four task forces into which the Team was divided. These task forces, whose titles and members are also given in Appendix A, examined specific components of the plan and wrote reports which constitute a major part of the Evaluation Team's report.

The Team started its work by generating a series of general criteria to serve as a common basis for the task forces' examination of the proposed System. These criteria were:

- + compatibility with the Egyptian environment
- + completeness
- + continuity beyond the 3-year implementation stage
- + utilization of international experience and resources
- + system adaptability and robustness
- + operational feasibility

These criteria were applied in a variety of ways by the task forces. The criterion, compatibility with the Egyptian environment, is meant to designate to what extent the proposed system meets well the present circumstances, which prevail in Egypt both physical and organizational and to likely future developments. The criterion, system adaptability and robustness, refers to how the system can adapt to changes and in particular how fragile the system is. The term, robustness, is used to designate whether the system is overly dependent on a particular element which if it fails could result in making the entire system inoperable. There was a daily interaction between the task forces and the entire Team so that each Team member had an opportunity to participate in the work of all the task forces. However, the task force members who were the principal authors of the sections are listed in each section.

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The report uses a findings and recommendations format. The findings are essentially the conclusions reached by the Evaluation Team and the recommendations are the actions which the Team proposes on the basis of its findings. An additional breakdown used by several task forces is to subdivide their findings into 3 categories:

- A. Indicating the Team concurs with the contractor's proposal.
- B. Indicating that the Team does not concur with the contractor's proposal and has a specific modification to recommend.
- C. Indicating that the Team does not concur with the contractor's proposal and recommends a joint effort to resolve the differences in the future.

Not all the task forces used exactly the same format because of the different content of the components under examination and the different approaches to their tasks taken by different task forces.

The Team operated as a single group to develop its position on national STI policies and also to determine the general findings and recommendations which are summarized in the Conclusions section.

An additional ad hoc task force examined the Training Program undertaken by the Catholic University of America and summarized the reports by Dr. Bahaa El-Hadidy. This program which was separate from the STI System Design effort, was carried out simultaneously with USAID support.

The Team also hosted a roundtable on the fourth working day to present its preliminary results to the Project Executive Committee whose members are listed in Appendix A. The Team received recommendations and suggestions from this Committee.

The final (sixth) working day was devoted to revising the task force reports and all the sections and their appendices, except for the introduction and preface which were written by the Team Chairman after the completion of the working period. Each Team member approved the content of all the other sections of the report and the associated appendices. It is, therefore, appropriate to state that this report represents the unanimous position of the Team members.

In addition to the description of the history of the project and to the composition and procedure of the Evaluation Team, it is desirable to address one substantive issue in this introduction. The Team devoted considerable time to the question of who would be the potential users of the STI System. It was quickly agreed that if STI were taken in its literal sense of scientific and technical information, it could be inferred that only scientists and engineers would be users. This clientele is certainly too narrow a group for the System's potential services. Dr. Slamecka defined the System's potential clientele to be all problem - solvers active in national socio-economic development. While this term is much broader, it also allows room for ambiguity.

Thus, an effort to describe the System's users is worth undertaking.

The users of the proposed National STI System can be categorized into three major groups:

1. decision makers, policy makers, planners and managers and staff support personnel.
2. research and development personnel, and the academic community.
3. people at the "grass roots" levels, such as professionals and para-professionals in business, education, manufacturing, agriculture, public service, etc.

Traditionally, an STI System addressed itself largely to group 2. But increasingly it is found to be essential to provide information support to the activities of groups 1 and 3. However, the fundamental orientation is to be directed towards socio-economic development.

Finally, it is worthwhile to indicate the extent of the information support that the System would provide its users. In its Implementation plan, scheduled to occur over a 3-year period, the System would initially supply information in the form of numerical data, bibliographic data, documents, and provide referral services, etc. Information analysis services would be developed in a subsequent stage of development. However, it could supply the individual who performs information analysis services much of the information he needs; however, it would not supply him with simulation models.

While it is too early to predict all the services that the System might provide as it gains maturity, it should be kept in mind that in its initial phases, it is directed toward the more traditional information services through the application of state-of-the-art methodologies and technologies.

The next five sections of this report are devoted to the finding and recommendations of the task forces. The final two sections on national information policy and general conclusions were written by all Team members acting as an enlarged task force.

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School of Library and Information Science, The Catholic University of America, Washington, D.C.

## II. INFORMATION RESOURCES AND SERVICES

Task Force Members - Dr. Jacques Michael, Chairman  
 Ms. Nagah Habit  
 Mr. Osama El-Sayed

### INTRODUCTION

The task force evaluated the design study report having in mind that the objective of the STI System is to serve the information needs of many users. The evaluation work was segmented in two parts: information resources and information services.

The task force considered the general concept proposed by the contractor for maintaining on Egyptian territory a non-trivial portion of the world's high quality scientific and technical literature. It also considered the general concept and proposed structure of an open-ended network of information services. Included in the activities of the System are clientele development, data development, generation of different types of data bases, access to domestic and foreign data bases, document delivery, and publications. For each of those components, the generic criteria were used as a basis for the analytical evaluation.

### INFORMATION RESOURCES

#### 1. General Comments

##### A. Findings

The task force fully endorses the strategies for the national development of STI resources in Egypt as outlined by the contractor including:

- + a common resource-sharing methodology
- + the systematic supplementation of national STI holdings
- + the central acquisition and processing of purchased materials
- + the maintenance of a union list of STI holdings.

##### B. Recommendations

1. During the implementation phase, it will be necessary to determine the number and the locations of document repositories having specialized collections. For this purpose a new survey should be made of all the major Egyptian STI libraries, especially those which could be document repositories in the STI System. In particular, surveys and comparisons with the core lists should be made at the American University in Cairo, Military Technical College, and U.S. Navy Medical Research Unit 3. In these surveys, the 1000 new titles of periodicals which have been already delivered to the Egyptian university libraries by USAID should be analyzed. The possibility of obtaining 5-year back-file collections on microfilm should be considered.

2. Consideration should be given to include the social sciences in establishing the core journals list.

## INFORMATION SERVICES

### 1. General Comments

#### A. Findings

The creation of a geographically distributed open-ended network of information services is an excellent concept and is fully endorsed by the task force. Such a network has the following desirable characteristics:

- + a flexibility which permits progressive implementation
- + an adaptability to the Egyptian environment
- + technical feasibility
- + low risk of service discontinuity since most components fail soft
- + fully adaptable to international cooperation because a similar sectoral approach is followed in most countries and by many international organizations.

The functions of the information services which have appropriately been taken into account are:

- + the systematic development of user clientele
- + the compilation of data bases of indigenous information
- + the provision for foreign and domestic sources of data information.

The special attention given in the Design study to the marketing activities of the information services is noteworthy and is endorsed by the task force.

The progressive operation of sectoral information services will serve the socioeconomic development of Egypt and reinforce its scientific, technical, and cultural leadership in the Arab world.

#### B. Recommendations

Although the implementation of the information analysis function is proposed for a later phase due to the time needed to train manpower, this function should be initiated as soon as possible via existing extension programs and extension officers.

Information services should be strongly committed to serve the information needs of professional people engaged in science, technology, and development activities, including decision makers and practitioners and not only researchers. For this reason information services should be managed by individuals who have both adequate professional experience in specialized fields and detailed knowledge of information operations.

## 2. Clientele Development

### A. Findings

It is essential in an environment which is not information-oriented and does not make adequate use of information, to have a strong clientele development program. The success of the whole national STI System depends on the energy put into the marketing of services. The role of the project director in influencing educational programs to make students more information-minded is crucial. Students who are the future engineers, scientists, and professionals should learn that the first thing to do when facing a problem is to determine if a solution already exists and is available.

### B. Recommendations

The marketing effort should cover the evaluation of local and sectoral needs, the study of markets, the promotion of products and services, through advertising and mailings. Appropriate information products should be designed iteratively by using evaluation and feedback techniques.

Present user education programs should be surveyed and evaluated. For example, the user training program for managers in Ain-Shams University should be used and, if necessary, it should be assisted to gain greater strength.

Special training sessions for students on new information technology should be encouraged and if possible integrated in existing curricula. Information resources should be made available to the faculty members involved including special incentives. Continuing education programs regardless of topics under consideration should be encouraged to pay some attention to available information services.

## 3. Bibliographic and Referral Data Bases

### A. Findings

The compiling of electronic data bases of indigenous information is most desirable. The estimate that the number of Egyptian documents to be put into bibliographic data bases to be about 3000 per year is reasonable for the present. The proposed access to data bases is fully satisfactory and the proposal of decentralized data-base searching is endorsed.

### B. Recommendations

Two problems are raised:

- 1) For building an indigenous bibliographic data base of 3000 documents per year, it is not economical to have it built on a decentralized basis. The burden of coordinating such activities will be heavy; as many people will be used for coordination as for doing the work. A centralized input and processing activity is recommended.

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- 2) Bibliographic data bases are raw information materials; they cannot be used directly by many users. Usually only researchers are able to use them without repackaging. Decision makers and practitioners are much more interested in obtaining practical information which is contained in referral data bases such as product information, standards, and ways of identifying exports. Therefore, the task force strongly recommends that:
- a) The data base activity in the information services should be focused on referral information as mentioned in Table 13 of the Design study. Developing referral-type information services should help the marketing of information product and services by their direct appeal to end users and in this way contribute strongly to the success of the overall program.
  - b) One node in the STI System should be given major responsibility for building the Egyptian bibliographic data base.
  - c) The Implementation study should define in more detail the content of referral data bases and determine:
    - + the type of information to be collected
    - + the volume of such information
    - + the cost involved.

#### 4. Document Delivery

##### A. Findings

The Design study proposals are very appropriate.

##### B. Recommendations

Three recommendations are made:

- + a strong coordination with existing document repositories is necessary,
- + a standardized and simple document order procedure based on coupons use (in order to avoid heavy accounting work) is needed,
- + the mail delay should be reduced by making the connection between copy production facilities and users as direct as possible.

#### 5. Publications

##### A. Findings

The task force concurs with the Design study's recognition of the need for publishing printed products as data base outputs.

**B. Recommendations**

Publishing only abstracts or STI profiles does not fully serve users.  
It is recommended that regular publications be made of:

- + Directories from referral data bases as specified in the Design study
- + State-of-the-art summaries in different fields of science and technology
- + Newsletters for managers and decision-makers to provide them with technological trends and news of innovations and newly available technology.

### III. TECHNOLOGICAL ASPECTS

Task Force Members - Dr. Nabil Aly, Chairman  
Dr. Aly Fahmy

The technological aspects of the STI System project were broken down into the following main evaluation areas:

- + Overall system architecture
- + Hardware and administrative software
- + User interface with databases
- + Data Communication
- + Arabization
- + Applications development considerations

The generic evaluation criteria were broken down into specific set of design-related issues. Appendix B includes a detailed list of these issues as an indication of how the task force viewed the overall evaluation criteria in its own specific perspective.

The Design and Implementation studies were cross-examined against the exploded list of evaluation criteria. The outcome of this exercise is presented below for each of the evaluation aspects using A,B,C, categories:

- A - Areas where the task force concurs with the Design study and endorses the design decisions
- B - Areas in which the task force recommends a specific modification
- C - Issues which need joint future study to resolve.

#### 1. Overall System Architecture

A. Findings: The task force endorses:

- + the overall structure with its minimum reliance on intercomputer links,
- + the analysis of how the STI System will interface with an international packet switching network, and the resource sharing principle to avoid duplication.
- + the ring configuration of the network in light of the experience of STI networks in other countries.
- + the six nodes proposed since these represent a reasonable sectoral coverage and provide an achievable project scope in the implementation phase.
- + the major design criterion that the national STI system will continue to evolve over a long period. It is important to avoid system rigidities since there has been a high rate of failure of national information projects in less developed countries due to discontinuities, political decisions and/or organizational changes.

## B. Recommendations

- 1.1 - Beside the sectoral coverage of the nodes, technical consideration should be given to ensure wide geographical access to the sectoral nodes.
- 1.2 - Extension of the resource sharing concept beyond the information resources to include also central technical support, research and development activities and system-wide network functions.
- 1.3 - The design should include a clearer concept of the functional hierarchy of the STI System as a whole and the relation of central staff to the nodes.
- 1.4 - The STI System project directorate should have its own facilities or gain access to computerized facilities to support its coordinating, monitoring and common development functions, such as
  - + monitoring of overall system performance
  - + development of common applications
  - + assessment of the utilization of service
  - + interfacing with local and foreign networks
  - + research and development on standards.

## 2. Hardware and Administrative Software:

### A. Findings; The task force endorses:

- + the gross sizing estimation technique adopted
- + the guidelines developed to specify the hardware
- + the recommendations for a single operating system.

### B. Recommendations

- 2.1 - More guidelines are needed to help in selecting the administrative software to include word-processing capabilities, editing and on-line data entry functions, automatic monitoring features, and data communication drivers.
- 2.2 - While "problem solvers" are the major clientele of the STI System, the search volume upon which design estimates were based included only scientific and research usage. In view of the unpredictability of the workload and storage requirements, more attention should be directed towards how the STI System can cope with such uncertainties.
- 2.3 - Maintenance responsibility of hardware and basic software should be assigned to the supplier, at least in the first 3 years of the equipment life. The 2% figure for maintenance cost should be revised to meet the local market costs.
- 2.4 - The statement in the Design study (page 57) regarding asynchronous ports should be clarified or corrected.

- 2.5 - The Design study should spell out clearly and document the pitfalls to be anticipated in the subsequent detailed design and implementation phases.
- 2.6 - The distributed database (DDB) approach adopted in the system design was investigated thoroughly. It is understood that the DDB is restricted to that of sectoral specialization of the nodes rather than the integration of the dispersed data bases as a single logical system. Such a clarification should be formally stated in the detailed design specifications to avoid any future misinterpretations.

### C. Joint Future Efforts

- + Since the STI System is to serve problem-solvers, the reliance on locally produced information will be significant. The design should explore the technicalities involved in providing interfacing of existing data bases as well as those that are currently under development. Difficult problems are encountered when diverse hardware and software are involved.
- + The design should emphasize the criteria governing the choice of a node location especially in relation to proximity to users and physical repositories as well as the possibility of connection to the network.
- + A set of guidelines to direct the procurement process has to be developed such as those related to vendor selection, second sourcing, and compatibility matters.

### 3. User Interfaces with Databases

#### A. Findings; The task force endorses:

- + the relational database concept.
- + the use of unified query language.

#### B. Recommendations

- 3.1 - The use of relational databases should be coupled with the software that suits local conditions. The importance of a single updating entry to all relevant files should be stressed.
- 3.2 - The aggregated database at the central project directorate has to be outlined to interrelations between the specific data sets included in Appendix D-1 of the Design study. Incorporation of a log file on problems faced by users seems desirable.

### 4. Data Communication

#### A. Findings; The task force endorses the decision to interface with an international packet switching network.

#### B. Recommendations

- 4.1 - Technical specifications of the required local network as well as the link to the packet switching network needed for the STI System have

to be defined such that proper requests can be made to the Egyptian Telecommunication Agency. A primary objective of this coordination should be the establishment in Egypt of a node of the international telecommunication networks and record carriers. The Agency should be invited to participate in the detailed design phase, and the time-consuming task of coordinating should be taken into consideration in the implementation plan. Recommendation should be made in the detailed design regarding TELETEXT and the linkage of terminals to the nodes.

- 4.2 - Though the need for interfacing the nodes with each other and with foreign databases was stressed in the Policy and Design studies, the interfacing needs to be properly phased in the implementation plan.

## 5. Arabization

- A. Findings; The task force endorses the short-term solution for the Arabization requirements which is based on the mechanical English to Arabic replacement of query commands and dictionaries.

### C. Joint Future Efforts

The design should explore the efforts done in Egypt and other countries in Arabic informatics such as the Industrial Development Center of Arab States (IDCAS), the Central Agency for Public Mobilization and Statistics (CAPMAS), and other groups to avoid duplication and wrong decisions such as using last names for Egyptian authors. However, to guarantee a long-term evolution, a genuine Arabization development program should be planned.

The international experience of other countries such as India, Japan, and Mexico on how they handle native languages in STI systems should be assessed and analyzed. Also translation activities need more emphasis. Organizational and manning requirements should be specified. Although automatic/semi-automatic translation of English to Arabic is available, its use is not anticipated in the early stages of the implementation phase. Further information on this matter should be developed.

## 6. Applications Development Considerations

- A. Findings; The task force endorses the adoption of ready-made software packages to make the implementation phase as smooth and free of major trouble as possible.

### B. Recommendations

- 6.1 - The detailed design should define the types of applications in adequate detail to phase in the recruitment of professional and paraprofessional technical personnel and their training in the implementation stage.
- 6.2 - A set of guidelines should be specified to govern the applications package selections process such as modifiability and customization.

C. Joint Future Efforts

- + The development of user manuals in both English and Arabic for both the local system and the foreign-based databases should be undertaken.
- + The Egyptian group responsible for implementation should be complemented by competent members from the user communities. User groups should explicitly participate in developing the organizational structure.

#### IV. MANPOWER DEVELOPMENT

**Task Force Members - Dr. A. Neelamegan, Chairman**  
 Dr. Mohamad Madkour  
 Dr. Farag Sedky  
 Dr. Samir Rashad

##### A. Findings

The contractor's analysis of the manpower needs of the proposed STI System and the proposals for the development of the required professionals and paraprofessionals through a crash program of short training courses are generally sound and acceptable.

It is also noteworthy that the STI policy proposals rightly recognized manpower development, in adequate number and of the appropriate quality in the different specialties, as of crucial importance in the practical realization of the STI System.

The objectives of the crash program for manpower development are well defined in relation to the STI System implementation in the next three-year period.

The proposed strategies to develop the required information personnel to implement the STI System are well conceived and feasible in the Egyptian environment.

The facilities, resources, and finances needed to implement the crash program of a series of short courses as identified in the manpower report are reasonable and necessary.

The centralized management of the crash training program through an Information Career Training Center (ICTC) is a sound proposition and should prove effective.

The proposed syllabus for the short courses, the manner of conducting the courses, etc. are appropriate for the purpose.

##### B. Recommendations

The following comments and recommendations relate to the practical realization of a manpower development program for supporting the national STI System development in Egypt.

1. Although the manpower development proposals address themselves mainly to the immediate needs of the STI System Implementation phase and gives a brief chapter regarding strategies, after the three-year implementation phase, it is desirable that more definitive guidelines be provided on the actions to be taken now in parallel with the crash program for the long term institutionalization of the education and training for information personnel development in Egypt. The development of a good complement of resource persons (faculty), defining appropriate curricula and teaching levels, building up the necessary teaching aids and facilities, etc. for graduate and postgraduate level courses in Egypt could take two to three years of preparatory work.

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2. Development of a core faculty/trainers in information science/informatics is a critical factor in the manpower development effort. Some guidelines in this regard would be helpful, for example:

- a) the use of the Egyptian resource persons involved in teaching/training in the crash courses in the faculty development program,
- b) formulating and implementing a carefully prepared long term plan for training selected Egyptians in other countries (e.g. USA, UK, France) for teaching information science/informatics subjects at the graduate and postgraduate levels.
- c) the identification of existing informatic centers, programs and facilities in Egypt for use in the training of teachers of information science/informatics.

3. The availability and provision of local facilities especially computer hardware and software for use in the training programs, for demonstration and hands-on experience are important. A survey and compilation of the resources of such facilities is a worthwhile project to be undertaken. It would then be possible to formulate appropriate assistance schemes for upgrading the facilities to an adequate level wherever necessary.

4. The selection of persons for the training is an important function. The proposals do contain some guidelines on the criteria or qualifications for the selection. However, more detailed procedures have to be formulated and adhered to. In most cases the administration of a pre-admission test including foreign language competence (especially English), professional/technical knowledge and experience, motivation, and attitude would be necessary for the selection of the right type of candidates.

5. Although the contractor's manpower report does not deal with the training of the fifteen Egyptian library/information personnel in the program at The Catholic University of America in Washington, D.C., the experiences gained from that program in the selection of candidates, language competence requirements, types of courses to be provided, and the depth of training, could be useful in preparing guidelines and in planning future training programs. Also, the candidates trained under the Catholic University program should be considered as potential human resources in the STI System implementation phase.

6. It appears that there is a high degree to turnover of trained and qualified informatics personnel in Egypt and that this undesirable characteristic is likely to continue. This factor could become a serious problem in ensuring the availability of an adequate number of competent persons for the implementation and continued operation of the STI System. Although this is a matter for resolution by Egyptian authorities, nevertheless hints at some possible approaches might be helpful. For example, the provision of adequate career opportunities and financial incentives in the STI System and the formation of a separate cadre of information specialists with appropriate status for its members could be useful motivation to information professionals. Also establishing some types of reasonable contractual obligations for those selected and trained for the STI System may serve as a deterrent to a large turnover. It is also desirable that the number of persons trained be at least 50% more than the estimated requirements so as to constitute a buffer of back-up expertise for the loss due to attrition of various kinds.

7. Experience in other developing countries shows that persons trained under a crash program of non-degree courses face problems of recognition of their certificates vis-a-vis those obtaining a degree or diploma from local universities in library/information science. The severity of the problem varies from one country to another. Nevertheless, it is desirable that the STI System project directorate initiate early action with the appropriate agencies including universities, the Ministry of Education, the body concerned with establishing equivalence of degrees and diplomas, to mitigate, if not solve, the problem. The documents and guidelines generated by UNESCO in this regard are useful.

8. The Information Career Training Center (ICTC) that manages the training program should be affiliated with the STI System project directorate.

9. The link between the information personnel training and user-education program should be brought out more explicitly so that helpful arrangements for resource sharing between the two programs can be made.

10. Continuing education programs for information professionals must be developed now. The experiences in this matter in other countries should be studied and utilized. The financial resources required should be found outside the current US AID allocation for the implementation of the STI System.

11. As the STI System is implemented, a considerable amount of documentation such as manuals and guidelines, especially for the computerized systems will be prepared and kept updated. These documents should be produced in sufficient volume for use in the training programs.

12. In formulating the curricula for the graduate and postgraduate training courses in information science/informatics in the institutions of higher learning in Egypt, the recent development and proposed programs in the Egyptian universities and the guidelines for an informatics course for developing countries recently proposed by the UNESCO/Science Sector/Informatics Unit should be studied and taken into account. Account should be taken of the recent changes in the existing training facilities in the Department of Electronics and Computer Engineering at Ain-Shams University, the Department of Library and Information Sciences at Alexandria University, and also the courses in library automation, application of computers in library operations, library administration, psychology and behavioral sciences introduced recently at Cairo University.

13. While the initiation of action for instituting fullfledged graduate courses in information science/informatics in Egypt even now is important for the continued operation and development of the national STI System after the implementation phase, it must be stressed that the financial resources required for the purpose should be found outside the current USAID allocation of the implementation of the STI System. The Universities Linkage Program could provide the necessary resources for the purpose.

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### C. Joint Future Efforts

For the purpose of formulating uniform guidelines on incentives and contractual obligations for those trained under the STI System project, further studies on the existing situation, rules and regulations and labor laws in Egypt should be examined as soon as possible. What has been done in other countries may also prove to be helpful.

## V. TRAINING PROGRAM

Ad Hoc Task Force Members - Dr. F.K. Willenbrock, Chairman  
 Dr. Nabil Ali  
 Dr. Mohamad Madkour  
 Dr. Nadia Hegazi

### Introduction

The ad hoc task force which considered the training program at the Catholic University of America used three major sources of information in reviewing the training program. These were the briefing by the principal investigator, Dr. Hadidy, the final report on the program<sup>3</sup>, and contacts with a number of the trainees in the program. The ad hoc task force noted the following:

1. The program was initially designed for five library-oriented training tracks, which were later modified to accommodate nine additional tracks which were information science-oriented. These latter tracks involved a substantial amount of sophistication in computer-based information handling,
2. The training program even after modification was completed prior to the completion of the STI System design,
3. The trainees completed their training much earlier than the determination of the functions they might perform in the STI System and the possible jobs or positions they might hold.

### A. Findings

1. For each trainee, the program succeeded in
  - a. organizing the training paths to meet individual needs,
  - b. dividing the training program into modules,
  - c. packaging the overall training of the individuals appropriately.
2. The Principal Investigator showed great flexibility in accommodating the additional requirements of nine new training tracks. He also redistributed the training time among fifteen trainees instead of the twelve trainees originally specified in the contract.
3. The Principal Investigator, through his direct involvement and strong personal commitment, assisted the trainees through the difficult period involved in their individual adaptation to a foreign country and its customs.
4. The present working affiliations of the fifteen trainees are presently as follows:

Seven trainees are staff members at the National Information and Documentation Centre, one is on the staff of the Academy of Scientific Research and Technology, and seven are attached to Cairo University. Three are lecturers in the Department of Librarianship at the Faculty of Arts, one is a lecturer in the Faculty of Engineering, and two are programmers at the Scientific Computation Center. One of the fifteen trainees has resigned from her original job at the Industrial Development Centre for the Arab States (IDCAS) and is employed by a private computer software company. However, her employer has made a firm commitment to make her available to the STI System project on a part-time basis of two to three days a week.

#### B. Recommendations

1. In view of the prohibitive cost per trainee incurred in this program, future training should be performed in Egypt whenever possible.
2. Training abroad should be confined to the acquisition of specific operational skills or the education of trainers. The attendance of Egyptian personnel at a particularly important technical gathering relevant to the overall STI System development and performance will also require time overseas.
3. Training should be carried on as an intrinsic part and subcomponent of the STI System development and not as a separate activity.
4. More strict criteria and testing procedures should be applied in the selection of trainees in the forthcoming phases of the STI System project. The criteria should include technical background, personal capabilities, personal commitment, and foreign language proficiency.
5. The fifteen trainees involved in the Catholic University Training Program should be considered as a significant asset when forming the STI System project staff. However, they should meet the criteria specified for the job under consideration.

## VI. MANAGEMENT AND GOVERNANCE

Task Force Members - Dr. A. Neelameghan, Co-chairman  
 Dr. Mohamed Madkour - Co-chairman  
 Dr. Farag Sedky  
 Dr. Samir Rashad

The dual title of this section indicates that two distinct phases will be considered. They are:

- 1) the interim project management for the 3 years implementation phase,
- 2) the establishment of a permanent governance body for the ensuing period.

A basic function of the interim project management is to seek the establishment of the permanent governance body.

In Figure 1 of the Implementation study, a possible project organization is outlined and in Figure 10 of the Design study, a Council on Information Services and Resources is proposed as a possible permanent governance body. While the configurations proposed are certainly feasible, the task force concluded that the determination of the most appropriate location for the STI System in the Egyptian governmental structure is clearly a decision to be made in Egypt. However, by drawing on organizational experience from 14 other nations as indicated in a paper by A. Neelameghan (Appendix C), there are a number of comments which may help determine the best organizational structure for Egypt.

A structure for the interim project management is shown in Figure 1. The project directorate should operate with two major committees whose membership and functions are distinctly different. The Steering Committee should serve as the link between the project and the political structure of the government. It should be comprised of high-level representatives from the Egyptian ministries of Industry, Agriculture, Health, Housing and Human Settlements, Petroleum and Mineral Resources, Electricity and Power, Telecommunications, Education and Scientific Research, Planning, and the Supreme Council of Universities. Other organizations Central Agency for Public Mobilization and Statistics (CAPMAS), the Academy for Scientific Research and Technology (ASRT), the Egyptian Organization for Standardization and Quality Control, Al Ahram and the Chamber of Commerce should also be included. The Steering Committee should provide policy guidance to the project director; it should also facilitate making decisions which will maximize the benefit of the STI System to these organizations.

In contrast, the Advisory Committee should consist of persons who are selected solely on the basis of their individual expertise. They are not organizational representatives but, rather, serve as sources of information and knowledge important to the effective operation and management of the project.

It is difficult to overemphasize the importance of the selection of a highly-capable project director who has high technical and managerial expertise. The success of the project is directly dependent on the quality of the director. He must be

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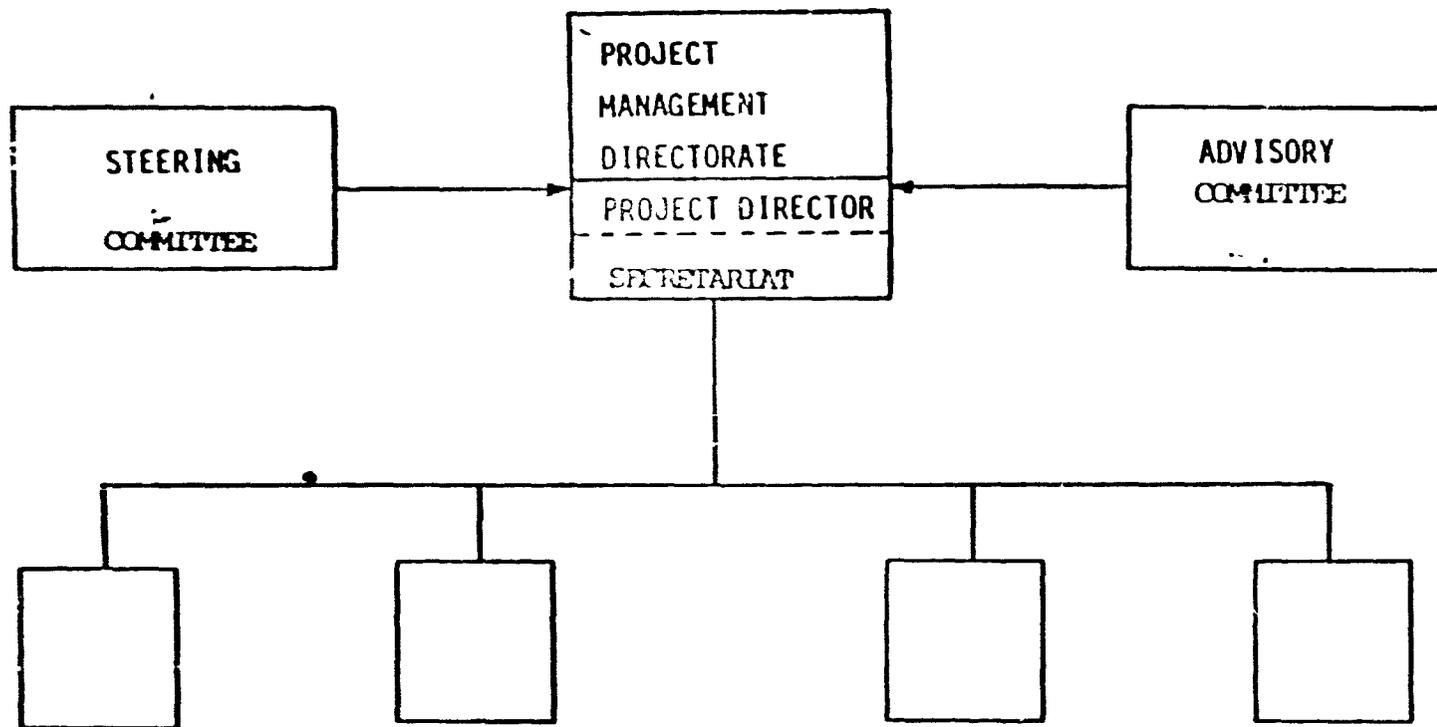


FIG 1

energetic and be dedicated full-time to the project. The same applies to all members of the Technical Implementation Group (TIG) as described in the Design and Implementation studies.

The organizational structure of the directorate is the prerogative of the project director. However, the functions to be performed include, but are not limited, to the following:

System promotion  
 Manpower development  
 System and network development  
 Central technical support  
 Policy and planning

The directorate should not have operational responsibility, which is the role of the nodes, but should operate as the National Focal Point (NFP), a concept which is extensively developed in many of the UNESCO documents related to STI. Appendix C summarizes some of the functions associated with the NFP.

#### A. Findings

The task force found that:

1. the determination of the appropriate permanent governance structure is best done by Egyptian authorities;
2. the interim project management can be described in general terms on the basis of experience gained from other countries; and
3. there are specific functions that the project directorate of the interim project management should perform.

#### B. Recommendations

The task force recommends that:

1. a project directorate of the general format shown in Figure 1 be established;
2. a Steering Committee of representatives of the Ministries and other appropriate organizations as listed should be appointed;
3. a capable full-time project director be appointed;
4. the project director be authorized to appoint an Advisory Committee of experts whose knowledge would be of value to the project;
5. the project directorate shall have as a major responsibility seeking to establish the permanent governance body to have responsibility for the project upon the completion of the Implementation phase; and

6. during the early stages of the implementation phase, it is desirable that the core Egyptian group involved be exposed to the experiences gained in other both developed and developing countries in the establishment of national STI Systems.

## VII. NATIONAL STI POLICY

### Task Force Members - Entire Evaluation Team

The Policy report presents seven broad policy statements which provide a general framework for a national STI policy for Egypt. However, the Evaluation Team concluded that a more specific list of policy objectives should be formulated to provide more specific policy objectives. Drawing on experience gained from other countries, a series of sixteen policy objectives have been identified which can serve as a basis for both a broad and specific policy statement. These sixteen objectives which follow are not in conflict with the seven broad statements presented in the Policy report but rather amplify and complement it.

1. The national STI System when fully established should endeavor to provide access to timely and reliable information and data to all sectors of the Egyptian community, supporting research and development, problem solving, educational and other development activities. In the earlier stages of its development the System should ~~be~~ initially oriented to meet the information needs of problem-solvers in the production and service sectors as well as users involved in research and development, research management, and education in science and technology.
2. Responsibility for building up appropriate information resources and for providing information services appropriate to different user clientele should be allocated to different Egyptian organizations so as to maximize resource utilization.
3. Appropriate codes, guidelines and standards should be formulated and adopted so as to facilitate system interconnections, resource sharing, networking and collaborative and cooperative activities in the System.
4. A national referral facility supported by appropriate tools and mechanisms such as union catalogues, directories, clearing houses, and switching centers should be established.
5. Suitable information personnel development programs should be established to meet the immediate as well as future manpower requirements of the STI System. Procedures for a periodic survey and forecasting of manpower needs of the system should be formulated.
6. Differentiated user education, user orientation, user sensitization programs should be developed, supported, and organized so as to promote the effective utilization of the information resources and services.
7. Periodic surveys or other appropriate mechanisms shall be organized for assessing the changes in the composition of information user groups, their information use patterns, information needs, and the impact of STI services.

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8. The national STI System and its components should collaborate with regional and international information systems, services and programs so as to augment the resources and services to the Egyptian user clientele.

9. The national STI System and its components should cooperate with and draw upon existing information systems, services and programs in other sectors and agencies.

10. The national STI System should utilize bilateral and multilateral exchanges and collaborative arrangements with other countries.

11. The STI System should promote and develop adequate translation facilities to augment information use domestically and facilitate the use and recognition of indigenous sources internationally.

12. The development of adequate information technology facilities such as computer hardware and software, telecommunications, micrographics, and audiovisual technology management should be promoted and supported.

13. The STI System should endeavor to secure adequate service conditions, status, job opportunities, incentives, for information personnel.

14. Research projects in the information area, especially relevant to the development of the national STI System should be promoted and supported.

15. The nation's science and technology publications capability should be augmented and improved so as to maximize the capture of the national science and technology research information and its dissemination to the widest extent possible.

16. A national focal point (NEP) placed high in the government structure, with a management directorate and function similar to those recommended by UNFSCO for such purposes should be established to facilitate the effective management of the national STI System in its implementation, and operational phases.

#### A. Findings

The Evaluation Team finds the seven policy statements in the Policy report are acceptable. However, these statements are not specific enough to provide an adequate base for a national statement on STI policy.

#### B. Recommendations

The Evaluation Team recommends that the seven statements in the Policy study be augmented by the two following two policy statements:

1. In the design and development of the national STI System, the experience of other developing countries in the planning, implementation, and operation of such systems should be taken into account.

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2. The STI System should give due consideration to the need for research and development in Arabic informatics to consolidate local and regional efforts and to restore Egypt's regional leadership in informatics.

C. Future Joint Efforts

The Evaluation Team urges that an appropriately definitive policy statement be developed for promulgation by Presidential decree, by legislative enactment, or through incorporation in the Egyptian National Socioeconomic Development Plan. Such a promulgation should have the two-fold effect of raising public consciousness to the importance of STI and also focussing the responsibility for STI System development in the appropriate agencies and defining the location of the System in the governmental structure of Egypt.

## VIII. CONCLUSIONS

These conclusions were developed by the entire Evaluation Team.

### A. General Findings

#### 1. The Evaluation Team

- + appreciates the significant initiative taken by Egypt to formulate a plan for a national information system for science technology and development;
- + strongly endorses the concept of an integrated network to constitute a national STI System;
- + is convinced that such a System can play a major role in accelerating Egypt's development efforts.

2. The Evaluation Team commends the efforts of the Georgia Institute of Technology contractor and finds the overall design of the national STI System presented in the series of reports is

- + basically sound,
- + compatible with the Egyptian environment,
- + properly reflective of the experience in other countries involved in similar STI System development efforts.

However, with a view to strengthening the System design and to facilitating its implementation, the Evaluation Team has developed a number of general as well as specific suggestions and recommendations in this report.

3. The Evaluation Team concluded that the community for whom the STI System is being developed has not been adequately identified and apprised of the characteristics of the proposed System.

4. The Evaluation Team found that the response to the interim recommendations and actions proposed during the first phase of the proposed STI System were slow and in some respects final decisions are still lacking. As a result, progress towards design consolidation has been substantially delayed.

### B. General Recommendations

These general recommendations are to be considered as supplementing the specific recommendations made in Sections II, III, IV, V, VI, and VII of this report. Both the specific and general recommendations should be systematically reviewed and appropriate resolutions should be made.

1. Since the overall design is acceptable and the specific modifications recommended by the Evaluation Team can be completed in the next three months, the actions needed to make the general design more concrete can become the first stage of the coming implementation phase. However, the completion of these actions should be subject to review and endorsement by the Egyptian Executive Committee. This procedure permits the formal approval of the STI System, Design, Implementation, and Manpower development plans (Phase I) to be accomplished immediately and the detailed design and implementation plan (Phase II) to be started at once.

2. The Egyptian user community for whom the System is being developed should be systematically identified and given adequate opportunities for active participation in the detailed design and implementation of the STI System.

3. During the next stages (Phase II) a workable arrangement should be developed to secure more rapid progress in implementing the STI System. Hence,

- a) Egypt should provide a highly responsive project leadership and decision-making mechanism;
- b) the detailed design, the actual implementation, and the monitoring of the subsequent stages should be performed in Egypt whenever possible;
- c) there should be continuous interaction between the US contractor and the Egyptian decision-making and implementation groups; and
- d) the Egyptian participation should be maximized.

4. An innovative incentive scheme should be developed to ensure the recruitment of highly competent full-time project staff willing to provide long-term dedicated service to the project. Appropriate incentives should also be provided to ensure effective cooperation among the participating organizations.

5. The Academy for Scientific Research and Technology (ASRT) and the USAID should finalize the specific allocation of all funds needed in the next phases as specified in the Implementation study. The budget breakdown proposed should be reviewed and adjusted at an early stage of the implementation phase after a detailed analysis of the allocation of responsibilities between the Egyptian project staff and the US contractor has been made. An appropriate balance between staff, material, and ancillary expenditures should be maintained.

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## APPENDIX A

## LIST OF PERSONNEL

EVALUATION TEAMEgyptian Members

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Dr. Neelanegan - Co-chairman  
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 Dr. Samir Rashad

Technological Aspects

Dr. Nabil Aly - Chairman  
 Dr. Aly Fahmy

Training Program Evaluation

Dr. F.K. Willenbrock, Chairman  
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 President, Central Agency for  
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Dr. Aziz Morsi El-Kholi  
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Dr. Ahmad Aziz Kamal  
 Dean, Faculty of Engineering  
 Cairo University

\* Dr. Ali El-Selmi  
 Professor, Faculty of Commerce  
 Cairo University

Dr. Ahmad Mohamad Gad  
 Director  
 National Information and  
 Documentation Centre

Dr. Mohamad Younis  
 Head Information Systems  
 Academy of Scientific Research  
 and Technology

Dr. Mohamad Madkour  
 Director-General  
 Al-Ahram Organization  
 and Microfilming Centre

\* Did not attend Roundtable on fourth working day.

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## APPENDIX B

DETAILED BREAKDOWN OF THE  
GENERIC EVALUATION CRITERIA FROM A TECHNOLOGICAL VIEWPOINT

This detailed breakdown of the technological aspects of the STI System design with respect to the generic criteria served as the basis of the analysis of the task force on technological aspects. It will be beneficial as guidance for the detailed design stage and as a checklist in assessing the overall design.

I. Compatibility with the Egyptian Environment

- I.1 Overall System Architecture-related Issues
  - Suitability of the network topology
  - Sharability of critical and expensive resources
  - Ability to interface with local databases
- I.2 Hardware-related Issues
  - Transparency to end-users
  - Commonality of hardware and software
  - Maintainability
  - Utilization of existing resources
- I.3 Database-related Issues
  - Database maintainability
  - Natural language interface
- I.4 Data Communications-related Issues
  - Coping with the modest quality of the Egyptian public telecommunication network
  - Node location considerations
  - Interface with international packet-switching networks
  - Coordinating considerations with the Egyptian Telecommunications Agency
- I.5 Arabization-related Issues
  - Utilization of local efforts in Arabic Informatics
- I.6 Applications Development Considerations
  - Extent of analysis of the "Acquire or Develop" issue

II. Completeness

- II.1 Overall System Architecture-related Issues
  - II.1.1 Inclusion of alternatives
  - II.1.2 Validity of the estimating techniques
  - II.1.3 Clarity of the system hierarchical structure
- II.2 Hardware-related Issues
  - II.2.1 Completeness of the major hardware requirements
  - II.2.2 Completeness of the software requirements

**II.3 Database-related Issues**

II.3.1 Presentation of the conceptual databases

**II.4 Data Communications-related Issues**

II.4.1 Utilization of the local experience gained in establishment of data communication networks

**II.5 Arabization-related Issues**

II.5.1 Long-term view of the Arabization efforts

**II.6 Applications Development-related Issues**

II.6.1 Outlining of types of applications

II.6.2 Clarity of the structure of applications development process

**III. Continuity Beyond the Implementation Phase****III.1 Overall System Architecture-related Issues**

III.1.1 System expendability considerations

III.1.2 Building-in of "true" user participation

III.1.3 Highlighting of anticipated difficulties and pitfalls

**III.2 Hardware-related Issues**

III.2.1 Continuity of supply

III.2.2 Provision of guidelines on how to cope with unpredictable workload and storage requirements

**III.3 Database-related Issues**

- Not applicable

**III.4 Data Communication-related Issues**

III.4.1 Degree of participation of the Egyptian Telecommunication Agency

**III.5 Arabization-related Aspects**

III.5.1 Organizational aspects of the Arabization activities

**IV. Utilization of International Experience and Resources****IV.1 Overall System Architecture-related Issues**

IV.1.1 Consideration of international and regional STI-related studies and experience

IV.1.2 The orientation of the STI System to national development

**IV.2 Hardware-related Issues**

- Not applicable

**IV.3 Database-related Issues**

- Not applicable

**IV.4 Data Communications-related Aspects**

- Not applicable

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**IV.5 Arabization Aspects**

- Utilization of the experience of non-Latin countries and Arab regional efforts

**V. System Adaptability and Robustness****V.1 Overall System Structure-related Issues**

- V.1.1 Inclusion of system monitoring capability
- V.1.2 Consideration of fail-safe characteristics

**V.2 Hardware-related Issues**

- V.2.1 Consideration of performance-monitoring issues
- V.2.2 Consideration of system-tuning and diagnostic tools

**V.3 Database-related Issues**

- Emphasis on database integrity
- Consideration of database activity monitoring

**V.4 Data Communications-related Issues**

- V.4.1 Reconfigurability of the network
- V.4.2 Considering the line control functions

**V.5 Arabization-related Issues**

- Not applicable

**V.6 Applications Development-related Issues**

- V.6.1 Consideration of applications maintainability

## APPENDIX C

COORDINATING AGENCY FOR THE NATIONAL  
STI SYSTEM

A. NEELAMEGHAN

INTRODUCTION:

It would be helpful to establish a national agency (called the national focal point) to facilitate the implementation of the national STI plan, for resource mobilisation, for co-ordination and monitoring of programme activities, and for assessment of system performance. Although socio-political factors and the character of the government structure would influence the choice of the national focal point (NFP) and its functions, there are several common features among existing NFPs in different countries. The UNESCO Guidelines provide useful ideas on the structure and functions of NFP. In order to ensure the effective functioning of a NFP, the following aspects should be given attention from the outset:

1. Position of the NFP in the national government structure;
2. Objectives and terms of reference;
3. Functions and activities;
4. Organisational and management aspects;
5. Financial resources.

These aspects are considered in the succeeding sections.

1. Position of the NFP:

It is desirable to have a single NFP placed as high as possible in the government hierarchy, for example, in the Prime Minister's Office or Ministry of Education, Science, Planning, Industry, etc., so as to secure adequate support to the STI system development. The Ministry of Education or Science is the usual focus. The NFP should be endowed with adequate policy making, financial and executive powers. Table (1) indicates the location (or proposed location) of the NFP in several countries.

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Table (1) Location of NFP in Government Structure

Country	Prime Minister's Office	Ministry of Education	Ministry of Industry Eco. Affairs
BELGIUM.....	X		
DENMARK.....		X	
FINLAND.....		X	
FRANCE.....		X	
GERMANY.....		X	
HOLLAND.....		X	
INDIA.....		X	
IRAN.....	X		
ISRAEL.....	X		
MEXICO.....		X	
NORWAY.....		X	
PHILIPPINES.....		X	
POLAND.....		X	
SWEDEN.....			X
TURKEY.....		X	
U.K.....		X	

Location of Management (N F P) directorate in government structure  
in 16 countries (develop 11 developing 5)

Ministry of Education/Science.....	12
Prime Minister's Office.....	3
Ministry of Industry/Econo. Affairs.....	1

## 2. Terms of Reference:

Existing models indicate a possible choice between a NFP with only an advisory role to one with policy making, advisor, planning, and operational functions. The choice would depend upon:

- + How large the community to be served is,
- + Financial resources of the NFP,
- + The state of development of the existing information services in the country, and
- + The extent of the coordination and extent of centralisation or decentralisation of information activities.

The terms of reference of the NFP could be drawn up from the objective formulated and the study of the existing national infrastructure. The proposed or anticipated improvement in the STI infrastructure should have a relation to the changes in the information environment. The statement of the policy objectives should be clear, precise and unambiguous.

Table (2) indicates the terms of reference of NFPs in several countries.

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Table (2) Terms of Reference of NFP

Tasks	Belgium	Denmark	Finland	France	Holland	India	Israel	Norway	Poland	Sweden	Turkey	U.K.
National STI Network development	x		x	x	x	x	x		x			
National STI Network Coordination	x	x		x	x	x	x	x	x	x		
STI Services Development	x		x	x	x	x	x	x			x	x
Promotion of User Education			x	x		x	x			x		
Promotion of Information specialist training			x	x		x	x			x		
R&D in information promotion	x	x	x	x	x	x	x	x	x	x	x	
Financial support	x		x	x	x	x	x	x		x		
International responsibilities in STI	x	x	x	x	x	x	x	x	x	x	x	x
Function as UNISIST national focus	x	x	x	x	x	x	x	x	x	x	x	x
Long-range planning of STI objectives				x	x	x		x	x			
Development of national STI policy	x		x	x	x	x	x					x
Advice and guidance to national institutions on information systems planning and development			x	x	x	x				x	x	x
Involvement in STI at operational level					x						x	x
Promotion of standards in information handling	x	x	x	x	x			x	x	x		x

TERMS OF REFERENCE OF NATIONAL FOCAL POINTS

(14 COUNTRIES)

STI NETWORK DEVELOPMENT .....9

STI NETWORK COORDINATION.....11

STI SERVICES DEVELOPMENT.....11

PROMOTION OF USER EDUCATION..... 7

PROMOTION/SUPPORT MANPOWER DEV. .... 7

PROMOTION/SUPPORT R AND D IN INF. .... 12

INTERNATIONAL RELATIONS ..... 14

LONG RANGE PLANNING OF STI ..... 9

ASSESSMENT AND MONITORING OF STI DEV. ....

DEVELOPMENT OF STI POLICY ..... 10

ADVICE TO LDC. CENTRES/SYSTEMS ..... 9

PROMOTION OF STANDARDS IN STI ..... 11

PROVISION OF STI SERVICES ..... 3

Table 3. Operational procedure of NFP in  
Carrying out Tasks

Procedures	Belgium	Denmark	Finland	France	Holland	India	Israel	Norway	Poland	Sweden	Turkey	U.K.
Publicity of STI services. ....			X	X	X		X	X	X		X	X
Promotion of use of STI. ....	X	X	X	X	X	X	X	X	X		X	X
Advisory functions	X	X	X	X	X	X	X	X	X	X	X	X
Solution to sectoral needs. ....	X	X	X	X	X	X	X	X	X	X	X	X
Liaison operation .							X				X	
Publishing operations. ....							X		X			
El. and activities in information												
--advisory		X	X					X			X	
--support/management	X			X	X	X	X		X	X	X	X
Education and training in information												
--General advice	X	X	X	X	X	X	X	X	X	X	X	X
--Coordination of STI education ....	X	X	X				X		X			
--Management of education schemes			X			X					X	
--Financial support	X	X	X			X						X
--Promotion of user education .....	X		X	X	X	X	X		X		X	X
--Promotion of information education .....	X		X	X	X	X	X		X		X	X
--In house training, postgraduates ....			X				X					
--In house training, other .....			X				X				X	

OPERATIONAL PROCEDURES  
OF NATIONAL FOCAL POINT IN CARRYING OUT TASKS

PUBLICITY/PROMOTION OF STI SERVICES .....	14
ADVISORY FUNCTIONS TO INFO. CENTERS/SYSTEMS	14
PROMOTION/SUPPORT RESEARCH IN SECTORAL NEEDS	14
EDUCATION AND TRAINING (MANPOWER) :	
• ADVICE AND MANAGEMENT .....	14
• FINANCIAL SUPPORT .....	7
• IN-HOUSE TRAINING .....	2
PROMOTION OF USER EDUCATION .....	17
PUBLISHING .....	2

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### 3. Functions:

The functions of the NFP would include:

- + Advising the government in the formulation of the national STI policy and on the methods for its implementation.
- + Ensuring that the national STI policy and plan are incorporated into the national development policy and plan documents.
- + Developing mechanisms to ensure adequate inputs of manpower, finance, and facilities to the STI systems.
- + Co-ordinating, stimulating and promoting information activities in collaboration with other organizations within and outside the country.
- + Allocation of finances for projects and monitoring and evaluation of the projects.
- + Encouraging and supporting research and development in information and related areas.
- + Promoting and supporting education and training programmes in information and in user education.
- + Developing co-operative and collaborative operations with regional and international STI systems and programmes.
- + Formulating criteria, guidelines and standards for the planning, developing, financing and assessing the performance of the STI systems.

Table (3) indicates the usual operational procedures of NFP in carrying out task.

#### 4. Organization and Management:

##### 4.1. COVERAGE

It is desirable to determine at the outset whether the national information policy, plan and programmes would cover science and technology only (cf. France, India) or the social sciences and humanities as well (cf. Great Britain). The scale of organization and networking will differ depending upon the extent of sectoral/disciplinary coverage. Perhaps, initially the plan and programme may be limited to STI in which there may be the greater demand for information and subsequently extended to other areas on the basis of experience, needs and demands.

##### 4.2. STEERING COMMITTEE

A Steering Committee of 10-15 persons should be constituted to provide the political linkages to the government structure. The Steering Committees should have representation from appropriate government departments and private sectors, should represent a cross-section of the different disciplines, and be able to accommodate minority interests.

For example, representatives of the:

- + R and D Organizations,
- + Industry,
- + Government departments — education, sciences, planning, finance, industry, communications, etc.
- + Academic and professional organizations representing user agencies and information bases.
- + National libraries, information and documentation centres, etc.
- + Information experts in personal capacity.

Table (4) indicates composition of the steering committee of NFP\* in several countries.

Table (4) Composition of Steering Committee of the NFP

Representation from	Belgium	Denmark	Finland	France	Holland	India	Israel	Norway	Poland	Sweden	Turkey	U.K.
National R & D organizations .....		X		X	X	X	X	X		X		X
Current Ministries .....	X		X	X	X	X	X	X			X	X
Industry .....		X	X	X	X	X				X		X
Libraries-General .....				X	X	X						X
-Spl/Res .....		X	X			X		X				X
Information centres .....			X	X	X	X		X		X		
Higher Edn-Staff ...			X	X			X			X	X	X
-Students .....				X								
Information users ..			X			X		X				
Publishing organizations .....				X	X							
Statistical organizations .....				X								
Technological services .....			X									
Information specialists .....				X		X		X				

COMPOSITION OF STEERING COMMITTEE

( 14 COUNTRIES )

REPRESENTING

NATIONAL R & D ORGANIZATIONS .....	10
GOVT. MINISTRIES .....	11
INDUSTRY .....	9
LIBRARIES .....	
• GENERAL .....	4
• SPECIAL LIBRARIES/INTO CENTERS .....	9
HIGHER EDUCATION .....	7
PUBLISHING ORGANIZATION .....	2

#### 4.3. ADVISORY COMMITTEE

It is helpful to constitute an Advisory Committee with representation from the sectoral information systems, the library and information professions, etc. The membership may go by rotation between the sectors. The disciplinary/sectoral emphasis will depend upon national priorities (cf. the academic advisory group in Netherlands, industrial advisory in Sweden). The Advisory Committee may have about ten members at any one time. The members serve in a personal rather than organizational capacity providing specialized expertise and sectoral interest support to the NFP.

#### 4.4. SECRETARIAT

There should be a secretariat of 10-15 persons including professional information as well as administrative/secretarial personnel headed by a director.

#### 4.5. AD HOC WORKING GROUPS

The NFP should have powers and resources to constitute ad hoc working groups as and when required to carry out special studies, surveys, or other tasks.

#### 4.6. PERFORMANCE ASSESSMENT

There should be provision for feedback and periodic evaluation of the work of the NFP.

### 5. Financial Resources:

The annual expenditure on the national STI programme should be about 5 per cent of the national R and D expenditure. It may be up to 10-15 per cent in the initial stages. The operating cost of a sectoral center is of the order of \$200,000 (US) a year in developing countries. In most countries, that budget of the NFP is in the range of \$500,000 to \$1.0 million (US) a year. The major items of expenditure are usually network development, support for education and training, R and D projects in the information area. These account for 90 to 95% of the budget with 5 to 10% for the directorate staff. Some NFPs having information service functions recover at least part of the expenditure, especially on mechanised information systems, through charges and subscriptions for the service.