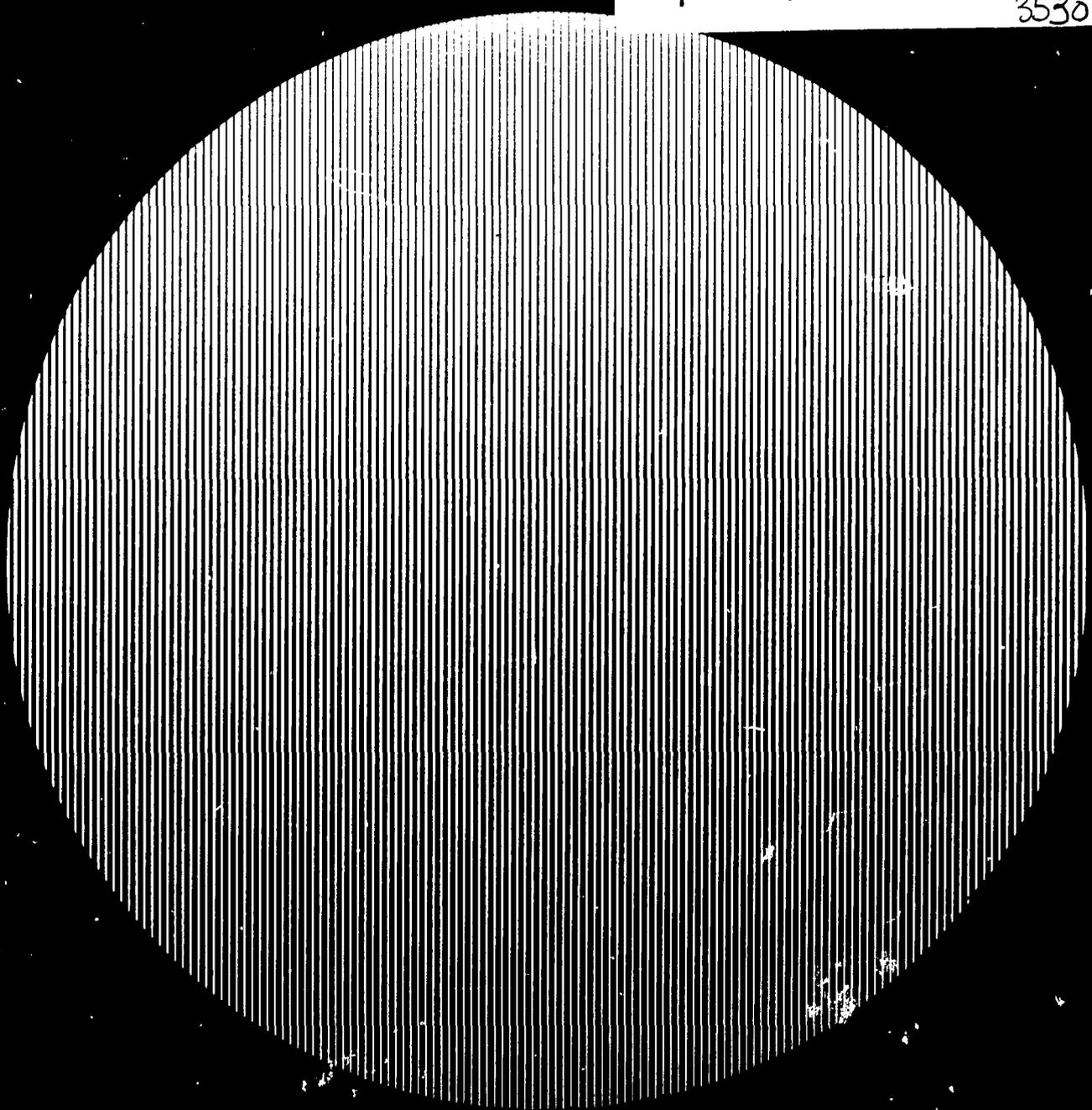


STATUS REPORT

JULY 1983

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PREPARED BY:
TECHNOLOGY ADAPTATION PROGRAM
MASSACHUSETTS INSTITUTE OF
TECHNOLOGY

SUBMITTED TO:
UNITED STATES AGENCY FOR
INTERNATIONAL DEVELOPMENT

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CAIRO UNIVERSITY - MASSACHUSETTS INSTITUTE OF TECHNOLOGY
TECHNOLOGICAL PLANNING PROGRAM

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TABLE OF CONTENTS

	<u>Page</u>
PREFACE	iv
PART ONE - OVERVIEW SECTION	1
Chapter I. Cairo University/MIT Technological Planning Program	2
Chapter II. Development Research and Technological Planning Center	15
Chapter III. Research Projects	39
Chapter IV. Academic and Manpower Development Activities	47
PART TWO - EXECUTIVE SUMMARIES OF CURRENT CU/MIT RESEARCH PROJECTS	63
Electric Power System: Planning and Economics	64
Intercity Multimodal Transportation	69
Engineering Applications for the Plastics Industry	73
Stochastic Models of Nile River Hydrology	76
Water Resource Planning	80
Performance of Paraffinic Asphalt Cements in Road Construction	85
Energy-Economy Interactions and Energy Policy	88
Infrastructure and Urban Planning Guidelines for Secondary Cities	92
Energy and Environmental Impact Studies for the Qattara Depression	94
Production Planning Methodology for the Automotive Industry	96
Energetics in the Egyptian Metal Industries	98
PART THREE - PUBLICATIONS	100

LIST OF TABLES

	<u>Page</u>
1. CHRONOLOGY OF MAJOR EVENTS IN THE CU/MIT TECHNOLOGICAL PLANNING PROGRAM	12
2. DRTPC RESEARCH PROJECTS	22
3. CU/MIT RESEARCH PROJECTS	41
4. INVOLVEMENT OF CAIRO UNIVERSITY FACULTIES AND DEPARTMENTS IN CU/MIT RESEARCH PROJECTS INITIATED SINCE JUNE 1980	43
5. INVOLVEMENT OF MINISTRIES AND GOE AGENCIES IN CU/MIT RESEARCH PROJECTS INITIATED SINCE JUNE 1980	44
6. CONFERENCES, WORKSHOPS, SEMINARS AND SHORT COURSES	49
7. GRADUATE DEGREES RECEIVED AT MIT BY CU/MIT VISITING FELLOWS	55
8. FELLOWSHIP AWARDS, 1982/83	58

FIGURE

1. ORGANIZATIONAL STRUCTURE OF THE DEVELOPMENT RESEARCH AND TECHNOLOGICAL PLANNING CENTER (DRTPC) AT CAIRO UNIVERSITY	20
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PREFACE

This report describes the status of the Cairo University/MIT Technological Planning Program at the end of June 1983, six and one-half years after its initiation. In Part One, a comprehensive view is provided of the Program and its relationship to MIT, Cairo University and the Development Research and Technological Planning Center (DRTPC). Chapter I presents a description of the Technology Adaptation Program at MIT and the development of its collaboration with Cairo University. In Chapter II the DRTPC, which was established by Cairo University to institutionalize the activities begun under the CU/MIT Program, is described in detail and the progress toward its institutionalization is presented. Chapter III summarizes the research activities of the CU/MIT Program in terms of their impact and accomplishments. Chapter IV provides a summary of academic and educational activities including conferences, workshops, seminars, and short courses.

Part Two contains Executive Summaries of the individual research projects which were active as of June 1983, in terms of their objectives, accomplishments, Government of Egypt involvement, and educational activities. Part Three lists publications of the Technology Adaptation Program at MIT resulting from the CU/MIT Program.

PART ONE

OVERVIEW SECTION

I. CAIRO UNIVERSITY/MIT TECHNOLOGICAL PLANNING PROGRAM

A. PROGRAM BACKGROUND AT MIT

In order to place the Cairo University/MIT Technological Planning Program into an organizational and historical context, a description of the various elements of its structure and a summary of the history of the Program are useful.

At MIT the Program is managed through the Technology Adaptation Program (TAP) under the Office of the Provost. TAP is an interdisciplinary research and academic program, focused on science, technology, and development. Its primary objective is to promote an awareness of and expertise in the technological and socio-economic problems facing developing countries on the part of the faculty and students at MIT, including the many foreign students and scholars who attend MIT. This objective is principally met by encouraging MIT faculty participation in specific, well-defined research projects with faculty collaborators from academic institutions in certain developing countries.

In addition to the research projects, TAP conducts a wide range of academic activities including:

- * Development of informal institutional ties between MIT and foreign universities, research institutions, and government organizations in developing countries;
- * Educational opportunities at MIT for those interested in issues of technology and development, such as interdisciplinary master's degree program, graduate research assistantships, and visits by foreign scholars;
- * Conferences, workshops, and seminars; and
- * Dissemination of information through publication of technical reports, working papers, and proceedings of its conferences.

The Technology Adaptation Program is organized according to the following principles:

1. The Program relates to those research activities for which there exists faculty support and faculty willingness to participate. The Program does not undertake research projects which require large-scale non-faculty staffing. The research activities are supervised and conducted by faculty members, and are administered through their respective academic departments;
2. The Program Committees are composed of MIT faculty members, and the Program Director is a faculty member, thus maintaining academic quality control not only in the conduct of research and educational obligations, but also in the selection of topics for research and the institutions with which the Program develops educational ties;
3. The Program's activities are carefully scrutinized by appropriate MIT committees such as the Committee on International Institutional Commitments. The Institute is consulted in the early stages of negotiation on all potential sources of funding, including public and private sources both in the United States and abroad.

The research activities of the Technology Adaptation Program have focused principally on those countries which have already created a sound technological base and are in the process of developing more advanced scientific and technological capabilities. TAP's cooperation with certain universities and institutions in these countries has provided the catalytic effect needed for the introduction of new technology and analytical techniques.

The Technology Adaptation Program and its faculty have collaborated with several institutions in developing countries, including Venezuela, Brazil, Colombia, Ethiopia, Greece, and Tunisia. At present, the TAP is either negotiating or involved with various universities and research institutions in Latin America, Portugal, Spain, Germany, Sudan, Turkey, Egypt, and Pakistan. In addition, it has conducted research with various agencies of the United Nations, the World Bank, and the Inter-American Development Bank.

The TAP is administered by the Director, Prof. Fred Moavenzadeh, and the Associate Director, Prof. Nazli Choucri. A Policy Committee, composed of senior faculty members with relevant experience, reviews the proposed and ongoing activities to insure consistency with the standards of the Program and of MIT. Current members of the Committee are Prof. Choucri, who serves as Chairman, Prof. Moavenzadeh, Prof. Jack Ruina, and Prof. Daniel Holland. The administrative staff includes Mr. Kevin O'Toole, Technical Officer, Mr. Robert Greene, TAP/MIT Representative in Egypt, and Ms. Jeanne De Pass, Administrative Officer.

B. TAP COLLABORATION WITH CAIRO UNIVERSITY

In December 1976, the United States Agency for International Development (AID) entered into a contract with MIT to establish a collaborative research effort with Cairo University and various ministries of the Government of Egypt to improve their capabilities in analyzing, planning, and managing important Egyptian development programs, and to study the feasibility of institutionalizing the process by assisting CU to establish a permanent research center. The means by which the general objectives have been pursued is through cooperation with the faculty of Cairo University in developing capabilities to contribute to the formulation and implementation of science and technology related policies designed to assist Egypt's development goals. To this end, three specific objectives have been pursued:

- * Mobilization of academic interest in research on specific development plans;
- * Organization of technical research in collaboration with Egyptian government ministries; and
- * Establishment of an institutional framework under Cairo University auspices capable of mobilizing development research and educational activities of Cairo University faculty, staff, and students.

To achieve these objectives a series of activities was initiated, including:

1. A set of collaborative research projects among faculty members of Cairo University, MIT, and appropriate Egyptian government agency and ministry representatives.
2. Educational exchange opportunities, through which Egyptian participants would come to MIT for special research-related instruction as well as for extended programs.
3. A series of conferences, workshops, seminars, and short courses focused on Program research activities and findings.

4. Establishment of a CU/MIT Liaison Office at Cairo University which would serve as an administrative model for a permanent institutional structure.
5. Extensive publication of research findings, through a series of Program technical reports, conference and seminar proceedings, and journal articles.

The specific research and educational activities undertaken by the Program focused on the following three general analytic approaches:

1. Engineering analysis and technical project evaluation, addressing specific technical issues, including field and laboratory studies, design, and training requirements.
2. Economic analysis, focusing on project, sector, and national planning issues, and micro- and macroeconomic studies related to specific Egyptian development programs.
3. Social science analysis of population and labor force issues, socioeconomic change including urbanization, extension of social services, and technology transfer.

At Cairo University, the Program was initially administered in the Office of the Vice Rector for Research and Graduate Studies. Subsequently, it was transferred to the Office of the President. An Executive Committee composed of distinguished senior faculty members was appointed to serve as a counterpart to the MIT Policy Committee. Together, the two committees have approved all project activities on an annual basis, and have provided overall policy direction and quality control.

During the first few years of the Program, the long-term joint research projects were the primary focus of Program efforts, in order to establish the feasibility of the collaborative approach between Cairo University and the ministries. These projects are classified into four broad subject areas:

1. Energy, including electricity generation and distribution, and Egyptian petroleum resources, including production, processes, and consumption.
2. Manufacturing, including small scale industries, plastics, and building materials.

3. Public Works, including housing, transportation, and water resources.
4. Socio-economic development, including population migration, health care delivery, economic planning, and rural communications.

The key element in each of these efforts has been the interdisciplinary team drawn from faculty and staff from MIT, Cairo University, and government ministries. In addition to producing useful research results, emphasis has been placed on the involvement of Egyptian personnel in the process of project identification, evaluation, and management, and the development and maintenance of the data necessary to monitor their projects.

At the inception of the Program, a Program Liaison Office was established within Cairo University's Faculty of Engineering. Starting with a small core staff dedicated to the administration of the CU/MIT Program, several policies and procedures were developed which greatly facilitated the conduct of the Program's different activities.

In March 1979 the first steps were taken towards creation of the permanent institutional framework. The "Development Research and Technological Planning Center" (DRTPC) was formally chartered as an autonomous research unit within Cairo University, a set of bylaws was enacted, and the first director was appointed.

From April to July 1980, USAID conducted an in-depth evaluation of the Program. The Evaluation Team reported that significant progress had been achieved in several areas, and that institutional changes were occurring in the Egyptian organizations participating in the Program. They recommended that the Program should continue, with modifications to insure a transition to an independent Egyptian capability. The team further recommended that the end of project status be more fully clarified and that an operational

plan be developed which would gradually merge the functions of research management and logistic support performed by the MIT Liaison Office and the DRTPC.

In response to these recommendations, the Program in the fall of 1980 established a set of end-of-activity status objectives for the institutionalization process. These were divided into three major target areas and described the expected status at the end of the contract:

Cairo University: For those departments which can contribute to the development goals of the government, a nucleus of faculty will have been trained through the Program who will be able to continue similar activities with the Center.

GOE Ministries: In those ministries whose function addresses the development goals of Egypt, a nucleus of personnel will have been trained in planning and coordinating interdisciplinary and cooperative research. Organizational changes will have taken place which will facilitate usage of the research techniques and approaches emphasized by the Program.

Development Research and Technological Planning Center: A Center will have been established at Cairo University as a permanent mechanism to conduct applied research activities related to the priority requirements of Egyptian economic and social development. A solid administrative infrastructure will have been developed and maintained, which will be capable of managing several types of research and educational activities. The Center will have demonstrated its ability to attract substantial amounts of funding to support these activities.

Several new program activities were implemented in 1981 to increase the base of involvement at Cairo University and the ministries, and to broaden the scope of the educational activities. These were:

1. Fellowship awards at the postdoctoral level for junior faculty at Cairo University, to encourage their participation in research projects focused on important development areas.
2. Fellowships at the doctoral level to provide support for graduate students at Cairo University writing their theses on topics of relevance to the development goals of Egypt.
3. Internships in government agencies and public sector companies for Cairo University faculty to provide opportunities for them to become familiar with the operation of these organizations and for

them to work on specific research problems of importance to these organizations.

4. Development of library and computer facilities for the DRTPC.

In April 1981, the first "Organizational Plan to Achieve Institutionalization" was presented to USAID. The first phase of activity was defined as the Organizing Phase (November 1977-November 1980), during which the nature of the Center was defined, a focus for research and educational activities developed, and an initial administrative structure put into operation. During this phase significant progress was achieved in establishing the general policies and objectives of the Center, setting up the Center as a legal and financially autonomous entity at Cairo University, provision for space by Cairo University to house the Center's facilities, and defining the responsibilities of the policy making bodies and key administrative personnel. Senior Cairo University faculty members were appointed to the preeminent policy making body, the Board of Directors. The first director was appointed for a two year term, and a support staff was provided by Cairo University. Initial research activities were commenced, with both outside funding and contributions from Cairo University.

The next phase was defined as the Developmental Phase (December 1980-December 1981), which would be concerned with the development and implementation of a detailed and permanent organizational framework consistent with the goals and objectives of the Center and in concert with the experience gained over the first two years of the Center's operation. Staffing requirements, establishment of policies and procedures, documentation, functional organization, and institution building were some of the particulars which were to have been addressed during this phase.

At the beginning of this phase, it became apparent to the Joint Committees of the CU/MIT Program that the goals and objectives which had initially been established by the Center were too broad in scope and required redefinition. As a result of this assessment, a better understanding of the role and responsibility of the Center, what its focus should be, and the means to achieve these newly defined objectives was attained. The principal shift of emphasis which resulted has been to concentrate the research activities of the Center in those areas of science, technology, and development that had shown promise under the CU/MIT Program, and to reduce the breadth of activities previously envisioned.

The Rector of Cairo University announced a major reorganization of the Center in March 1981, and assumed the directorship for an interim period. In April 1982 a new director was appointed, and plans were formulated immediately for a revised organizational structure. In view of the delay encountered in the institutionalization of the Center and prospects for progress following the reassessment and reorganization, the CU/MIT Joint Committees proposed to USAID an extension of the Program to accommodate a third "Institutional Phase". A draft proposal was submitted to USAID in November 1982, which set forth a new timetable and series of phases for DRTPC self-sufficiency, revised criteria for funding of research and educational activities, and a general set of indicators against which progress towards institutionalization could be measured. The tasks of the institutional phase are defined as falling into two major categories:

1. Administrative: Developing the permanent institutional framework (DRTPC) and its administrative and research support infrastructure.
2. Program: Sponsoring research and educational activities aimed at strengthening the manpower capabilities and organizational structures within the ministries and Cairo University faculties, to facilitate maximum utilization of the facilities and administrative support available through the DRTPC.

From December 1982 to February 1983, the Program underwent a second formal evaluation by USAID. The comprehensive report submitted by the Evaluation Team reached an overall conclusion which was stated as follows:

In the light of managerial hiatus (beyond project control) and despite shortcomings, particularly in planning for institutionalization of the DRTPC, the project's efforts, particularly in research, warrant continuation of project activities for a duration and at a level of effort commensurate with carrying out the recommendations of this report.

A series of recommendations were presented and a revised proposal was prepared, including a detailed "Strategic Operating Plan" for the DRTPC. This proposal and other discussions with USAID over the period April-June 1983 have satisfied USAID that the recommendations of the evaluation report have been addressed, and that negotiations should begin for an extension of the Program to December 1986.

Table 1

CHRONOLOGY OF MAJOR EVENTS IN THE
CU/MIT TECHNOLOGICAL PLANNING PROGRAM

<u>Date</u>	<u>Event</u>
December 16, 1976	Contract for one-year feasibility study signed by USAID and MIT.
January 16, 1977	Formal agreement between Cairo University and MIT establishing the Technological Planning Program signed by Dr. Soufi Abou Taleb, Rector of Cairo University, and by Dr. Walter A. Rosenblith, Provost of MIT.
December 22, 1976- February 1, 1977	Twenty MIT faculty and staff visited Egypt to identify possible areas for collaboration through discussions with Cairo University faculty, USAID personnel, and ministry officials.
January 30, 1977	Cairo University Executive Committee was appointed. Facilities for the Liaison Office were provided in the Faculty of Engineering and renovations began.
March 1, 1977	Fifteen proposals submitted to MIT and Cairo University Executive Committees for review and funding.
April 1, 1977	Nine projects approved and initial tasks begun.
May 1, 1977	Renovations completed and Liaison Office became fully operational with the selection of senior staff.
June 3, 1977	Tax Exempt Status of Program established by the Ministry of Finance.
June 15, 1977	Two additional projects were approved.
June 30, 1977	USAID approval of request for additional funding. Extension of Phase I to June 30, 1978.

August 10, 1977	Formal Administrative Agreement signed by Mr. Stuart H. Cowen, Vice President for Financial Operations of MIT and Dr. Hassan Hamdy, Vice Rector for Research and Graduate Studies, Cairo University.
August 1977	Discussions held by Joint Committees at Cairo University to initiate planning for an autonomous center of technological planning during the next phase of the Program.
October 15, 1977	Draft Proposal for Multi-Year Program submitted to USAID.
November 10, 1977	Formal extension of USAID/MIT contract for six month period to June 30, 1978, and amendment for additional funding signed by USAID and MIT.
August 1978	Five Year Project Grant Agreement signed by USAID, Ministry of Planning, and Cairo University. Extension of USAID/MIT contract to October 30, 1980.
March 1979	DRTPC formally established, by-laws approved, and first director appointed.
October 1979- July 1980	Detailed evaluation of the Program, which included independent evaluation by USAID.
December 1979	MIT Liaison Office and DRTPC office moved to new building on Cairo University campus.
April 1980	Cairo University Executive Committee visits MIT to meet AID evaluation team.
July 1980- October 1980	Negotiations in Cairo for remaining three years of Project Grant Agreement. USAID/MIT contract extended to November 30, 1983.
November 1980	Rector of Cairo University and members of Joint Executive Committees met at MIT to plan for new phase of Program.
March 3, 1981	Reorganization of DRTPC announced by Rector of Cairo University.
April 1981	First plan to achieve institutionalization submitted to USAID.

July-September 1981	Implementation of first priority new initiatives: Postdoctoral and Doctoral Fellowships and Ministry Internships.
January 1982	Fifth Anniversary Symposium of the CU/MIT Technological Planning Program.
April 1982	Appointment of Dr. Mohamed El Hawary as the second Director of the DRTPC.
May 1982	Preparation of a revised Organization Plan for the DRTPC.
June 1982	Meeting of Joint Committees at MIT to review Program status and set priorities for new fiscal year.
November 25, 1982	Draft proposal for extension of Program to accommodate an Institutional Phase submitted to USAID.
December 1982- February 1983	Second USAID evaluation of Program undertaken in Cairo.
January 1983	Symposium on Energy and Development. DRTPC Computer System inaugurated by the Rector of Cairo University and the President of MIT.
April 1983	Strategic Operating Plan for DRTPC prepared, in response to USAID evaluation.
May 1983	Meeting of Joint Committees at MIT to review Program status and set priorities for the next phase of the Program.

II. DEVELOPMENT RESEARCH AND TECHNOLOGICAL PLANNING CENTER

A. INTRODUCTON AND OVERVIEW

As a result of the efforts of the CU/MIT Technological Planning Program, the Development Research and Technological Planning Center now provides an institutional mechanism at Cairo University for conducting contract research with Egyptian ministries, public and private sector companies, and appropriate international organizations in the area of science, technology, and development.

The need for such a center both in Egypt and at Cairo University had long been recognized. Until the Center's establishment, virtually all research for the Government of Egypt and international organizations performed by Cairo University faculty members had been done on a private consulting basis. A Center was needed that would provide access to the resources of Cairo University as a whole, and which would offer logistic support services (computer, library, contract administration, accounting, office facilities) greater than those at the disposal of individual faculty members. The Center would also provide a framework for conducting education and research dissemination activities, such as conferences, seminars, and short courses. It could also solicit and administer funds for fellowship programs in its fields of interest. The Center would provide a capability to establish productive linkages with Egyptian and international organizations, with the potential for research funding and subsequent financial incentives for Cairo University faculty members. Most importantly, it would foster an interest on the part of Cairo University faculty members in performing development-related research, and mobilize their capabilities on behalf of Egypt's national development efforts.

The CU/MIT Program is one of several research programs now administered under the DRTPC's auspices, and the former CU/MIT Liaison Office has been completely incorporated into its organizational structure. The following sections describe the development of the Center from its inception in 1979, its operating structure and scope, and its current program with regard to research, manpower development, and organization and administration.

1. DRTPC's Initial Period of Operation (March 1979-March 1981)

Following its establishment in March of 1979, the first director was appointed, a set of by-laws was enacted, and over 3,500 square meters of space were provided in a new building at Cairo University. The Center embarked on an ambitious program of research in a wide range of areas and an initial administrative organization was put into place.

This initial period was a cultivating experience whereby the DRTPC gained experience in organizing, administering, and managing a large scale research organization. This experience pointed out a set of difficulties in both approach and organization, and towards the end of 1980 it became apparent that a major intervention by the CU/MIT Program Joint Committees was necessary. This intervention consisted of a significant reappraisal and evaluation of the Center, its focus and its administrative processes, and a change in its leadership was made upon the expiration of the first director's appointment in March 1979. The Rector of Cairo University acted as the interim director while a search for a replacement was conducted. The Cairo University Executive Committee assumed a more direct role in the development of the Center, and a new set of more precise guidelines was established to shape the Center's research and educational objectives as well as its administrative development. These guidelines were more

carefully based on the successful experience of the CU/MIT Program, and are summarized as follows:

- * The principal activity of the DRTPC is research. The Center emphasizes sponsored programs and contract research with specific objectives.
- * The research focuses on those areas of science, technology, and development which address the development goals of the Government of Egypt. This research will not duplicate the work of other government agencies.
- * The Center will emphasize interaction with Egyptian government organizations and public and public sector enterprises to identify their research and development needs and assist in their resolution.
- * The Center's educational activities concentrate on fellowships, short courses, and workshops which support the training of research personnel at universities and government ministries, as opposed to the granting of academic degrees.
- * The Center will establish effective mechanisms for utilizing Cairo University faculty members and faculty members from other Egyptian universities in its research programs, and does not plan to develop a permanent research staff.
- * The quality of the research will be monitored by appropriate faculty committees, to insure that the standards and objectives of the Center are met.

2. DRTPC - from March 1981 to June 1983

The interim period continued for approximately one year. During this time, those activities and administrative structures of the Center which were not consistent with the new guidelines were gradually phased out, and planning was begun for the merger of the CU/MIT Liaison Office with the DRTPC. The Rector of Cairo University believed that appointment of a new director should take place after most of these activities were complete, so that the new director's efforts could be more productively devoted to research marketing and development of a new organizational structure.

The search for a new director was completed in April 1982, when Dr. Mohamed El Hawary of the Faculty of Engineering was appointed for a two year term. Plans for several changes consistent with the new guidelines

were implemented immediately. One month after Dr. El Hawary's appointment, he requested that Mr. James Culliton, Director of Personnel at MIT, visit Cairo to assist in the preparation of a new Organization Plan for the Center. The resulting document specified at one level the overall structure of the Center, as shown in Figure 1, and outlined its new objectives. The roles and responsibilities of the various groups and individuals responsible for the Center at the highest levels were set forth.

As described in the Organization Plan, the Center's Board of Directors is the major policy making authority and its responsibilities include approval of specific research areas, formulation of general development policies, review of administrative guidelines, review of proposals for outside contracts and grants, and approval of project and administrative budgets. The initial members of the Board of Directors were;

Dr. Hassan Hamdi Ibrahim, Rector of Cairo University, Chairman of the DRTPC Board of Directors*

Eng. M. Maher Abaza, Minister of Electricity and Energy

Dr. M. Zaki Shafei, Professor of Economics, Former Dean of the Faculty of Economics at Cairo University, former Minister of the Economy*

Dr. Hassan Ismail, Professor of Hydraulics and Irrigation, Former Minister of Education and Scientific Research, Former Rector of Cairo University, Former President of the Egyptian Academy of Scientific Research and Technology*

Dr. Salah Shahbender, Vice Rector of Cairo University for Research and Graduate Studies*

Dr. Ahmed Ebada Sarhan, Professor of Statistics, Former Director of the Cairo University Computer Center*

Dr. Mohamed El Hawary, Professor of Transport Planning and Railway Engineering, Head of Public Works Department, Director of the DRTPC*

*Members of the CU/MIT Program Executive Committee

Since that time, two additional members have been named to the Board:

Dr. Mohamed El Sayed El Gharouri, Minister of Industry

Eng. Kamal El Ganzouri, Minister of Planning

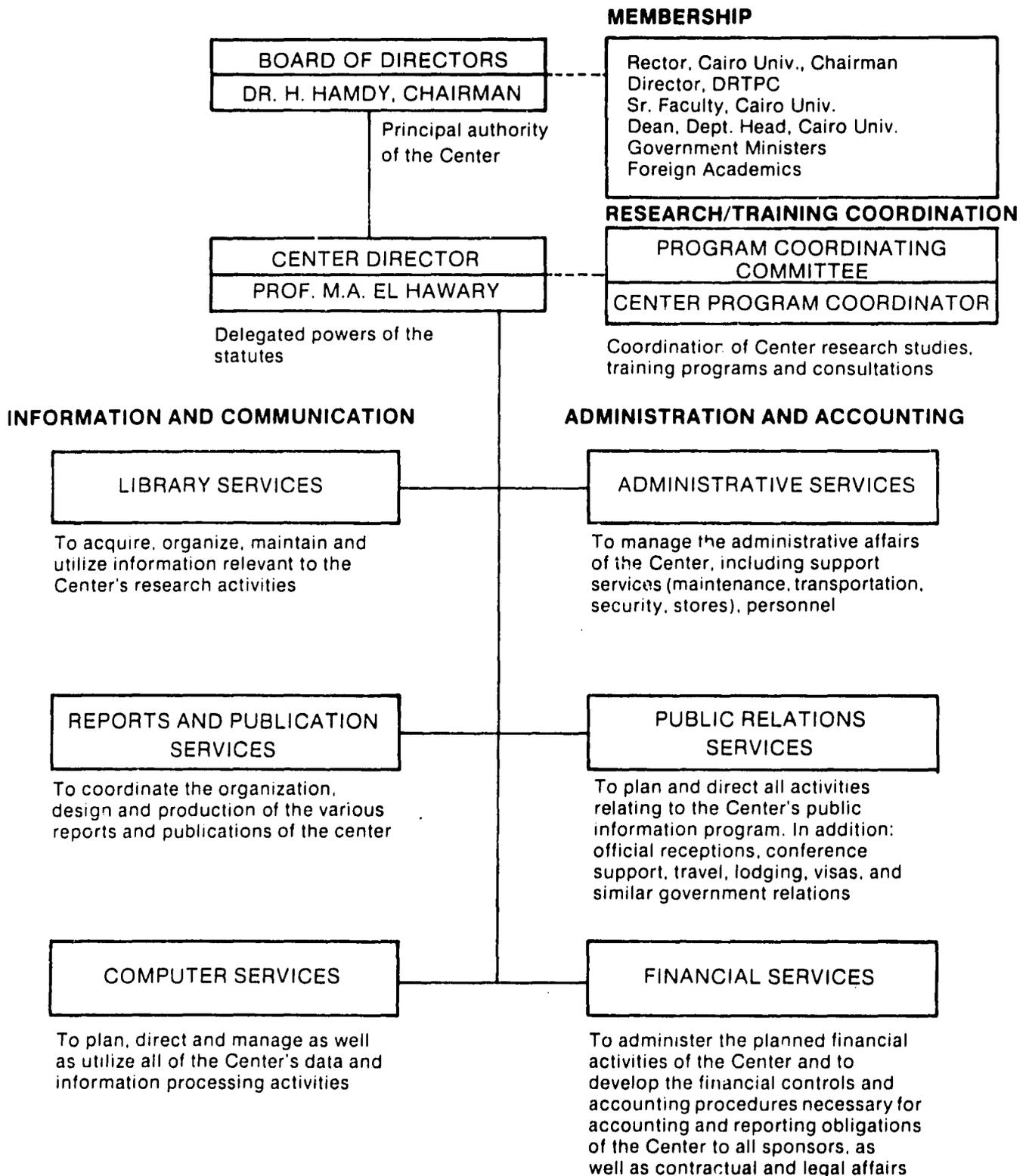
The Organization Plan further specifies that the Director of the Center is responsible for implementing the decisions of the Board of Directors, proposing the Center's plan of activities for the Board's approval, coordinating the Center's day-to-day operations and utilization of resources, and ensuring effective cooperation with government agencies and related institutions within and outside Cairo University.

To assist the Director in managing the research and educational activities of the Center, a Program Coordinating Committee will be established. This will consist of individual program coordinators to be designated by the Director for each major area of interest to the Center, as selected by the Board of Directors. The coordinators will review the progress of ongoing Center activities, identify potential projects, and promote close cooperation among the Center's research project teams. They will also, as the Center's operations increase, prepare overall assessments and strategies for research, training, consulting, and conference/seminar activity within their respective fields of expertise. To date, one area coordinator, Dr. Hamed El Sinbawy, has been named to supervise the fellowship and internship activities of the Center funded by the CU/MIT Program.

The Organization Plan, at another level, also contains detailed specifications for the Center's administrative and logistic support structure, as outlined in Figure 1. The functions of the six administrative support units were described, and individual position descriptions were prepared. Starting salary ranges for each type of

FIGURE 1

ORGANIZATIONAL STRUCTURE OF THE CENTER OF DEVELOPMENT RESEARCH AND TECHNOLOGICAL PLANNING (DRTPC); CAIRO UNIVERSITY



position were recommended, based on a review of comparable organizations in Cairo. Current staff members were assigned to fill these positions, including the CU/MIT Liaison Office staff, who were formally integrated into the Center's payroll on July 1, 1982. As of June 1983, approximately 40 positions had been filled.

The three sections below explain in more detail the Center's progress during the past two years in the following areas: applied research, manpower development, and organization and administration. A fourth section then summarizes the Center's plans for the next period of operation.

B. APPLIED RESEARCH

The Center has, to date, received funding for several research projects in addition to those sponsored by the CU/MIT Program. These are listed in Table 2. In accordance with the Center's objective of funding diversification, fifteen Egyptian government ministries and agencies have contributed funds, along with four international organizations and six Egyptian private sector companies. Nine different academic departments have been involved at Cairo University. The CU/MIT research projects, which continue to form a major portion of the Center's applied research program, are described in Chapter III of this report.

Table 2

DRTPC RESEARCH PROJECTS
June 1983

I. CURRENT RESEARCH PROJECTS - FUNDED BY EGYPTIAN SOURCES

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored by</u>	<u>Approximate Funding</u>
Study of the Cement Market in Egypt	Dr. Atef Ebeid Faculty of Commerce	Egyptian Cement Office	LE 77,000
Education Information Systems	Dr. Ahmed Omar Faculty of Economics	Ministry of Education	LE 22,000
Development of Pharmaceutical Chemical Systems	Dr. S. Balbaa Faculty of Medicine	Ministry of Health	LE 70,000
Performance of Paraffinic Asphalt-Cements in Road Construction (joint project with CU/MIT Program)	Dr. Abdel Moneim Osman Faculty of Engineering Dept. of Civil Eng.	General Authority for Roads and Bridges The Arab Contractors The Nile Company for Roads and Bridges El Nasr Contracting Company The Nile Company for Road Construction The Nile Company for Desert Roads The Nile Company for Construction and Paving	LE 155,000
Guidelines for Urban Area Planning (joint project with CU/MIT Program)	Dr. Mahmoud Yousry Faculty of Engineering Dept. of Architecture	General Organization for Physical Planning	LE 27,000
Protection of the Open Railway Connection Serving Abou Tartour Phosphate Mines from the Danger of Floods	Dr. Halim Salem Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Transport and Communications	LE 80,000

Table 2 (continued)

I. CURRENT RESEARCH PROJECTS - FUNDED BY EGYPTIAN SOURCES (CONTINUED)

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored by</u>	<u>Approximate Funding</u>
Real Time Forecasting and Control for the High Dam	Dr. Halim Salem Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Irrigation, Water Master Plan	LE 15,000
Upper Nile Valley Project	Dr. Halim Salem Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Planning	LE 20,000
Protection of 15 May City from Flash Floods	Dr. Halim Salem Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Housing and Reconstruction	LE 80,000
Traffic Management Schemes in the Roxy Area of Heliopolis	Dr. Magdy Salah Nour-eldin Faculty of Engineering Dept. of Civil Eng.	Ministry of Housing and Reconstruction	LE 45,000
Engineering Applications for the Egyptian Plastics Industry (matching funds for CU/MIT project)	Dr. Mohamed El Salamony Faculty of Engineering Dept. of Mechanical Engineering	Egyptian National Plastics Company	LE 8,000
Upgrading and Improvement of the Lock Entrance at Kilometer 61, Noubaria Canal	Dr. Ibrahim El Assiouti Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Transport, Inland Waterway Organization	LE 50,000

Table 2 (continued)

II. CURRENT RESEARCH PROJECTS - FUNDED BY NON-EGYPTIAN SOURCES

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored by</u>	<u>Approximate Funding</u>
Economy Wide Modeling and Social Accounting Matrix Updating Project	Dr. Amr Mohie-eldin Faculty of Economics	United States Agency for International Development	LE 379,000 US\$ 18,000
		World Bank	US\$ 25,000
Employment of Women: Patterns and Demographic Change	Dr. Amr Mohie-eldin Faculty of Economics	International Labor Organization and United Nations Fund for Population Activities	LE 30,000
Economic, Social, and Cultural Characteristics of Egyptian Pilgrims (Hajj Project)	Dr. M. Zaki Shafei Faculty of Economics	Pilgrimage Research Center University of King Abdel Aziz Jeddah, Saudi Arabia	LE 196,000

Table 2 (continued)

III. COMPLETED RESEARCH PROJECTS

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored By</u>	<u>Approximate Funding</u>
Studies of the Central Nasr and Gesr El Suez Workshops	Dr. M. El Alaili Dr. Mohamed El Hawary Faculty of Engineering Dept. of Civil Eng.	Cairo University	LE 32,000
Replanning and Development of El Fayoum City	Dr. Taher El Sadek Institute of Planning Cairo University	El Fayoum Governorate	LE 30,000
Optimum Policies for Maintenance of the Delta Paved Road Network	Dr. Mohamed El Hawary Faculty of Engineering Dept. of Public Works	General Authority for Roads and Bridges	LE 232,000
Study of Manpower Demand at both Occupational and Sectoral Levels	Dr. Amr Mohie-eldin Faculty of Economics	Ministry of Planning	LE 10,000
Study of the Sinai Society and its Structure and Preparation of a Structural Plan for Sinai Peninsula	Dr. Sobhi Abdel Hakim Faculty of Arts Dept. of Demography	Ministry of State for Scientific Research	LE 25,000
Structural Planning for El Amal City	Dr. Mahmoud Yousry Faculty of Engineering Dept. of Architecture	General Organization for Physical Planning	LE 155,000
Design and Mechanization of the Financial and Managerial System of the Family Planning Organization	Dr. Abdel Moneim Mahmoud Faculty of Commerce	Family Planning and Population Agency	LE 36,000

Table 2 (continued)

III. COMPLETED RESEARCH PROJECTS (CONTINUED)

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored by</u>	<u>Approximate Funding</u>
Planning and Design of Youth Villages	Dr. Mahmoud Yousry Faculty of Engineering Dept. of Architecture	Ministry of Housing and Reconstruction	LE 80,000
Completed Mini-Projects			LE 35,000

Table 2 (continued)

IV. PROJECTS IN FINAL STAGES OF NEGOTIATION

<u>Project</u>	<u>Principal Investigator</u>	<u>Sponsored by</u>	<u>Approximate Funding</u>
Connecting New Cities Road Network with Greater Cairo	Dr. Mohamed El Hawary Faculty of Engineering Dept. of Public Works	Ministry of Housing and Reconstruction	LE 150,000
Demonstration of Solar Pond Technology in Egypt	Dr. Abdelwahab Amer Faculty of Engineering Dept. of Irrigation and Hydraulics	Ministry of Electricity and Energy	LE 77,000

V. MAJOR PROPOSALS OUTSTANDING

Permanent Traffic Counting Program on National Road Network	Dr. Mohamed El Hawary Dr. Farouk Abdel Bari Faculty of Engineering Dept. of Public Works	Ministry of Transport	LE 600,000 for first phase (6 mos.) LE 1,500,000 for second phase (3 years)
Development of Water Resource Planning	To be determined	Mersa Matruh Governorate	LE 400,000

Under the revised guidelines of the Center, more specific criteria have been established for the acceptance of research projects. The new Director, Dr. El Hawary, has outlined these criteria as follows:

1. The academic/educational content must be of a high level; for example, the work should involve the development and application of advanced analytical techniques, or the improvement of existing technical standards. Where possible, the work should contribute to the development of new expertise within the Center.
2. The subject area must be consistent with the focus on technological and socio-economic development established by the Center.
3. The Center must possess the necessary staff and qualifications to perform the work outlined within the time frame and budget specified.

Dr. El Hawary has also made a concerted effort to utilize the contacts and expertise of the CU/MIT Principal Investigators at Cairo University, and as a result seven new projects were funded during the first half of 1983. It has been further specified that all long-term projects under the CU/MIT Program must provide matching funds or parallel projects from Egyptian government agencies in order for continuation of their projects to be considered.

A greater effort is also being made by the Center to involve MIT faculty members on an advisory basis in reviewing RFPs, proposals, and reports, and providing other advice as requested.

C. MANPOWER DEVELOPMENT

The Center began to hold short courses and other training programs immediately after its inception in 1979. However, many of these were not consistent with the Center's intended focus on development-related subjects, and were therefore discontinued in 1981. Nonetheless, significant progress was made in the development of facilities at the Center, including two large conference rooms which were renovated with funds from Cairo University.

For the past two years, most of the Center's activities in this area have taken place within the context of its research projects. Those undertaken by the CU/MIT Program are described in Chapter IV of this report, and include a substantial number of fellowships, conferences, and short courses.

The Center intends to start a new program of short courses during the extension of the Program currently being negotiated with USAID. Some will focus on general topics of interest to participants from many disciplines, such as sector level planning, computer modeling, and cost/benefit analysis, while others will concentrate on analysis of specific issues of concern to the organizations involved. Development of appropriate facilities has continued with the purchase and installation of videotape and other audio-visual equipment.

D. ORGANIZATION AND ADMINISTRATION

The Center has established six units to provide administrative support to the faculty, ministry personnel, graduate students and other staff participating in Center activities.

With the assistance of MIT and Cairo University, substantial progress has been made in organizing, staffing, and developing these units. Efforts have been made to incorporate both international and Egyptian standards and practices so that the Center can be responsive to requests for its services from many different types of organizations. The current status of each department is described below, along with some of the inputs received from MIT and Cairo University.

1. Financial Services

a. Accounting

Since its inception in 1979, the Center has received funding for over 25 projects, from both Egyptian and international sources. Substantial experience has been gained in managing several types of funds and accounts, and in providing reports to Center management and sponsors. An awareness has also been created of the difficulties involved and the kinds of assistance needed to develop a sound, fully integrated system.

Within the CU/MIT Program, periodic assistance had been provided by the MIT Comptroller's Office in developing appropriate procedures and in training Egyptian staff. It was expected that the financial management system developed for the CU/MIT Program and its individual research projects would serve as a model for the Center. As the Liaison Office staff acquired more skills, they assumed more responsibility, and with the integration of the Liaison Office and the Center in 1982, they were given high level positions in the new organizational structure.

The assistance from MIT in this area has shifted from development of basic procedures for the CU/MIT Program to four new general areas of emphasis for the Center:

1. Development of an integrated system for all the Center's accounts, which will provide the Center's management with ongoing reports of the Center's financial status.
2. Computerization of the manual accounting and financial management systems.
3. Establishment of cost centers for allocation of Center services such as photocopy, telex, computer, secretarial services, etc.
4. Establishment of a system for determining the Center's indirect costs, to provide an overhead rate that can be used in contract negotiations with potential sponsors.

Mr. Philip Keohan, the Comptroller at MIT, has visited Cairo twice to discuss these matters with Center staff, USAID, and Cairo University administration. Two other MIT staff members, Mr. John Donahue and Mr. Richard May, also traveled to Cairo to provide specific assistance on computerization of the manual systems. Hardware and software systems have been selected, and delivery is expected in the summer of 1983.

In conjunction with all the other activities, an accounting advisor from Cairo University has been appointed, and preparation of accounting manuals has been initiated to outline the Center's specific policies and procedures.

b. Contract Administration

As in the accounting area, the projects administered by the Center to date have given the Center's administration an appreciation for the issues involved in contract management, and the potential areas for problems which must be resolved over the short and long term. Mr. George Dummer, the Director of MIT's Office of Sponsored Programs, has visited Cairo twice to discuss the needs of the Center with regard to contract management.

A channel has been set up whereby MIT (at the request of the Center) will review (1) proposals prepared by the Center for submission to outside sponsors, and (2) proposals received by the Center from CU faculty who already have outside funding and are interested in having their projects administered under the auspices of the Center. Mr. Dummer has also agreed to assist in the development of contracting policies and procedures for the DRTPC. A number of MIT's written policies (such as those for proposal and budget preparation, and guidelines for entering into relationships with outside sponsors) will be modified for the Center's use. MIT's written procedures have already served as the basis for the RFPs issued by the Center in conjunction with the CU/MIT fellowship and internship programs.

2. Administrative Services

This department is responsible for personnel, maintenance, local transportation, international and domestic travel, security, and inventory control. Most of the current systems are based on those developed for the CU/MIT Program. MIT assistance has been concentrated in the area of personnel administration, and several visits have been made by Mr. James Culliton, Director of Personnel at MIT. During his visits, the following have been accomplished:

1. Establishment of a personnel policies and procedures manual for the Center, which combines Egyptian and international practices and regulations.
2. Development of detailed job descriptions and structure for each administrative unit within the DRTPC's "Organization Plan".
3. Several wage and salary surveys, which are intended to maintain the Center's staff at competitive levels of compensation.
4. Implementation of annual performance reviews for all Center staff.

3. Computer Services

It is anticipated that this unit will eventually provide:

1. General computational support for the Center's research and manpower development programs.
2. Support for the administrative operations of the Center, including various management information systems.
3. A computerized search and retrieval system to reference the holdings of the DRTPC Library.

From the period June 1981-December 1981, a mini-project was funded by the CU/MIT Program that led to the successful procurement of a computer system for the Center. Two MIT counterparts were identified at the School of Engineering's Joint Computer Facility; the faculty supervisor and the facility's director. The Egyptian counterparts for this effort were the present and former directors of the Cairo University Statistical Center. During meetings in Cairo, extensive discussions were held with several administrative personnel at Cairo University and with researchers on the CU/MIT and Center projects. An appropriate system for the Center was carefully designed, and bids were solicited. A Digital VAX 11/780 system was selected, and approval obtained from USAID for purchase.

The Cairo University counterparts assumed responsibility for investigating such areas as power supply, renovations to the facility, and installation and maintenance agreements with local suppliers.

Shipment of the computer and renovations of the facility at the Center took place during the summer of 1982. The computer was installed in the fall of 1982, and officially inaugurated by the Presidents of Cairo University and MIT in January 1983.

Dr. Hisham El Sherif was nominated to assist the Director of the Center in further development of this system, and a second mini-project was established. Dr. El Sherif received his Ph.D. from MIT under the

sponsorship of the CU/MIT Program, and his thesis was on "Informatics in Developing Countries". Under his guidance, the computer services unit has established a training program for both researchers and administrative personnel, using videotape packages and hands-on demonstration on the equipment itself. Current work also focuses on procurement of additional language, system, and application software packages appropriate for the Center's needs, and development of a user accounts system to allocate the various costs. The Center's computer services unit is also planning to establish a microcomputer/informatics laboratory.

4. Library Service Department

The library is responsible for acquiring, maintaining and utilizing information relevant to the Center's research activities. It deals principally with academic and technological information and utilizes hard copy, microfiche, and computerized systems. The library is developing a large collection of books, periodicals and reports including:

- * All DRTPC publications, including working papers, theses, and journal articles related to DRTPC activities.
- * A basic collection of statistical information as well as other important reference sources on science, technology and development in Egypt and other countries.
- * Reference works pertinent to research currently underway at the DRTPC.

The library is responsible for the exchange of research reports with Egyptian and foreign cooperating institutions. It also distributes DRTPC reports in response to outside requests.

The first library staff and structure established for the Center was carefully evaluated during the summer and fall of 1981. It was decided by the Board of Directors that a much stronger and more efficiently designed facility should be developed.

Current activities of the library focus on evaluating the material already on hand, establishing acquisition and service policies consistent with the goals of the Center, and carefully investigating other library facilities in Cairo in order to avoid duplication. The librarian is also implementing a plan to utilize the space made available by the Center, and to obtain the necessary furnishings and equipment. A card catalog and microfiche reader/printer are among the items purchased to date.

The Director of the MIT Libraries has been approached in regard to prospective support from MIT in this area. MIT has had extensive experience in setting up libraries overseas, as well as at remote locations on campus. It is expected that increased assistance to the Center will be provided in the next phase of the Program.

5. Reports and Publications Services Department

This department is responsible for the design and production of all the Center's technical reports as well as all other publications and brochures that describe the different activities of the Center. It has staff and facilities for design, typing, printing, and binding many of these publications. DECmate Word Processing equipment was purchased in early 1982, and is now operational at the Center. Personnel from the Center have been trained at the manufacturer's facility in the U.S. and a staff member from MIT went to Cairo in November 1983 to assist in the start-up of the system.

6. Public Relations Services Department

This department is responsible for the planning and implementation of all activities that are concerned with the public information program of the Center. Assistance is provided to the director, the program coordinators and/or principal investigators in arranging press conferences,

television and radio interviews and in publishing non-technical reports of the Center's activities in the public press and in popular journals. This unit also organizes official receptions and assists in organizing conferences, seminars, and workshops.

E. DRTPC'S FUTURE PLANS

1. Strategic Operating Plan

As part of the proposal for the extension of the present contract to incorporate an Institutional Phase, the Center has prepared a Strategic Operating Plan to facilitate a transition state from reliance on USAID funding to reliance on other sources of funding. This period requires carefully defined planning strategies and management structures.

The Center has organized its planning strategies in the three areas of applied research, manpower development, and organization/administration. Within this framework human, financial and technical resources will be coordinated to gradually increase operational strength and financial self-sufficiency. New or modified role relationships will be achieved, vis-a-vis USAID, MIT, Cairo University, the Government of Egypt and other organizations.

In this regard the Center has begun the process of:

1. Describing the present institutional status of the Center, and identifying areas for short-term and long-term change.
2. Setting objectives and defining end-of-project status in terms of specific indicators of achievement, both final and interim.
3. Defining appropriate strategies for the transition state within each area.
4. Preparing action plans within each strategy area.
5. Instituting appropriate and effective review procedures to monitor and refine the change process.

The DRTPC Strategic Operating Plan will be used to identify strategies, objectives, priorities, and methods whereby progress can be measured. A section has been prepared for each of the Center's three main areas of activity and is structured as follows. First an overall statement is made of the strategies and objectives for each section. Second, an assessment of current status is made, which focuses on quantitative indicators. Third, the primary end-of-project status objectives are presented, with potential strategies, indicators, and use of resources. Finally, a statement is made concerning the specific means of reviewing the progress made by each individual area within the context of an annual review of the Center's progress. This annual review will be undertaken by the DRTPC both to analyze total system performance and change, and the effects of specific institutionalization activities and efforts. It is considered to be an important mechanism in maintaining momentum of effort towards achievement of end-of-project status.

The Strategic Operating Plan also contains a detailed section on the Center's plan to achieve financial self-sufficiency. The general funding strategy focuses on revenues from the following sources:

1. Grants from the Government of Egypt for:
 - * Research
 - * Training
 - * General Administration
 - * Technical Assistance
2. Research contracts from Government of Egypt institutions
3. Research contracts from foreign institutions
4. Grants and endowments from international institutions
5. Service contracts from Government of Egypt and international institutions

6. Research contracts and service contracts from public sector corporations and from private Egyptian and international corporations

Once the extension of the Program is signed, a marketing strategy plan will be prepared which will specify plans for development of each of these areas. This plan will also be reviewed on an annual basis.

2. MIT Involvement

During the Institutional Phase, MIT's involvement will gradually be phased down; however, there are certain areas of assistance that are vital for the continuation of the present efforts and their new emphasis on strengthening the DRTPC. MIT will continue to provide support aimed at creating an environment conducive to productive research, encouraging Egyptian participation, and insuring continuity of efforts. The commitment of MIT will remain very strong in assisting the Center to:

1. Gain independent capability to identify and select pertinent research projects based upon proven evaluation procedures,
2. Design individual research activities according to accepted scientific methodology, and
3. Manage both the technical and administrative aspects of these projects.

III. RESEARCH PROJECTS

A. INTRODUCTION AND OVERVIEW

The funding of collaborative, long term research projects has been a major activity of the CU/MIT Program since its inception, and has proven to be an extremely effective mechanism in promoting institutional changes at the DRTPC, Cairo University, and Egyptian government ministries. Through these projects, the previously untapped resources of the academic community in Egypt have been mobilized. Ministry planners have developed and upgraded those skills and capabilities needed to carry out their responsibilities for formulating and implementing development plans. The linkages established between the ministries and the academic community have demonstrated the value of collaborative applied research on development topics.

The strategy used to bring about these new and important linkages has been to find a broad problem, critical to national development, which is of mutual interest to an MIT faculty member, a Cairo University faculty member and an Egyptian ministry. Teams are then formed with representatives from each of the three participating institutions, to prepare a proposal which is carefully reviewed by the Program's Joint Committee. The commitment of senior faculty and GOE officials has been essential in the successful demonstration of the feasibility of this approach.

The following are specific objectives of the research projects:

1. Solution of pressing problems facing the ministries, and institutionalizing the relevant project evaluation skills and research methodologies necessary for continuation of similar efforts.
2. Orienting faculty members toward multidisciplinary applied research related to national goals. Familiarizing them with contract research and collaborative research with ministries, other Egyptian organizations, and international agencies.

3. Convincing ministries that the resources of Cairo University can be used effectively to meet some of the development needs of Egypt, and creating an environment within the ministries whereby resources can be used productively.

All of the research projects are required to submit proposals on an annual basis, along with a report describing the results that have achieved during the prior year.

The specific projects that have been conducted over the past six and one half years are listed on Table 3. The specific achievements of the ongoing projects (as of June 1983) are outlined in a series of executive summaries, which are contained in Part Two. The overall achievements of the Program research were highlighted at the Fifth Anniversary Symposium of the CU/MIT Program held in January 1982. On this occasion, U.S. Ambassador Alfred L. Atherton stated that:

These past five years have proven the Program to be eminently successful. Through tri-partite collaboration, key personnel in a number of Egyptian government ministries, engaged in priority development areas identified in the Five Year Plan, have increased their know-how in project identification, evaluation and analysis. The positive results of this collaboration with their academic counterparts have demonstrated to officials of these ministries the technical and professional potential which exists at Cairo University, and the mutual benefits to be derived from government and academic cooperation.

Dr. Soufy Abou Taleb, the Speaker of the Egyptian People's Assembly and former Rector of Cairo University, further remarked that:

This program has had major impacts in many ways on Cairo University and on the planning process in Egypt...Literally hundreds of Cairo University faculty members and graduate students have been involved in joint research projects important to the development of Egypt. Through this process, the very latest planning tools and systems have been adapted for use in Egypt and are now being used on a day-to-day basis in many of these organizations.

Dr. Mostafa Kamal Helmy, Deputy Prime Minister and Minister of State for Education and Scientific Research, referred to the CU/MIT Program as:

The single most successful joint international scientific venture undertaken by universities representing our two countries.

Table 3

CU/MIT RESEARCH PROJECTS

Ongoing (as of June 1983)

Electric Power System: Planning and Economics
Intercity Multimodal Transportation
Engineering Applications for the Plastics Industry
Stochastic Models of Nile River Hydrology
Water Resource Planning
Performance of Paraffinic Asphalt-Cements in Road Construction
Energy-Economy Interactions and Energy Policy
Infrastructure and Urban Planning Guidelines for Secondary Cities
Energy and Environmental Impact Studies for the Qattara Depression
Production Planning Methodology for the Automotive Industry
Energetics in the Egyptian Metal Industries
Informatics and Development (mini-project)

Completed

Communication Needs for Rural Development
Regional Groundwater Studies
Housing and Construction Industry
Urban Transportation Policy
Government Incentives for Small Scale Industry
Labor Migration
Improved Methods of Macroeconomic and Sectoral Planning
Health Care Delivery Systems
Gypsum Quarrying and Product Manufacturing (mini-project)

B. CHANGES IN LONG-TERM RESEARCH SINCE THE PROGRAM'S INCEPTION

The July 1980 USAID evaluation recommended a broadening of the base of Egyptian participation in the Program as one element of insuring a lasting institutionalization of the effort. The research project element of the Program has been one of the areas in which it has set out to fulfill this recommendation. During the annual review of project proposals in 1980, a new set of criteria were established by the Joint Committees, which have been used to determine those projects which should be phased out. These criteria are summarized as follows:

1. The scope of work in the research proposal has evolved to the point where no new skills are being developed and continued funding is no longer considered appropriate.
2. The accomplishments of the research project and the capabilities acquired by the principal investigator are such that the project has achieved self sufficiency; i.e., outside funds can be acquired to continue to support the research activities which were developed under CU/MIT sponsorship.
3. The activities of the project have reached a logical concluding point and the researchers have decided to go into different but related areas.

Using these criteria, the Joint Committees have concluded six projects. The Housing and Construction Industry and the Communication Needs for Rural Development are examples of the first; the Urban Transportation and the Macroeconomic and Sectoral Planning Projects fall under the second. Labor Migration and Regional Groundwater are examples of the third.

Five new projects were approved to replace these. In each case new research teams involving different faculties, faculty members, and ministries were established. Tables 4 and 5 show these changes, and demonstrate the multi-disciplinary nature of the project teams, which has been encouraged since the start of the Program.

Table 4

INVOLVEMENT OF CAIRO UNIVERSITY FACULTIES AND DEPARTMENTS IN
CU/MIT RESEARCH PROJECTS INITIATED SINCE JUNE 1980

<u>Project</u>	<u>Cairo University Faculties and Departments</u>
Resource Development and Policy: Petroleum	Department of Economics, Faculty of Economics and Political Science Department of Geology, Faculty of Science*
Urban Infrastructure	Urban Planning Institute* Department of Architecture, Faculty of Engineering Department of Public Works, Sanitary Engineering Division, Faculty of Engineering*
Qattara Depression	Department of Meteorology, Faculty of Science* Department of Irrigation and Hydraulics, Faculty of Engineering
Auto Production Planning	Institute of Statistical Studies and Research: Operations Research Department*, Computer Sciences Department* Department of Applied Mathematics and Physical Sciences, Faculty of Engineering* Department of Electric Power, Faculty of Engineering
Energetics in the Egyptian Metal Industries	Department of Metallurgy, Faculty of Engineering* Department of Mechanical Power, Faculty of Engineering* Department of Mechanical Design and Production Engineering, Faculty of Engineering Department of Electric Power, Faculty of Engineering
Gypsum Quarrying and Product Manufacturing in Egypt	Department of Mining, Faculty of Engineering*

*Indicates new department involved in CU/MIT Program.

Table 5

INVOLVEMENT OF GOE MINISTRIES AND AGENCIES IN CU/MIT

RESEARCH PROJECTS INITIATED SINCE JUNE 1980

<u>Project</u>	<u>GOE Ministry or Agency</u>
Resource Development and Policy: Petroleum	Ministry of Planning Ministry of Petroleum* Egyptian General Petroleum Company* AGIBA (state petroleum operating company concerned with natural gas)*
Urban Infrastructure	National Organization for Water and Sanitary Drainage* General Organization for Physical Planning
Qattara Depression	Civil Aviation Authority, Department of Meteorology* Ministry of Electricity and Energy
Auto Production Planning	El Nasr Auto Company*, Ministry of Industry
Energetics in the Egyptian Metal industries	Egyptian Iron and Steel Corporation*, Misr Aluminium Company*, Ministry of Industry
Gypsum Quarrying and Product Manufacturing in Egypt	Fayoum Governorate*

*Indicates new ministry or government agency involved
in CU/MIT Program.

The following additional criteria for project selection and continuation were implemented in June 1983, in accordance with the increased Program emphasis on institutionalization:

- * Specific potential for financial contributions by ministries or other organizations.
- * Potential for the application of proven marketing skills on the part of Cairo University faculty members.
- * Specific intent to promote an awareness of the DRTPC's capabilities and create an environment within the cooperating ministry for future use of these capabilities.

It is now felt that Cairo University and ministry participants should view participation in the CU/MIT research efforts not only as a vehicle for involvement with MIT, although this will remain an important aspect of these projects. It is important that they also view it as a means to associate themselves with the Center, through which other collaboration similar to that established with MIT can be facilitated.

There have been other significant changes over time in the long-term research projects, which demonstrate progress toward institutionalization of the effort at Cairo University and the ministries involved, for example:

1. Many CU faculty members have obtained matching funds for their CU/MIT Projects, or financial support for parallel projects at the DRTPC.
2. The number of faculty, graduate students, and ministry personnel involved has increased and changed.
3. The division of the research effort has shifted toward the Egyptian participants and away from MIT.

In regard to point (3) above, Egyptian counterparts have assumed much of the responsibility for proposal preparation, the design and execution of computer models, the organization and supervision of conferences, workshops, seminars, and short courses, and the preparation of final reports and journal articles disseminating the results of their research. At this

point in time the Cairo University participants are now taking the major initiative in suggesting research topics, initiating educational activities, obtaining follow-on funding, and devising appropriate quality control mechanisms.

The individual executive summaries presented in Part Two evaluate the Program's current research projects in four areas. The first section of each summary describes the objectives of the project. Following that is a summary of those research accomplishments which have been implemented in Egypt. The next section provides information regarding the degree of involvement and acceptability of the approach by the particular government agency. Finally, the activities of the research in manpower development/education are summarized.

IV. ACADEMIC AND MANPOWER DEVELOPMENT ACTIVITIES

The academic and manpower development aspects of the CU/MIT Program have formed an integral part of the process of technology transfer. Benefits to all participants - Cairo University faculty and students, ministry personnel, MIT faculty and students - are enhanced through a diverse array of educational activities, many of which are carried out in the context of the individual research projects. These activities have served as models for the Center, and several of the Center's other projects have conducted or plan to conduct similar activities. In this part of the report, the three major approaches utilized by the CU/MIT Program will be described.

A. CONFERENCES, SEMINARS, WORKSHOPS, AND SHORT COURSES

Within the context of the CU/MIT Program, the following definitions of terms apply:

Conference: A major meeting on a fairly broad subject area attended by Cairo University/MIT personnel, ministry personnel, and international participants. Conferences are co-sponsored by the ministry which has the major interest in the subject area.

Seminar: A smaller meeting, usually held to present and discuss project results in a specific area. Attended by Cairo University/MIT personnel and ministry staff participating in a particular project. Attendance may also be open to selected outside individuals.

Workshop/
Short Course: A short term course of instruction or series of discussions, focused on an area of knowledge that needs upgrading in order to accomplish project objectives. A "workshop" is usually conducted on an informal basis for a period of a week or less. A "short course" generally lasts for more than a week, is more precisely structured, and has a more formal academic content.

In addition to those conferences organized by the research projects, a Program-wide conference has been held in Cairo since 1980 on an annual basis. By so doing, all participants from Cairo University, MIT, and the

Government of Egypt have had an opportunity to present the results of their research efforts to their peers and to other personnel working in the field, who may not be aware of the state-of-the art research being conducted at the DRTPC. In addition, these conferences have provided an excellent opportunity for senior MIT and Cairo University administrators to review the Program and evaluate the activities of faculty members and students. MIT Provosts Walter A. Rosenblith and Francis Low have visited Cairo during these conferences, and upon returning to MIT have met with the principal investigators involved to discuss the value and quality of their research efforts. In January 1982 Dr. Howard Johnson, Chairman of the MIT Corporation, participated in the Fifth Anniversary Symposium of the Program, and in January 1983, MIT President Paul Gray was a participant in the Symposium on Energy and Development.

Attendance of other dignitaries at these conferences has also been noteworthy. For example, at the Fifth Anniversary Symposium the speakers included Dr. Soufy Abou Taleb, the Speaker of the Egyptian People's Assembly, Dr. Mostafa Kamal Helmy, Deputy Prime Minister and Minister of State for Education and Scientific Research, Dr. Mohamed Zaki Shafei, Former Minister of the Economy, Eng. Soliman Metwally, Minister of Transport and Communications, Eng. Maher Abaza, Minister of Electricity and Energy, Dr. Hassan Hamdi Ibrahim, President of Cairo University, The Honorable Alfred L. Atherton, U.S. Ambassador to Egypt, and Mr. Donald S. Brown, Director of the USAID Mission to Egypt.

Table 6 provides a listing of the major conferences, seminars, workshops, and short courses that have been conducted since the inception of the Program.

Table 6

CONFERENCES, SEMINARS, WORKSHOPS, AND SHORT COURSES

Conferences

<u>Date</u>	<u>Title</u>	<u>Scope and Participation</u>
January 1978	Development of New Approaches to Housing Policy and Production	175 participants, including representatives from the General Organization for Physical Planning, Ministry of Housing, and the Ministry of Planning. Discussions provided a focus for continued work on the Housing and Construction project and were responsible for introducing new areas of research. The proceedings have been published.
June 1978	Transportation Planning Policy	200 participants from the Ministry of Transport, Ministry of Planning, and the Transportation Planning Authority. Areas of discussion included national transport policy, transport systems analysis, transport modes and urban transportation.
June 1979	Water Resources Planning	225 participants from the Ministry of Irrigation, the United Nations, and seven foreign universities. The conference established a mechanism for providing timely communication of important research findings and policy directions. The proceedings have been published.
January 1980	General Conference on the CU/MIT Technological Planning Program	The technical research results of all projects sponsored by the CU/MIT Technological Planning Program were presented to invited officials from various ministries and Egyptian universities; 50 faculty, staff, and students from MIT traveled to Cairo to jointly present the results of their work with their Egyptian counterparts.
January 1981	Water Resources Management	250 participants, with further foreign participation, including representatives from the Sudanese government. Technical sessions were held on the Water Master Plan, surface water hydrology, water quality and groundwater hydrology. Proceedings have been published.

Table 6 (continued)

Conferences

<u>Date</u>	<u>Title</u>	<u>Scope and Participation</u>
January 1981	Second Annual Conference on the CU/MIT Technological Planning Program	The technical research results of all projects sponsored by the CU/MIT Technological Planning Program were presented to invited officials from various ministries and Egyptian universities.
January 1982	Fifth Anniversary Symposium of the CU/MIT Technological Planning Program	Presentations were made by six government ministers, the Speaker of the Egyptian People's Assembly, the U.S. Ambassador, the Mission Director of USAID, and the Chairman of the MIT Corporation. The Symposium was attended by over 200, including representatives from the Government of Egypt, USAID, the MIT Corporation Executive Committee, and faculty from Cairo University and MIT. Proceedings have been published.
January 1982	Third Annual Conference on the CU/MIT Technological Planning Program	The technical research results of all projects sponsored by the CU/MIT Technological Planning Program were presented to invited officials from various ministries and Egyptian universities.
January 1983	Symposium on Energy and Development	Presentations were made by two GOE ministers, the Presidents of Cairo University and MIT, the Deputy Director of USAID, and the Director of the DRTPC. An afternoon round table discussion on Science and Technology in the Arab World was also held. Proceedings have been published.
January 1983	Fourth Annual Conference on the CU/MIT Technological Planning Program	The technical research results of all projects sponsored by the CU/MIT Technological Planning Program were presented to invited officials from various ministries and Egyptian universities.
June 1983	Water Resources in Egypt	The purpose of the conference was to continue the dialog established in previous conferences on Egyptian water resource problems. Twenty five Egyptian papers and eight MIT papers were presented. Proceedings will be published.

Table 6 (continued)

Seminars, Workshops, and Short Courses

Date	Title	Scope and Participation
January 1978	Polymer Science and Technology	50 Cairo University, GOE and industry representatives attended. Purpose was to update participants in the state-of-the-art in polymer research.
May-June 1978	Elements of Water Resource Systems: Analysis and Planning	75 participants from Cairo University, Ministry of Irrigation, and Egyptian Water Master Plan organization. Lectures in fundamental areas were given initially to provide background for application lectures on physical modeling of surface and groundwater hydrology, the role of uncertainty in water resource planning, and evaluation methods to help resolve multi-objective, multi-interest group conflict problems concerning allocation of water resources. Particular emphasis was given to the tools being developed by the CU/MIT projects on water resources.
December 1978- January 1979	Reliability of Power Systems	50 participants from Cairo University and the Ministry of Electricity. Course was designed to familiarize personnel at Cairo University and the Ministry with the principles of reliability evaluation, and the methods commonly used to analyze those particular problems presented by the Egyptian National Electrical System. The notes from this workshop have been published and are used in a course at Cairo University.
January 1979	Core Housing and Site and Services Projects for Low Income Groups	Ministry of Housing and Reconstruction staff, architects, planners and engineers actively involved in the design and implementation of these projects, and experts from Cairo University and MIT participated. The workshop was conducted to fill a need for dialog between specialists on these issues, and to encourage exchange of information. The major issues covered were private ownership, development in new, isolated areas, developments adjacent to existing cities, role of local governorates, subsidies, standards and regulations, utilities, and experimental nature of projects. Bilingual proceedings have been published.

Table 6 (continued)

Seminars, Workshops, and Short Courses

Date	Title	Scope and Participation
January 1980	Management of the Construction Industry in Egypt	60 top construction industry managers, ministry officials, and university faculty and students attended to review, discuss and debate important industry issues. The workshop was designed to provide an understanding of constraints limiting company growth and entrance of new firms into the construction sector with a fuller appreciation of the applicability or non-applicability of modern project management techniques.
January 1981	Management of the Nile Delta Groundwater Aquifer	Over 80 participants from government agencies, three Egyptian universities and two U.S. universities. Workshop focused on the management alternatives for the Nile Delta aquifer. Newly recognized upward leakage of groundwater in the Delta area has caused concern within the Ministry and research findings were used to discuss the impact and alternatives.
January 1982	Analysis of Water Resources Systems	This workshop incorporated research results and techniques developed since the first workshop was held in 1978.
January 1982	Communication for Rural Development in Egypt	This seminar presented results of research by the Communications Project, and included sessions on communication structure and policy in rural Egypt, appropriate technology for rural development, technological alternatives and telecommunication policy in Egypt, and development communication and national development.
May 1982	Plastic Piping for Potable Water Supply and Drainage Systems	Attended by 90 people. Approximately 40% were representatives from the private construction industry.
November 1982	Energy in the Egyptian Economy	The research activities of the project teams were reviewed.

Table 6 (continued)

Seminars, Workshops, and Short Courses

Date	Title	Scope and Participation
November-December 1982	Design of Irrigation Structures	This short course was conducted at the request of the Minister of Irrigation. 25 engineers from the Ministry attended.
January 1983	Opportunities for Solar Ponds as a Source of Electrical Generation in Egypt	The results of a solar pond feasibility study were presented and discussed.
January 1983	Energetics in the Egyptian Metal Industries	Areas for conserving energy in the metal industries were presented to members from these industries.
February 1983	Urban Planning Workshop	Results of research activities and future plans were discussed.
May 1983	Progress and Processing Technology in Plastics	Twenty engineers from the leading Egyptian plastics processing firms attended.

B. VISITS TO MIT

To date over 190 visits have been made to MIT by Egyptian counterpart personnel from Cairo University and various government agencies. In addition to working directly with their counterparts on project research, some have received specific training in relevant planning methodologies and analytic techniques through the Visiting Fellows Program or as MIT students. For these longer term visits, three different categories have been established:

1. Visiting Fellows Program

A study program of short duration is individually designed which applies to a specific aspect of an approved project. Approval of the participant's status is granted by the principal investigators of the project and funds are provided by that project.

2. MIT Students

- a. Regular Graduate Students are admitted to MIT in degree-granting programs. Following admission by MIT, the TAP Policy Committee reviews the student's background and may offer the student a research assistantship applied to a specific project. The student receives the regular MIT research assistant stipend amount.
- b. Special Graduate Students are admitted to a specific MIT department to enroll in courses to broaden their educational backgrounds. Special students do not pursue degree-granting programs. At MIT, the TAP Policy Committee approves all special graduate student requests and funding is provided by the Program.

Students attending MIT have studied in the areas of highway transportation, economics, electrical power, water resources planning, rural communications, urban transportation, housing and construction, plastics, migration, and geology. To date, twelve advanced degrees have been received at MIT by Egyptian students sponsored under the CU/MIT Program. Their names and thesis topics are listed in Table 7.

Table 7

GRADUATE DEGREES RECEIVED AT MIT BY CU/MIT VISITING FELLOWS

M.S. Degrees

Selim, Tarek Mohamed, "Issues facing the Development of Contractors in Egypt", M.S. Thesis, Department of Civil Engineering, 1979.

Allam, Mohamed Nasr, "A Planning Model for Irrigated Agricultural Expansion: A Methodology and Case Study of the Nile Delta", M.S. Thesis, Department of Civil Engineering, 1980.

Darwish, Ahmed El Sayed Younis, "Application of Fracture Mechanics to PVC Pipe Materials", M.S. Thesis, Department of Materials Science and Engineering, 1980.

El Henry, Ismail Ibrahim, "Water Balance Estimates of the Machar Marshes", M.S. Thesis, Department of Civil Engineering, 1980.

Al Sayyad, Nezar Mahmoud, "Streets of Islamic Cairo: A Configuration of Urban Themes and Patterns", M.S. Thesis, Department of Architecture, 1981.

Bakr, Sawsan El Sayed, "Form and Territory: A Comparison Between Four Areas in Cairo", M.S. Thesis, Department of Architecture, 1981.

Engineer Degree

Selim, Tarek Mohamed, "Development of the Construction Industry in Egypt", Engineer Thesis, Department of Civil Engineering, 1983.

Ph.D./Sc.D. Degrees

Boutros-Ghali, Youssef, "Essays on Structuralism and Development", Ph.D. Thesis, Department of Economics, 1981.

Darwish, Ahmed El Sayed Younis, "Fracture Analysis of PVC Pipe Materials", Sc.D. Thesis, Department of Materials Science and Engineering, 1981.

Allam, Mohamed Nasr, "Methodological Issues in Irrigated Agricultural Expansion Planning: Scheduling, Income, Redistribution, and Resilient Design", Sc.D. Thesis, Department of Civil Engineering, 1981.

Safwat, Kamal Nabil Ali, "The Simultaneous Prediction of Equilibrium on Large Scale Networks: A Unified Consistent Methodology for Transportation Planning", Ph.D. Thesis, Department of Civil Engineering, 1982.

El Sherif, Mohamed Hisham, "An Accelerated Development Strategy for Developing Countries: An Informatics Decision Support Systems Approach", Ph.D. Thesis, Department of Civil Engineering, 1983.

C. NEW INITIATIVES: FELLOWSHIPS AND INTERNSHIPS

As one of its efforts to increase the base of Egyptian involvement, the Program has instituted doctoral and postdoctoral research fellowships and internships for qualified Egyptian students and young faculty members at Cairo University. These fellowships are designed to provide research and study opportunities in those areas of science, technology and development which will contribute to the achievement of the development goals of Egypt. The primary effort within this program is spent at Cairo University, although MIT resources can be made available to support the fellow's activities. The fellowship/internship opportunities are defined as follows:

Postdoctoral Fellowships: To encourage Cairo University junior faculty to participate in development related projects in Egypt. Individually structured educational programs at MIT can be made available for up to six months. Counseling services from MIT faculty can be available. Provision can be made for graduate student support.

Doctoral Fellowships: To provide incentive for doctoral candidates at Cairo University to write theses in areas of relevance to the development goals of Egypt. Course work may be undertaken at MIT not to exceed six months. Counseling services from MIT faculty members will be available, in addition to laboratory and computer facilities.

Internships for Cairo University Faculty: To provide opportunities for Cairo University Faculty to become familiar with operations of ministries and industry, and to increase the interaction between CU and these organizations.

Cairo University assumed primary responsibility for designing and implementing the selection process, as well as establishing mechanisms for monitoring the progress of the participants. The Center has appointed Professor Hamed El Sinbawy as the Fellowship Officer to provide guidance and assistance to the fellows. The quality of the research and methodology are periodically evaluated by the DRTPC's Board of Directors and other academic officials at Cairo University. For 1982, 14 doctoral fellowships, 14 postdoctoral fellowships, and five ministry internships were awarded.

Twelve fellowships in the various categories were completed. These awards are listed in Table 8.

On April 23-24, 1983 fifteen fellowship recipients presented the results of their research at a seminar held at the DRTPC. The proceedings have been published, with all of the production work accomplished by DRTPC facilities.

Table 8
FELLOWSHIP AWARDS
1982/83

Internships (current)

<u>Name</u>	<u>Project</u>	<u>Faculty</u>	<u>Cooperating Organization</u>
Dr. Kamal Gohar	The Economical Aspects of Recycling the Drainage Water in the New Valley	Faculty of Engineering Electrical Dept.	New Valley Governorate
Dr. M.A. El Shahawy	Studies of Air Quality at the National Cement Co. Helwan	Faculty of Science Astronomy Dept.	National Cement Co. (N.C.C.)
Dr. D.A. El Gillani	Concentration of Baharia Barites	Faculty of Engineering Mining Dept.	Egyptian Iron & Steel Co.
Dr. Mohammed Abdel Aziz	Effect of Soil Type on Cables Loading of Cairo	Faculty of Engineering Electrical Dept.	Electricity Distributing Co. for Cairo
Dr. F.O. El Kashif	New Aluminum Cables Joining Method	Faculty of Engineering Metallurgy Dept.	Egyptian Iron & Steel Co.

Internships (completed)

Dr. Mohammed Fikry Mekkawi	Improvement on Thomas Converter Practice at Egyptian Iron & Steel Co.	Faculty of Engineering Mining Dept.	Egyptian Iron & Steel Co.
Dr. M. Abou El Hussein	Utilization of some Fermentation Byproducts (Stillage)	Faculty of Engineering Chemical Engineering Dept.	El Nasr Organic Chemical Co.
Dr. Abdel Zaher Abouzeid	Steel Wear Problems in Cement Grinding in Egypt	Faculty of Engineering Mining Dept.	Egyptian Portland Cement Co. Torrah
Dr. Mohamed Mahmoud Khalifa	Pollution Flashover of High Voltage Insulators	Faculty of Engineering Electronics Dept.	Ministry of Electricity
Dr. Mohamed Raafat El Koussy	Improvement of the Quality of Steel Used for Building & Machine Parts with the Purpose of Replacing Imported Steels	Faculty of Engineering Metallurgy Dept.	Delta Steel Co.
Dr. Farouk Ismail Ahmed	Adaptation of Modern Power Electronics to Egyptian Iron & Steel Industry in Egypt	Faculty of Engineering Electronics/Power & Machines Dept.	Egyptian Iron & Steel Co.

Table 8 (continued)

Postdoctoral Fellowships (current)

<u>Name</u>	<u>Project</u>	<u>Faculty</u>
Dr. Ibrahim Shabaka	A Study of Plume Dispersion & Its Implications to Public Health & Plants' Insecticidation in Egypt	Faculty of Engineering Engineering Aeronautics Dept.
Dr. Amir Khalil	Minimum Cost Design of Reinforced Concrete Buildings	Faculty of Engineering Structural Engineering Dept.
Dr. Saad Ghoneim	Improving Recovery from Egyptian Oil Fields which Contain Highly Viscous Crudes	Faculty of Engineering Engineering Petroleum Dept.
Dr. Yehia Z. Bahnas	Applications of Solar Cells in teh Protection of Pipe Lines & Steel Structures	Faculty of Engineering Electronics Dept.
Dr. Mikail Naguib Mikhail	Parallel Use of Solar & Wind Energy in Food Security Projects: Feasibility & System Design	Faculty of Engineering Mechanical Engineering Dept.
Dr. Fawzi Arafa	Coastal Protection Structures Effect on the Northern Coast of Egypt	Faculty of Engineering Hydraulics & Irrigation Dept.
Dr. Abdel Moneim Awadallah	A Discriminant Analysis Model for Rationalizing Governmental Decisions with Regard to Private Investments in Egypt	Faculty of Commerce

Postdoctoral Fellowships (new awards)

Dr. Samir Shaheen	Evaluation & Comparative Study of the Information Management System in Egypt	Faculty of Engineering Electronics Dept.
Dr. Mohamed Helmy Hadad	Prediction of Crack Initiation and Propagation in Steel Structures Subject to Cyclic Loading	Faculty of Engineering Mechanical Engineering Dept.
Dr. Abdel Moneim Ahmed Seif	Development of Iron & Steel Industry Using Computer Control	Faculty of Engineering Electrical Engineering Dept.
Dr. G.B. Salim	An Assesment of Energy Storage Systems Suitable for Wide Solar Energy Applications in Egypt	Faculty of Engineering Aeronautical Engineering Dept.
Dr. Hassan Farid A. El Hamid	Desulphurisation of Maghara Coal	Faculty of Engineering Mining Dept.
Dr. Mohammed Shalaby	Effect of Variability in Performance Time of Maintenance Shop at the Public Transport Authority	Faculty of Engineering Mechanical Engineering Dept.
Dr. Fawzi El Refai	Development of Sodium Probe for Aluminium Making Process	Faculty of Engineering Metallurgy Dept.

Table 8 (continued)

Postdoctoral Fellowships (completed)

Dr. Hisham Samah	Investigation of Possible Technical Improvements & Design Strategy Implementation for Mud-Brick Architecture	Faculty of Engineering Architecture Dept.
Dr. Mohammed Kamal Bedeway	The Use of Small Scale Wear & Friction Testing in the Development of Composition Friction Materials for Railway Braking	Faculty of Engineering Mechanical Engineering Dept.
Dr. Abdel Moneim Gabr	Production of Accelerated Ion Beams and its Implementation	Faculty of Science Physics Dept.
Dr. El-Sayad A. Mottaleb Ghaneim	Reform of Local Government in Egypt: Citizen Orientation	Faculty of Economics & Political Science

Table 8 (continued)

Doctoral Fellowships (current awards)

<u>Name</u>	<u>Project</u>	<u>Faculty</u>
Magda Fayek	Pattern Recognition Techniques & Applications	Faculty of Engineering Civil Engineering Dept.
Osamah El Nabawy	Geophysical Exploration of Oil & Gas Accumulation in Some Areas in A.R.E.	Faculty of Engineering Civil Engineering Dept.
Michel Albert Nashed	Analysis of Cellular Structural Quays Under the Influence of Static & Dynamic Loading	Faculty of Engineering Hydraulics & Irrigation Dept.
Mohammed Abdel Wahed	Structural & Petrological Studies on the Migif-Hafafit Geneisses, Eastern Desert, Egypt	Faculty of Engineering Geology Dept.
Laila Lotfy Iskandar	Inflation in the Egyptian Economy in the Seventies & Its Effect on Egypt's Economic Development Plans	Faculty of Economics & Political Science Economics Dept.
Hala A. El Kholi	Accounting Valuation of Technology Transfer & Adaptation in Developing Countries -- An Analytical Study of Empirical Survey with Special Reference to the Egyptian Experience	Faculty of Commerce Accounting Dept.

Doctoral Fellowships (new awards)

Nevine Mahmoud	Analysis of the Alpha-Beta Pruning Algorithm	Faculty of Engineering Mathematics Dept.
Mohammed M.R. El Ghoneimy	Automatic Arabic Speech Recognition	Faculty of Engineering Electronics Dept.
Ahmed Abdel Aziz Ahmed	Studies of Some Egyptian Coals	Faculty of Engineering Geology Dept.
Naim Ahmed Abdel Halim	Studies of Effects of Upper Nile Projects on Egyptian Water Resources	Faculty of Engineering Civil Engineering Dept.
Hani El Bayadi Michel	Spectral Response of Piles Structures Under the Effect of Dynamic Loads and Impacts	Faculty of Engineering Civil Engineering Dept.
Shawki Mostafa Mohamed	Geology of the Area Around Wadi Mubarek	Faculty of Science Geology Dept.
Fawzy Abdel Aziz Maria	Geological Studies in Atud Area	Faculty of Science Geology Dept.
Awatef Amin Abou Seda	Geological Studies on the Mineralization Associated with Granitoid Pluto in the Central Eastern Desert	Faculty of Science Geology Dept.

Table 8 (continued)

Doctoral Fellowships (completed)

Abou Bakr Youssef

Ultrasonic Bilharzial Tissue Characterization --
A Means for Treatment & Modeling of Portal
Circulation

Faculty of Engineering
Biomedical Engineering Dept.

M. Ismail Sadawy

Comparative Study of the Efficiency of the
Activated Sludge Process for the Treatment of
Different Types of Wastes

Faculty of Engineering
Civil Engineering Dept.

PART TWO

EXECUTIVE SUMMARIES OF CURRENT CU/MIT RESEARCH PROJECTS

ELECTRIC POWER SYSTEM: PLANNING AND ECONOMICS

A. PROJECT OBJECTIVES

With the vastly growing demand for electricity in Egypt, the electric power system is being expanded at a marked pace. Power system planners are faced with a wide variety of options including a diversity of power generation plants and a multitude of configurations of power transmission grids. The studies included in this project are intended to aid electric power planners in making decisions that are crucial to the national economy. In so doing, modern power system analytical and computational techniques are invoked.

Since July 1977 this project has dealt with a number of power system problems including: transmission network planning, generation capacity expansion, planning of rural and urban distribution systems, power system reliability assessment, optimal hydro-electric power generation, residential load forecast, evaluation of power system dynamics, and electricity tariffs.

B. ACCOMPLISHMENTS

1. Subgroup on Electricity Tariff Studies

- * Quantification of damage done to the economy by misallocation due to improper electricity prices.
- * Assistance to the Ministry of Electricity in developing a rational electricity tariff.
- * Conducted workshop on energy tariff in January 1983.

2. Subgroup on Transmission Network Planning

- * Successfully developed a new reliability algorithm which tests a

configuration for durability under single or multiple contingencies.

- * Successfully tested this system and applied it to the expansion planning of the 200 KV transmission network of lower Egypt.

3. Subgroup on Optimal Hydro-Scheduling of the Egyptian Water Resources

- * Developed a computer program to determine the level of hydro-generation that must be used for minimization of electric power demand that is met by thermal generation.
- * Program is straightforward and requires only ten minutes of computing time for determining the hourly optimal schedule for a seven day period.

4. Subgroup on Forecasting Power Consumption and Distribution Parameters

- * Two statistical models have been developed and applied to the available estimates of the rates of increase in population and consumption by subscribers.
- * A statistical analysis of data has been performed on the nature of demand distribution among the population.

5. Subgroup on Long-Term Power System Dynamics

- * A prototype long-term system dynamics program developed in the U.S. has been modified to apply to the Unified Electric Power System of Egypt.
- * The dynamic behavior of the Unified Power System of Egypt following various major disturbances has been studied using this program.

6. Subgroup on Applications of Renewable Energy Resources in Egypt

- * Examination of the role of solar energy for water pumping and power requirements.
- * Determination of solar energy variation in Egypt and its effect on the energy output of solar cells for various collection configurations.
- * Comparisons of various pump types to match photovoltaic system motors to meet irrigation requirements.
- * Design of control systems for optimizing system operation.
- * Economic and technical comparisons of photovoltaic systems with thermal pumping systems.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The interest and involvement of the Government can best be summarized by quoting the Minister of Electricity and Energy, Eng. Maher Abaza:

"Project work has kept in tune with Ministry needs. Since the inception of the project, members of MIT and Cairo University have had a close working relationship with members of the Ministry of Electricity and many of the subprojects have been initiated following the suggestion of members of the Ministry."

Minister Abaza has recently expanded on his evaluation of the work of the project by stating:

"I would like to emphasize the impact of the project on both Cairo University and the Ministry. The project has clearly demonstrated the importance of the economical approach toward engineering problems. This involves economical analysis, planning and optimization techniques as well as statistical handling of engineering data. Some of these areas are new to many project participants who are more deeply rooted in classical engineering analysis. The project has resulted in close cooperation between the University and the Ministry of Electricity. Staff members at Cairo University have become thoroughly familiar with the power system of Egypt."

The Ministry has taken the following actions to implement the research results achieved by the CU/MIT project team:

- * Preinvestment survey study is being utilized in generation expansion program by the Ministry.
- * Computer program for network planning is being applied by the Ministry to the 200 KV transmission network of Lower Egypt.
- * Ministry of Electricity has decided to use a single phase design in the electrification of remote areas based on project studies and recommendations. These studies estimated a savings of between 11 and 22 percent in total costs and actual savings have been realized.
- * The network planning method is being used in the planning of the 50 KV grid which will be constructed to support the installation of the nuclear power plant in 1990.
- * The computer program for optimal hydro-scheduling is being used by the Ministry.
- * The Ministry has analyzed the dynamic behavior of the Unified Power System under conditions of four major disturbances, i.e., outage of the largest thermal power station, outage of the largest load, outage of the High Dam power station, and High Dam outage followed by load shedding.

E. EDUCATIONAL ACTIVITIES

In addition to the project's participation in the annual technical conferences, the members of the team have organized and conducted two significant workshops:

1. Reliability of Power Systems: This workshop was conducted in January 1979 to familiarize personnel at Cairo University and the Ministry with the principles of reliability evaluation and the methods commonly used to analyze those particular problems presented by the Egyptian National

Electrical System. The notes from this workshop have been published and have been used for the past three years in a course given at Cairo University. The workshop was attended by 50 people from Cairo University and the Ministry of Electricity.

2. Energy Tariff: This workshop was sponsored by the team and conducted in January 1983 to discuss energy tariffs and the problems of subsidies. In attendance were members of the Electrical Engineering and Economics Departments from Cairo University and MIT, the Ministry of Electricity, the Ministry of Petroleum and the Ministry of Industry. Reports were presented by the attendees concerning energy costs and prices in various sectors, the extent of subsidization and the effects of the subsidies. The method of average costing for tariffs was compared with the methods of marginal costing. There was general agreement that subsidization might be necessary as a social policy in Egypt, but that as it is now applied, energy subsidies do not necessarily contribute to the welfare of the groups that need support. It was concluded during the workshop that a feasible first step in the improvement of the use of subsidies in Egypt would be to eliminate the hidden nature of many of the present subsidies. This could be accomplished by a change in industrial and commercial accounting, whereby energy factor costs would be reported at world market values and the resulting imbalance would then be labeled as a subsidy. It was suggested that this would motivate discussions in the various concerned ministries about more rational energy pricing policies.

INTERCITY MULTIMODAL TRANSPORTATION

A. PROJECT OBJECTIVES

The Government of Egypt, through its Ministry of Transport and the Transportation Planning Authority, has been engaged in a comprehensive effort to overhaul its transportation infrastructure and to strengthen Egyptian institutional capabilities in investment planning and evaluation, and in formulation of effective maintenance, operating and pricing policies. In parallel with this thrust, this project has been conducted.

The objective of the research is to review Egyptian transportation policy and to develop analytical methods to assess alternative transport investment, maintenance, operating and pricing policies within Egypt. The scope of the project has encompassed both passenger and freight movements on the highway, railway and inland waterway modes.

B. ACCOMPLISHMENTS

The work in this project has required completion of several inter-related areas of investigation in engineering, economics, and operations research including:

- * A review of policies affecting intercity transportation and identification of those that could be feasibly represented within a transportation model.
- * Specification of exactly in what ways those policies affect transportation performance and costs through cause-and-effect relationships; for example, improvements in system reliability through investment in new construction, new technology, or maintenance, changes in user-perceived costs due to tariff revisions or improvements in system reliability.

- * Design and development of analytical models to capture policy-sensitive shifts in intercity travel demand, modal choice, system performance, and costs on the highway, rail and waterways networks.
- * A review of the Egyptian planning process to identify criteria by which transport policies may be judged to meet Egypt's development objectives; and to evaluate the impacts of different policies on owners, operators, and users of the system within each mode.
- * An assessment of data requirements, collection of data, and calibration of models to the current Egyptian situation.

Upon completion of the above, the Egypt Intercity Transportation Model has been developed, and an extensive series of runs was conducted to test its computational and logical operation. This model is a very large simulation of a national transport system, and employs a comprehensive data base. A procedure for transferring it to the DRTPC computer facility has been discussed and it is expected to be installed there in July 1983. This model has been designed to assess alternative transportation investment, maintenance, operating and pricing policies within Egypt. It encompasses movements of both intercity freight and intercity passengers on highway, railway, and waterway modes, and predicts transportation system performance, costs, and those impacts resulting from different policies that may be specified. The model incorporates a number of state-of-the-art analytical procedures and features particularly suited to analyzing transportation problems in developing countries. Its features include:

- * An equilibration procedure which provides a simultaneous solution of the generation, distribution, modal split and assignment problems.

- * Interactions among investment, maintenance and operating policies through the use of simulation models to estimate link costs.
- * Explicit treatment of constraints on availability of transportation services - not only link capacity, i.e., congestion, but also fleet capacity and the inability of modes to satisfy all of the latent demand.

The results of this work are being documented within a set of five technical reports which focus on the following areas:

- * A summary technical report encompassing the many aspects of the project.
- * A review of Egyptian transport policies over the past 30 years and their relationships to broad development goals.
- * A detailed technical report describing the intercity transport performance and costs within the Intercity Model.
- * A detailed technical report describing the simultaneous equilibration procedure used within the Intercity Model.
- * A description of the cost studies performed this past year with analysis and implications for Egyptian transport planning

C. GOVERNMENT OF EGYPT INVOLVEMENT

The intercity team has had a long and productive involvement with the Ministry of Transport. Through the team effort a close bond has developed, and the value of the resources at Cairo University has been both recognized and utilized by the Ministry. The Minister has spoken publicly about this relationship as follows:

"The effort spent in this project is very much appreciated by me personally and by the officials responsible for different sectors within the Ministry. The project and its people have raised and will continue to raise the efficiency level of the Ministry I have been a member of for more than 30 years and now have the privilege of heading."

The Minister has further pointed out previous accomplishments of the project and their value to him; for example, the Road Investment Analysis Model and his request that the initial study be applied to the whole Delta paved-road network. Most recently the Ministry of Transport and the Roads and Bridges Authority have requested the DRTPC to undertake a three year study program of traffic surveys to be financed by a loan from the World Bank. Several other initiatives have been taken by other ministries including the Ministry of Housing and Reconstruction.

D. EDUCATIONAL ACTIVITIES

In addition to the project's contribution to and participation in the annual technical conference, they have utilized a number of other educational mechanisms, which began with a major Transportation Policy Planning Conference in June of 1978. The most recent activity was a workshop in June 1983, where the team presented the results of the Intercity Model studies and described the types of analyses of planning issues that had been accomplished. Members of the Cairo team both from the Ministry and Cairo University have had the opportunity to visit MIT to participate in seminars on transportation-related issues and to take courses at the Institute in areas pertinent to the technical contributions to the research efforts.

Dr. K.N.A. Safwat received his Ph.D. from MIT. The research for his dissertation was a major contribution to this project.

ENGINEERING APPLICATIONS FOR THE EGYPTIAN PLASTICS INDUSTRY

A. PROJECT OBJECTIVES

The objective of this project is to strengthen the area of engineering plastics technology in Egypt which in turn will have a relevance to economic development in Egypt.

B. ACCOMPLISHMENTS

The Plastics Research Group at Cairo University, composed of faculty and students from two departments, Mechanical Engineering and Chemical Engineering, has been created and are working together on problems and opportunities in Egypt.

MIT and Cairo University participants have been continually in collaboration with a number of public sector and government establishments in the solution of a variety of problems, including:

- * Design, production and testing of corrugated, perforated PVC drainage pipe for agricultural applications.
- * Improved production and testing of polyethylene bags for fertilizer and agricultural chemicals.
- * Codification of plastics materials and products into a set of Egyptian standards and specifications for use by government and industry.
- * Development of flexible film bags and pouches for medical applications.
- * Design and development of a plastics module for rural use as a supply for potable water and as a sanitary drainage system.
- * Studies of stabilization of PVC against ultra-violet degradation in outdoor exposure.

- * Construction of testing apparatus to evaluate the quality of plastic pipes produced in Egypt and the use of the apparatus on products from various domestic manufacturers.

C. GOVERNMENT OF EGYPT INVOLVEMENT

Unlike many of the other CU/MIT research projects this one does not have the opportunity to relate to a specific government ministry or program within the government. However, the team has demonstrated the importance of a sound scientific infrastructure, and several governmental authorities as well as private organizations are starting to depend upon the group for consultation. Examples include the Egyptian Public Authority for Drainage projects, the Petrochemicals Project, El-Nasr Pharmaceutical Chemicals Company and the Pharmaceutical Packaging Company.

D. EDUCATIONAL ACTIVITIES

Participants in the project have developed competence in the field of engineering plastics through involvement in industrial research and development, the development of laboratory facilities, the acquisition of a plastics library and through visits to MIT and industrial units in the United States.

The project has also conducted a series of important and informative workshops in Cairo. In each case the subject was specific and its purpose was to update the participants on the state-of-the-art in research. The workshops conducted were:

- January 1978 - Polymer Science and Technology
- May 1982 - Plastic Piping for Potable Water Supply and Drainage Systems
- May 1983 - Properties and Processing Technology

Dr. Ahmed Darwish received his Ph.D. from MIT in 1981. His dissertation, "Fracture Analysis of PVC Pipe Materials", was based on the research effort conducted in this project.

STOCHASTIC MODELS OF NILE RIVER HYDROLOGY

A. PROJECT OBJECTIVES

Water is becoming a limited resource in Egypt. This project has investigated two ways to alleviate this problem:

- * Improvement of water use efficiency.
- * Augmentation of existing water resources.

An additional task studied in this research has been the pressing problem of flood risk estimation in desert valleys, i.e. "wadis".

The research on water use efficiency focused on understanding and improving the operation of the High Aswan Dam, the dominant water control facility in Egypt. In the area of augmentation of Egypt's water resources, the research investigated means to increase Nile inflows to Lake Nasser and/or exploitation of groundwater.

B. ACCOMPLISHMENTS

1. Forecasting and Control of Nile River Discharges

- * A general purpose computer program for a forecasting model was developed and implemented at MIT. This program is both on tape and on card, and a user's manual was turned over to the Cairo University collaborators. A technical TAP Report has been issued.
- * A real-time adaptive algorithm for control of reservoirs was implemented in Cairo on the Hewlett Packard computer of the Ministry of Irrigation, and is being utilized there by Ministry personnel trained by the CU/MIT team. A complete user's manual has been provided to the Ministry team.

- * The simulation model of Nile River inflows to Lake Nasser was used to study operation of the High Dam and the proposed Toshka diversion.
- * The program led to the development of adaptive reservoir operating rules for the High Aswan Dam. This method has the potential for significant improvement in water use efficiency through minimizing the excess releases. Under the sponsorship of the Ministry of Irrigation and the Water Master Plan, a comparative test of this procedure against the old one is currently underway at Aswan.

2. Augmentation of Water Resources

- * The most promising area for augmentation is by increasing Nile inflows to Lake Nasser. Using new estimation techniques the potential water yield to be achieved through drainage of the Bahr El Ghazal and Machar Swamps in the Sudan were determined. This extensive study revealed a potential yield approximately twice that obtained by conventional means.
- * Subsequent work has examined the dynamics of change in the Bahr El Ghazal Swamp during drainage. Associated with this research have been studies of spilling from the Blue Nile and its tributaries during flood periods as well as the carrying capacity of the White Nile downstream of the swamps. This work was critical for insuring that the drained water can be conveyed to Aswan.
- * Studies have indicated that in this region there is a significant leakage of Nile waters into a deep underlying aquifer.

This may possibly be important for groundwater resources in Egypt's Western Desert.

- * At the expressed need of the Minister of Planning the research team undertook the task of the modelling of flood risk in desert wadis. This model provides flood estimations from a given rainfall using only the observable geomorphology of the wadi. A simple version of this model is being used by the Ministry of Planning for preparing risk-zone maps at the sites of new and existing towns.

C. GOVERNMENT OF EGYPT INVOLVEMENT

This project, as well as the companion project in Water Resources Planning, has had a high level of interest, participation and support from the Ministry of Irrigation over the life of the project. In January 1982, Minister Mohamed Abdel Hadi Samaha participated in a symposium at the DRTPC and expressed his views regarding the notable achievements that were made under the project in water resource planning and management. Minister Samaha stated:

"The Cairo University-Massachusetts Institute of Technology water resources group has worked closely with the Ministry of Irrigation and its major research and planning centers. A variety of activities in new technique development, short courses, technology transfer and on-site training has taken place. The work has focused on the operation of the High Aswan Dam to meet multiple purposes and multiple objectives in a stochastic environment, planning for the development of an infrastructure, and the provision of drainage in the Nile Delta.

The most important achievement of these projects is the application of systems analysis and mathematical modelling as effective tools for the study of water management in Egypt.

Two extremely successful conferences co-sponsored by the Ministry of Irrigation and the CU/MIT program were held in Egypt and devoted solely to Egyptian water resource programs, with principal presenters being for the most part members of the professional Egyptian water resources community."

The effectiveness and productivity of the CU/MIT team has also attracted the interest of other ministries within Egypt. The Minister of Transportation through the Egyptian Authority of Railways has contracted the DRTPC to have the group study flash flood hazards at twenty wadi crossings of the Abou Tartour to Qena railway. The Minister of Housing and Reconstruction has requested a flash flood study for the area of the new City of 15th of May near Helwan; and the Minister of Planning has requested a water resource assessment in Northern Sinai especially along the Mediterranean coast and through the main valley.

D. EDUCATIONAL ACTIVITIES

In addition to the project's participation in the annual technical conferences at the DRTPC they have been deeply involved in the planning and conduct of the international water resources planning conferences in Cairo. These conferences have established a mechanism for timely communication of important research findings and policy directions. The conferences are held each year and have over 200 participants which include members of the Cairo University faculty, foreign universities, the United Nations and Ministry of Irrigation.

At the outset of the program, the group conducted a most important workshop in Cairo entitled "Elements of Water Resources Systems: Analysis and Planning". This workshop, with 75 participants from Cairo University, Ministry of Irrigation, and the Egyptian Water Master Plan provided lectures in fundamental areas to prepare the team members for application lectures on: physical modelling of surface and groundwater hydrology, the role of uncertainty in water resource planning, and new evaluation techniques to assist in the resolution of multi-objective, multi-interest group conflict problems concerning allocation of water resources.

WATER RESOURCE PLANNING

A. PROJECT OBJECTIVES

The broad objective of this project has been to develop state-of-the-art tools for aiding the planning process of Egypt's water resources. The areas of most critical need to the Egyptian economy were perceived to be the operation of the High Aswan Dam, expansion of agricultural lands, and the installation of agricultural drainage systems.

B. ACCOMPLISHMENTS

1. Nile Basin Management Studies

- * A large scale method of stochastic control of multi-reservoir systems capable of modelling the entire Nile Basin has been developed. This significant breakthrough in modelling capability will allow better real time operation of the system as well as investigation of the implication of long-term policy changes.
- * In January 1983 the principal investigators went to Sudan and met with officials of the Sudanese government to make arrangements for collecting basin wide data in anticipation of further studies for the entire basin.

2. Water and Energy Benefits from High Aswan Dam Downstream Storage

- * The problem of downstream storage was investigated. The present system possesses a low complementarity and inefficiency in hydro-power production. The problem is serious in winter, as water is over-released from the dam and dumped into the seas. The results of the study revealed that the use of the Wadi El-Natrun Depression will be more beneficial to downstream storage compared to the Upper Egypt groundwater reservoir.

- * The study indicated that such use would increase the total expected hydro-energy of the whole system while minimizing the risk of excessive channel degradation.
3. Operational Model for the Irrigation Network in Egypt
- * A linear programming approach to optimally allocate resources has been applied to the Sharkia Governorate area.
 - * The model was developed for proper allocation of water in the first order canals in Upper Egypt and the Delta.
 - * The model, intended to be an operational one to simulate existing conditions and allocation, is made using all available water resources (surface, ground, drainage) and is based on minimum cost criteria.
 - * Water saved for new lands and its availability at the proper location at the proper time are the major results of this research.
4. A Planning Model for the Development of Old and New Agricultural Lands
- * A model has been developed to investigate the problem of water resources reallocation for land cultivation (new land) and agricultural development (old land) in Egypt.
 - * The model includes a risk term which takes account of the stochastic nature of agricultural net revenues, thus reflecting the farmer's response in accepting a proposed agricultural planning policy.
 - * The model can be used to evaluate alternative water allocation schedules in terms of their impact on cropping patterns, domestic consumption, foreign trade, and employment.

- * Alternative direct public investments in new land expansion projects with respect to their social profitability can be ranked using the model.
5. The effect of On-Farm Water Management Practices on Quantity and Quality of Drainage Water
- * A simulation model to assess the impact of introducing water management practices on the drainage effluent has been developed.
 - * The model is capable of predicting, as a function of the irrigation water, the discharge rate and chemical composition of the drainage effluent and hence its potential for reuse in irrigation.
 - * The Ministry of Irrigation, through its Drainage Research Institute has agreed to allocate 100 feddans of drainage area for calibration and validation of the model.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The close working relationship with the Ministry of Irrigation has been detailed in the Stochastic Models of Nile River Hydrology project summary. In addition to those comments it is noteworthy to point out that the Water Research Centre of the Ministry of Irrigation has been collaborating with the research team of this project. The Centre has allocated 100 feddans of drainage area in the Mashtul Pilot region, seven miles northeast of the city of Zagazig in the Eastern Delta for the calibration of the Drainage Model. These models are directed towards investigating the effect of on-farm water management practices on the quality and quantity of drainage water. The Ministry of Irrigation has also agreed to provide the necessary

technical personnel, measuring equipment, and computer facilities at an estimated cost of LE 25,000.

The research team has also been working with the Ministry of Transportation's River Transport Authority to study ways to improve inland navigation in the Noubaria Canal that connects the port of Alexandria with the Delta region.

The project team's involvement with government agencies has expanded to include collaboration with agencies in Sudan. The principal investigators visited Sudan to discuss the participation of water resources engineers in the Water Resources Development conference in June 1983. During that visit they met with the Sudanese Minister of Irrigation and introduced him to the research activities of the team. In addition, a meeting was held with the Joint Permanent Technical Committee of the River Nile to obtain data for water resources development both in Egypt and Sudan.

D. EDUCATIONAL ACTIVITIES

An important product of this research effort was the completion of a Ph.D. degree by Mohamed N. Allam, an Egyptian student at MIT sponsored by the project. Dr. Allam has returned to Cairo University where he is working with the project team on a variety of water resources projects.

Through the research team a number of short courses and workshops have been conducted at Cairo University. Included are:

- * A workshop on the Elements of Water Resources Systems Analysis and Planning was held in two parts. The first part covered the fundamentals and the second addressed the state-of-the-art. The workshop was held in May-June 1979.
- * Two short courses on Systems Analysis in Water Resources were given from July 5-27, 1980.

- * A workshop on Analysis of Water Resource Systems was conducted January 16-27, 1982.
- * A training course on Design of Irrigation Structures was given on November 20-December 9, 1982.
- * At the request of the Ministry of Irrigation three courses were offered to their engineers. These were offered over the time period December 1982/June 1983. The subjects were:
 - (1) Design of Hydraulic Structures
 - (2) System Analysis in Water Resources Planning
 - (3) Use of Pressurized Pipe Line Systems in Irrigation Water Distribution

Finally, the team has conducted three major conferences on Water Resources in Egypt.

PERFORMANCE OF PARAFFINIC ASPHALT-CEMENTS
IN EGYPTIAN ROAD CONSTRUCTION

A. PROJECT OBJECTIVES

Egyptian asphalt cements produced by distillation of crude oils from the Red Sea were successfully used in hot asphalt mixtures for more than half a century. However, in the early 1970's production from the Suez refinery was halted and asphalt cements began to be produced using crudes from the Western Desert. These new crudes have caused serious performance and construction problems. For example, at ordinary summer temperatures these asphalts separate from the pavement layer and migrate vertically towards the surface and horizontally towards the curbs. It is estimated that the service life of these pavements has been reduced from the normal life-expectancy of 15 years to about three years. Due to the economic consequences of this situation, this project was organized with the objective to investigate methods of improving the performance of pavements constructed with Egyptian paraffinic-waxy asphalts.

B. ACCOMPLISHMENTS

- * An extensive literature survey has been completed and the team has benefitted from the experiences of others who have studied similar problems.
- * Laboratory and sampling studies have been completed to determine the properties of Egyptian asphalts.
- * An evaluation of available Egyptian aggregates and filler materials has been completed.
- * Methods of improving the performance of pavements have been analyzed and evaluated using laboratory methods.

- * A large scale test track has been designed and constructed at the Road Research Laboratory at Nasr City.
- * Based on the results of the laboratory studies a series of eight improved asphalts are being evaluated on the large scale test track.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The uniqueness of this project is the fact that from its initiation it has been co-sponsored by the Egyptian General Authority of Roads and Bridges as well as a group of Egyptian road construction companies. These co-sponsors have provided matching funds at the level of LE30,000 per year. In addition, they have provided technical personnel, equipment, laboratory facilities and have constructed the large scale test track. The organizations which are collaborating are:

- * The Central Laboratory of the General Authority of Roads and Bridges, Ministry of Transportation
- * The Egyptian Petroleum Research Institute of the National Academy of Science
- * The Arab Contractors
- * The Nile Company for Roads and Bridges
- * El-Nasr Contracting Company
- * The Nile Company for Road Construction
- * The Nile Company for Desert Roads
- * The Nile Company for Construction and Paving

D. EDUCATIONAL ACTIVITIES

Because of the nature of the research no specific workshops or training courses have been carried out. The bulk of the training has been conducted

on site and in the laboratory environment. In this mode a greater understanding of laboratory techniques and methods has been imparted to the Egyptian engineers within the construction sector.

ENERGY-ECONOMY INTERACTIONS AND ENERGY POLICY

A. PROJECT OBJECTIVES

Energy issues in Egypt can be characterized into distinct issue-areas, each with its own policy priorities and prospects for the future:

- * Demand issues: domestic consumption of energy is increasing at a rapid rate, due in part to the subsidized prices for energy and in part to the increasing level of economic activity.
- * Supply issues: those related to the uncertainties pertaining to the production of oil and natural gas in the future.
- * Government management issues: among the critical policy issues are identifying appropriate domestic petroleum price strategies, managing the adverse macro-economic impact of a reduction in petroleum use, developing incentives for interfuel substitution, expanding export earnings as a vehicle for sustained growth, specifying the rate at which reserves need to be developed, planning and implementing downstream investment projects in the petrochemicals sector.

Because of the inter-relationship of these issues a comprehensive analysis of energy-economy interactions is required to develop viable energy policies. Such an overall approach is the objective of this project.

B. ACCOMPLISHMENTS

Seven specific studies have been completed which together provide a picture of policy issues and performance in the Egyptian energy sector.

1. Macro-Economic Effects of Domestic Oil Prices

- * A short run macro model of the Egyptian economy has been

developed which enables analysis of appropriate petroleum pricing strategy.

- * The energy sector of the social accounting matrix has been disaggregated into three sectors: oil extraction, oil refining, other energy.
- * The effects of changing domestic oil prices to align with international prices have been identified.
- * The effects of policy alternatives to investigate the negative short-term macro-economic adjustment problems have been identified.

2. Role of the Energy Sector

- * A report summarizing a study of the detailed uses of energy in the Egyptian economy was issued in January 1983.

3. Oil Production

- * The Egyptian Petroleum Model has been formulated and utilized. This model is used to simulate oil production for Egypt over the next twenty years.

4. Natural Gas Model

- * An initial study of the uses and pricing of natural gas has been completed. The study is based on a linear programming framework to determine the best uses of natural gas to improve Egypt's foreign exchange position and to identify the price that should be charged to users.

5. Geological Conditions

- * A nation-wide geological assessment of petroleum bearing potentials has been completed. Recent information released by

the Ministry of Petroleum regarding new reserves and new concessions have borne out the results of this study.

6. Demand Studies

- * The first study on overall demand projection for petroleum in Egypt was completed. The sectoral demand projections for future years are based on a series of scenarios relating the growth rate of GDP and the level of domestic prices for energy products.

7. Petroleum Sector Plans

- * A study which reviewed the main features of Egypt's petroleum sector plans has been completed and a report has been issued.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The participation and collaboration of a wide cross section of both public and private individuals is a necessary requirement for the successful accomplishment of the tasks associated with this project. The Egyptian General Petroleum Corporation collaborated in the formulation of the supply-related issues and the geological surveys. Representatives from the AGIBA Petroleum Company collaborated throughout the analysis of the natural gas studies. Members of the Ministry of Petroleum and the Ministry of Planning have remained in contact with the principal investigators throughout.

D. EDUCATIONAL ACTIVITIES

A seminar workshop on the Petroleum and Natural Gas Project was held at the DRTPC on November 1, 1982. Issues discussed included:

- * Petroleum supply
- * Geological issues

- * Natural gas issues and prospects
- * Demand side
- * Energy in the Egyptian economy
- * Prospects for natural gas and petroleum
- * Issues for the short and long term

INFRASTRUCTURE AND URBAN PLANNING GUIDELINES FOR SECONDARY CITIES

A. PROJECT OBJECTIVES

This project has two components - Urban Infrastructure and Urban Planning Guidelines - each having their own objectives.

The Urban Infrastructure component's objective is to determine the potential usefulness of infrastructure planning and provision in the optimization of the urban development process with special emphasis on secondary cities.

The Urban Planning Guidelines component's objective is to prepare a set of guidelines for urban area planning to determine upgrading needs and priorities, options, and implementation.

ACCOMPLISHMENTS

Urban Infrastructure Component: The final report entitled "Peripheral Village Study" has been completed. This report describes the technical, financial and social problems anticipated in the extension of services to peripheral villages. Case study areas for Dar El Ramad, Quhafa, Kafr Abdel Aziz and Kafr M. Hussein are described in the report. The results presented include the general features of incorporated peripheral villages, the reasons for the lack of urban infrastructure, implications in the areas of legislation, affordability and technical problems.

Guidelines for Urban Area Planning: A draft Procedures Manual and Implementation Handbook has been completed. Both the manual and the handbook indicate the sequence of steps in the upgrading program and give guidance as to how these steps are best taken. The manual deals with the process up to implementation and provides the relevant guidance forms and instructions for documenting conditions, making evaluations, establishing

priorities and developing upgrading options. The handbook deals with the implementation process itself, informing participants of available options for all of the components of implementation - institutional, organization, procedures, funding, project monitoring and training.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The General Organization for Physical Planning (GOPP) has shown great interest in the research activities of the project and has been involved through active participation in the team. The GOPP contributed matching funds which enabled the research to focus more comprehensively than would otherwise be possible.

D. EDUCATIONAL ACTIVITIES

In addition to their participation in the annual technical conferences, the project team held an extensive workshop in Cairo in February 1983 at which time the results of the data gathering and the methodology for analysis were presented. This workshop provided an opportunity to share ideas to be incorporated in the final reports.

ENERGY AND ENVIRONMENTAL IMPACT STUDIES FOR THE QATTARA DEPRESSION

A. PROJECT OBJECTIVES

The objective of this project at its initiation in September 1981 was prediction of the water and salinity levels in the future Qattara Lake, which would be formed as the result of the proposed Qattara Depression Hydroelectric Project. During 1983 an additional objective was introduced: investigation of the potential for electric power production from solar ponds.

B. ACCOMPLISHMENTS

A mathematical model has been developed which is capable of predicting the time history of lake filling and salinity changes for the future Qattara Lake. However, meteorological data, necessary for the accuracy of this model, are not available. This uncertainty in data availability in addition to the potential of creation of such an extensive water surface raises questions regarding:

- * Environmental and underground water impact.
- * Potential for other energy and resource developments in the area concerned.
- * The relatively high expense of the initial project.

For those reasons, preliminary studies to investigate the solar energy potential of the Qattara area were carried out.

A study entitled "Solar Pond Feasibility Study for Egypt--Preliminary Report" has been published. This study contains three parts:

- (1) A description of past and ongoing work at MIT on solar ponds.
- (2) A discussion of the potential for large scale solar pond development in Egypt.

- (3) An outline, with supporting calculations, for a demonstration pond to be built for generation of electricity.

A document entitled "Demonstration of Solar Pond Technology--Proposal for Phase I" has been prepared and has been submitted by the DRTPC to the Egyptian Ministry of Electricity and Energy for a one year study at the site of the evaporation lagoons belonging to the El Nasr Saline Co. at El Mex near Alexandria.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The project has had considerable involvement with the Ministry of Electricity and Energy. In his visit to MIT, Minister Abaza met with the MIT principal investigators to be personally briefed on the state-of-the-art of solar pond technology and its potential in Egypt. The team has also had valuable inputs from the Meteorological Authority within the Ministry of Aviation, members of the Qattara Depression project team and the Energy Advisor of the Minister of Petroleum.

D. EDUCATIONAL ACTIVITIES

In addition to the team's presentations and participation in the annual technical conferences, they have sponsored a workshop on the opportunities for solar ponds as a source of electrical generation in Egypt. This workshop was held in January 1983.

PRODUCTION PLANNING METHODOLOGY FOR THE AUTOMOTIVE INDUSTRY

A. PROJECT OBJECTIVES

The objective of this project is to design new systems to plan and control assembly, fabrication, and procurement in the Industrial Vehicle Division at El Nasr Automotive Company (NASCO).

B. ACCOMPLISHMENTS

The project has given initial concentration to two systems--production planning systems and spare parts management systems.

1. Production Planning

- * A model has been developed and tested for the job shop production system at NASCO.
- * A model has been proposed for determining the economic batch size of manufacturing parts.
- * A statistical analysis has been completed on material supply delay at NASCO and recommendations to improve the system have been made.
- * The material requirement system which had been developed at MIT has been simplified. Results of tests on real life data showed that computer capacity at NASCO was not sufficient. This has been corrected.

2. Spare Parts Management

- * A model for spare parts management has been developed. This model suits the NASCO environment.
- * The model has been tested based on hypothetical data for items with relatively short and long lifetimes.

C. GOVERNMENT OF EGYPT INVOLVEMENT

This project has only peripheral involvement within the Egyptian government. Members of the Ministry of Industry are interested in the approach being taken and have been represented at some of the team's working sessions. The major non-academic involvement has been within the industry where the participation and contribution is at a high level.

D. EDUCATIONAL ACTIVITIES

The project has concentrated its educational exchange opportunities on short working team sessions where the exchange of data, methodologies, and approaches to problem solving have taken place.

ENERGETICS IN THE EGYPTIAN METAL INDUSTRIES

A. PROJECT OBJECTIVES

Estimates of energy consumption in the two largest metal industries in Egypt--the integrated steel works in Helwan and the aluminum smelter in Nag-Hammady--indicate the consumption of energy per unit product is significantly higher than international norms.

This project investigates the energy consumption and makes recommendations to improve the efficiency of the two plants. The approach includes the technical and economical feasibility of recommended solutions, cost analysis, estimation of energy savings, and the impact on productivity and product quality.

B. ACCOMPLISHMENTS

- * The planned program of data collection and measurement of energy consumption in each production process has been completed. The results have been published.
- * The data has been analyzed and compared with that of similar industries in other countries.
- * Causes of increased consumption have been investigated.
- * A study of appropriate modern technology that should lead to energy conservation and increased productivity has been started.
- * A proposed study of future energy needs has not been taken to an advanced state. This study was deferred until more information has been collected and both government and industry plans reach maturity.
- * Eight specific areas in which productivity and energy consumption can be improved and enhanced have been identified. Research plans

have been prepared for these areas and the studies have commenced.

C. GOVERNMENT OF EGYPT INVOLVEMENT

The primary thrust of this project has been with the personnel from the two industries involved. Areas of study are broken down into working groups each of which includes representatives from the industries.

D. EDUCATIONAL ACTIVITIES

A seminar was held on January 17, 1983 at the DRTPC to present and discuss the progress and research findings of the project. The chairmen of both the Iron and Steel Company and the Aluminum Company, representatives of the Ministry of Industry, and staff members of various Egyptian research institutes attended.

PART THREE

PUBLICATIONS

The following reports have been published by the Technology Adaptation Program since the inception of the Cairo University/MIT Technological Planning Program. They may be obtained at cost from:

Technology Adaptation Program
Massachusetts Institute of Technology
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<u>Report Number</u>	<u>Title and Authors</u>
83-15	<u>Incorporation of Channel Losses in the Geomorphologic IUH, Mario A. Diaz-Granados, Juan B. Valdes, and Rafael L. Bras, July 1983.</u>
83-14	<u>A Derived Flood Frequency Distribution Based on the Density Function of Rainfall Excess, Mario A. Diaz-Granados, Juan B. Valdes, and Rafael L. Bras, July 1983.</u>
83-13	<u>Asians in the Arab World: Migration Processes and Policies, Nazli Choucri, September 1983.</u>
83-12	<u>Evaluation of Methods to Improve the Characteristics of Asphalt Cements and Concrete Mixtures, The Performance of Paraffinic-Waxy Asphalt Cements in Egyptian Road Construction Project, June 1983.</u>
83-11	<u>Energy Policy Project: Petroleum and Natural Gas in Egypt - Final Report, Nazli Choucri and M. Zaki Shafei, with the collaboration of the Egyptian General Petroleum Corporation, the Ministry of Planning and the Ministry of Petroleum, June 1983.</u>
83-10	<u>Macroeconomic Impacts of Remittances in Egypt: An Exploratory Analysis, Nazli Choucri and Supriya Lahiri, May 1983.</u>
83-9	<u>Migration in the Middle East: Transformations, Policies and Processes, Volume II, Nazli Choucri with the collaboration of Peter Brecke, July 1983.</u>
83-8	<u>Migration in the Middle East: Transformations, Policies, and Processes, Volume I, Nazli Choucri with the collaboration of Peter Brecke, July 1983.</u>

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- 83-6B Cairo Urban Transport Project: Transport Planning Aids and Methods, Final Report - Volume III, Part 2, M. El-Hawary, F. Abdel-Bari, M. Nouredin, T. El-Reedy, A.S. Huzayyin, K. Abd El-Nasser. Printed in Cairo, February 1983.
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- 83-3 Resource Development and Policy in Egypt: Petroleum and Natural Gas - Summary and Conclusions, Nazli Choucri and M. Zaki Shafei, January 1983.
- 83-2 Solar Pond Feasibility Study for Egypt - Preliminary Report, Atul Salhotra, E. Eric Adams, Donald R.F. Harleman, January 1983.
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- 82-6 Identification and Estimation of a Monthly Multivariate Stochastic Streamflow Model for the Nile River Basin, Mario A. Diaz-Granados and Rafael L. Bras, July 1982.
- 82-5 Planning and Design of Agricultural Drainage Under Uncertainty: A Dynamic Multi-Level Approach, Kenneth M. Strzepek, John L. Wilson, and David H. Marks, July 1982.
- 82-4 The Linear Channel and its Effect on the Geomorphologic IUH, Diana M. Kirshen and Rafael L. Bras, June 1982.
- 82-3 Cairo Urban Transport Project, Project Programming: Final Report, Volume I, Ralph Gakenheimer, March 1982.

- 82-2 Agricultural Expansion Planning: Incorporating Water Reuse, Mohamed Nasr Allam and David H. Marks, May 1982.
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