RTI

EGYPTIAN DEVELOPMENT AND THE POTENTIAL ROLE OF SCIENCE AND TECHNOLOGY

UNITED STATES OF AMERICA

Volume II

A Report Prepared for
The United States Agency for International Development
June 1976
(Contract AID/Afr-C-1144)

RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709

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USAID/CAIRO
DEVELOPMENT
INFORMATION
CENTER

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PREFACE

The Arab Republic of Egypt and the United States Agency for International Development (U.S. AID) have been exploring the possibility of the United States providing assistance to the scientific and technological community of Egypt. As a means of examining this possibility in greater detail, U.S. AID requested the Research Triangle Institute (RTI), under an existing contract for short-term consulting, to send a team of individuals to Egypt to assess the feasibility of the program under consideration, and to formulate such recommendations as may be appropriate.

Members of the team are listed below. In addition, Mr. George R. Herbert, President, RTI, accompanied the team for the first ten days of its assignment. The report of the observations and recommendations of the team consists of two volumes. Tables of contents for both volumes are included in each.

The team very much appreciates the excellent cooperation of Egyptian officials in the many organizations, institutions and agencies visited, particularly those of the Academy of Scientific Research and Technology and the National Research Center.

Chester W. Clark, Team Leader
Donald D. Evans
David B. Lewis
Quentin W. Lindsey
Vivian T. Stannett

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EGYPTIAN DEVELOPMENT AND THE POTENTIAL ROLE OF SCIENCE AND TECHNOLOGY

I. INTRODUCTION

Assignment and Terms of Reference

Egyptian leaders have perceived the potential role that the scientific and technological community can play in the development of Egypt. The gap between the potential and the extant peripheral status of this community is also recognized. Steps are being taken to close this gap, to move this community into the center of the action. In recognition of the multiple demands upon Egyptian resources, coupled with unfamiliarity with processes by which scientists and technologists can become intimately and effectively involved, assistance in this endeavor has been requested of the U.S. Agency for International Development (U.S. AID). Discussions have taken place and a "Project Identification Document" (PID) prepared by U.S. AID. The PID summarizes these discussions and presents a tentative outline of possible types of assistance.

In view of this background, U.S. AID has engaged the authors of this report as a consultant team to accomplish the following:

1. To assess the potential role of the Egyptian scientific and technological community in the development of Egypt.
2. To examine the tentative scope and nature of U.S. AID assistance to this scientific and technological community as perceived by Egyptian and U.S. AID representatives.
3. On the basis of this assessment and examination, draw conclusions and recommendations regarding:
   a. The types of assistance that might properly be provided.
   b. The magnitude and duration of this assistance.
   c. Institutional relationships appropriate for such assistance.
   d. Such other aspects as may be identified within the time available.

Organization of Report

The report consists of two volumes. The first volume summarizes such observations, assessments, conclusions, and recommendations as the team has been able to accomplish within a three-week period. In this, the second volume, we present several documents assembled by the Academy of Scientific Research and Technology, the National Research Center, U.S. AID, and other organizations. Additional information of interest is also included (see Table of Contents).

The documents assembled and the support and cooperation provided the team have been invaluable. Without such assistance, accomplishment of our mission would have been impossible. Our expression of appreciation is therefore sincerely extended to our Egyptian colleagues and to representatives of U.S. AID.

II. THE ACADEMY OF SCIENTIFIC RESEARCH AND TECHNOLOGY

Historical Background

The first government-sponsored body for the organization of scientific research was the National Research Council which was established in 1948. It concentrated on the completion of the infrastructure for scientific and technological research by establishing the laboratories of the National Research Centre which started operation in 1956.

This Council was replaced in 1956 by the Supreme Science Council. Its main function was the organization of science in the country, and its membership included a number of ministers and prominent scientists. The Council mobilized a great number of scientists in elaborating the first "scientific research plan" which appeared in the form of an ambitious number of research projects to be carried out, on a national basis, in the different scientific institutions including the Universities, the National Research Centre, and the specialized institutes belonging to the technical ministries.

This Council was superseded by the Ministry of Scientific Research, established in 1961.

Another body which was entrusted with the organization of scientific research was the Supreme Council of Scientific Research which came into existence in 1965 and was abolished in 1968 with the recreation of the Ministry of Scientific Research.

The Academy of Scientific Research and Technology was established in 1971 as being the responsible body for science and technology in Egypt having the following functions:

1. To support scientific research directed towards solving problems of national interest or priority;
2. To encourage the application of modern technology in areas included in the national programmes of economic and social development;
3. To formulate policies that insure strong linkages at a national level between scientific and technological

organizations, within the frame of the principal trends of the scientific and technological research which serve the national development plans;

4. To coordinate the major research projects affecting the national economic and social plans that have been put forward by the various institutes or departments;
5. To participate in the study of the scientific and technological aspects of the major development projects, and when necessary, to recommend the establishment of new research institutes;
6. To encourage basic research as a means of building up human research resources, and to support research schools working in modern fields of science;
7. To disseminate information concerning the potentialities of international modern technologies;
8. To participate in the development of science curricula;
9. To organize incentives for scientific workers;
10. To organize scientific publishing and the popularization of science;
11. To support scientific societies and to encourage and participate in convening of scientific conferences; and
12. To develop international relations.

Organization of the Academy

The Academy is organized in the following manner:

1. The President.

The Academy is headed by a President who is appointed by a Presidential Decree. He has the rank of Minister.

His duties and responsibilities are:

a. The chairmanship of the Academy Council.
b. The supreme administration of the Academy.
c. The national and international representation of the Academy.

d. The approval of the activities of the following institutions:

1) National Research Centre.

a) Theodor Bilharz Institute for Endemic Diseases.

b) Central Metallurgical Research and Development Institute.

c) Ophthalmological Institute.

2) Atomic Energy Establishment.

a) National Centre for Radiation Technology Research.

3) Institute of Oceanography and Fisheries.

4) Institute of Astronomy and Geophysics.

5) National Institute of Standards.

6) Egyptian Petroleum Research Institute.

7) Scientific Instruments Centre.

8) National Information and Documentation Centre.

The President of the Academy is assisted by two Vice-Presidents and a Secretary General.

Annex 1 presents the names and titles of the Senior Staff of the Academy.

2. The Academy Council.

The policy-making body of the Academy is its Council. Its resolutions are generally based on recommendations submitted by the Specialized Research Councils and Principal Committees on matters concerning scientific research and technology. The Council's resolutions are approved by H. E. State Minister of Scientific Research and Atomic Energy.

The Academy Council is headed by the President of the Academy and has as members:

The Vice-President of the Academy; the Chancellors of the Egyptian Universities; the Directors of the National Research Centre, the Atomic Energy Establishment, and the National Social and Criminological Research Centre; the Under-Secretaries of State or Deputy Ministers responsible for science and technology in the following ministries:

Irrigation, Agriculture, and Land Reform; Education and Higher Education; Health; Electricity, Housing and Reconstruction Transport; Communication; Industry; Petroleum and Mineral Resources. The Ministries of Finance and Economics and Planning are represented on the Council by an Under-Secretary of State nominated by the Minister concerned. The Egyptian Science Association (which represents the scientific societies in the country) is represented by a further member. The Secretary General of the Academy is also a member of the Council and acts as its Secretary. In addition to these members, the President of the Academy appoints up to ten members selected on their personal merits for periods of up to three renewable years.

Annex 2 gives the names and titles of the members of the Academy Council, as well as listing the members of the Bureau of the Council, the Technical Secretariat, and the Technical Staff Office of the President of the Academy.

3. The Bureau of the Council.

The Bureau of the Council is headed by the President of the Academy, and has as members the two Vice-Presidents, the Secretary General, and three elected members of the Council. This Bureau reviews the Agenda of the meetings of the Council. (See Annex 2).

4. Technical Secretariat.

Members of the Technical Secretariat to the Bureau of the Academy Council are nominated by the President of the Academy from the Scientific Research Staff or from technologists working in research institutions, universities, or the production sectors. In addition to a distinguished scientific career, they should have additional interest and experience that would help the Academy fulfill its tasks.

The Technical Secretariat is headed by the Secretary General of the Academy and reports to him. (See Annex 2).

5. Technical Staff Office of the President of the Academy.

The Technical Staff Office is made up of a group of experts selected from the Technical Secretariat who, in addition to serving as a specialized staff to the President, help carry out the technical studies

and day-to-day business of the Office of the President of the Academy. (The members of this staff are also listed separately in Annex 2.)

6. The Specialized Research Councils.

In order to carry out the Academy's functions in the planning and coordinating of scientific research at the national level, the Council of the Academy established fourteen specialized Research Councils sectorial-wise in the following fields of research:

a. Plant Production and Protection.
b. Animal and Fishery Resources.
c. Soil and Water Resources.
d. Environment.
e. Medical Research.
f. Radiation Technology.
g. Industry.
h. Petroleum and Mineral Resources.
i. Energy.
j. Building Technology.
k. Transport.
l. Physics and Electronics Applications.
m. Basic Sciences.
n. Social Sciences.

Each Research Council has a Chairman and a Deputy-Chairman appointed for a renewable year from amongst the members of the Academy Council and others engaged in research or technological applications. Each Council has a Secretary General in order to insure interaction at a high level of planning and coordination between the research workers and technologists and the users of the results of science and technology. A good representation of both categories on all the councils is ensured. One of the Vice-Presidents of the Academy is responsible for the coordination of the work amongst all the Research Councils.

Each of the Research Councils includes a number of permanent or ad hoc special Subject Committees which make recommendations to the parent Research Council. The structure and nature of the Research

Councils and the Subject Committees will be discussed in greater detail in section I.C. Annex 3 presents the names of the Chairman, Deputy Chairmen, Secretaries General, and the distribution by affiliation of the members of the Research Councils and the Subject Committees.

7. The Principal Committees.

It has been realized that some of the major activities related to science do not fall within the scope of the Research Councils. The Academy has therefore organized a number of principal committees to cover these activities. Four committees are functioning at the present time, namely:

a. Scientific Publications and Information.

b. Scientific Personnel.

c. Scientific Culture and Educational Aids.

d. Scientific Relations.

Since it is expected that there will be some overlapping of the activities of these committees, provision is made for the coordination of their work.

Annex 4 gives the names of the Chairman, Deputy Chairman, Secretaries General, and members of the Principal Committees.

8. The Advisory Board.

The Academy has an Advisory Board whose members are Egyptian scientists and experts who either are currently serving or have previously served for a substantial period of time in agencies of the United Nations or other international or regional organizations. They are kept informed of all the major activities of the Academy, and they give advice based on their wide experience gained by serving international agencies. The members of the Advisory Board are presented in Annex 5.

9. The Academy Conferences.

In order to mobilize the scientific efforts of the members of the scientific community in the country and to obtain general consensus on Academy plans and procedures, two types of general conferences are held every year:

a. Each Research Council convenes an annual conference to which it submits its progress report and future plans. The President of the Academy nominates the members (100-150) of each conference according to the proposals of the Council concerned.

b. The Academy convenes its annual conference to which it submits a progress report and the outlines of the future plans in the different fields. This conference is attended by all members of the Research Councils and other scientists and technologists invited by the Academy Council, the total number being about 1500.

These conferences give the scientific community a role to play in science and technology policy-making.

The Research Councils

1. Introduction.

The Research Councils discuss problems which face the various sectors of national activity. The deliberations of each Council are not limited to one specific subject or discipline. They are concerned with all the scientific, technological, economic, and social activities which are connected with the Council's field of interest. For this reason, each Council constitutes an integrated team of members selected from scientists and technologists in the various disciplines which embrace the basic functions of the concerned sector or sectors.

The deliberations which take place during each Research Council's meetings are based on the findings of specialized permanent or ad hoc subject committees, called Subject Committees, which exist in each of the Research Councils.

As described in section I.B.6, there are fourteen Research Councils:

a. Plant Production and Protection Research Council.

b. Animal Resources and Fisheries Research Council.

c. Soils and Water Resources Research Council.
d. Environmental Research Council.
e. Medical Research Council.
f. Radiation Technology Research Council.
g. Industrial Research Council.
h. Petroleum and Mineral Resources Research Council.
i. Energy Research Council.
j. Building Technology Research Council.
k. Transport Research Council.
l. Physics and Electronics Applications Research Council.
m. Basic Sciences Research Council.
n. Social Sciences Research Council.

2. Functions.

The main functions of the Research Councils include the following:

a. Study and plan the policies which can provide an effective bridge between national institutions of scientific research and technology and the main trends of scientific and technological research necessary to cope with the needs of the general plans for national development, each Council in its own field of interest.

b. Investigate problems of national impact, define these problems, assess new technologies, and advise the Council of the Academy on the role and responsibilities that the Academy may undertake in sponsoring relevant research programs, financing the needed research, or investigating and following up their execution.

c. Suggest the methods and procedures for participating in the scientific and technological aspects of the main projects proposed in the development plan, each Council in its own major field of interest.

d. Recommend holding seminars, conferences, or workshops and establish new subject committees for subjects of national impact.

3. Subject Committees.

a. Responsibilities.

1) To lay down detailed programs for proposed research items on the basis of the directives of the various Research Councils, taking into consideration the statistical surveys and information, accumulated by the Academy, on the completed and current research activities in the concerned field. The programme must include the following differentiations:

a) Items which can be carried out locally, either completely or with the aid of foreign experience for limited periods.

b) Items which necessitate cooperation with foreign countries through joint research projects that can be included in working programmes of scientific and technological agreements with those countries, and

c) Items in which Egyptian scientists residing abroad can participate in their laboratories, or which may form points of research for Egyptian graduates who continue their post-graduate or post-doctorate studies outside Egypt.

2) To nominate scientific personnel for project research teams and the team leaders (principal investigators), and to help secure approval of the organizations to which they belong for full- or part-time participation in the research projects.

3) To delegate the responsibility for approved projects to appropriate research organizations, and to obtain their participation.

4) To define all the facilities required to carry out the research work, the necessary budget (specified in local and foreign currency) that is needed to

provide these facilities, and the estimated preparation period for recruitment of staff and importation of necessary equipment.

5) To specify the period needed to complete the proposed research and the timetable for executing each phase.

6) To outline the procedure of follow-up, the frequency of submitting progress reports, the forms of these reports, and the system for evaluating the results.

7) To lay out programs for the practical application of positive results and for the follow-up.

8) To prepare reports and programs for submission to the parent Research Council and the other cooperating or concerned Research Councils.

b. Membership.

The Subject Committees are made up of selected personnel from the relevant Research Council. Some committees are formed of three categories of personnel:

1) Members from the parent council.

2) Members representing other Research Councils specified by the Council of the Academy. Each of these cooperating Councils is represented by only one member.

3) Members who are not of the two above-mentioned categories but are selected on the basis of their merits and contributions in the field of the concerned subject.

Each committee has a rapporteur and a secretary, both of whom are members of the parent council.

All members of the committee, particularly those of categories (1) and (3) mentioned above, are either performing or supervising research that falls within the scope of the committee.

Young scientists, at the level of researchers or assistant research professors or their equivalents, are well represented in these committees.

The average Subject Committee has nine members. Scientific personnel who are leaders or members of the same research team cannot form more than one third of the total membership of the committee.

Like the Research Councils of the Academy, all standing Subject Committees are reconstituted after each term of approximately one year. See Annex 3 for a list of the current members of the various Research Councils and Subject Committees.

4. Annual Conferences.

The planning of a science policy, which at a national level can form an effective bridge between scientific and technological institutions and the principle trends of scientific and technological research, requires active participation from all concerned personnel, from top authorities to young researchers. This policy is first formulated by keen and intensive studies in the Subject Committees which derive their authority from the Research Council. Such policies are then evaluated by the relevant Council, which takes into consideration the accomplishments of the other Councils.

So that each Research Council can make the best-founded recommendations, each Council convenes a conference annually to present its activities to approximately 200 representatives from the scientific and technological community encompassing a broad range of relevant disciplines. Those who attend the conference are invited to contribute to the discussions and evaluations of the Council's activities. In this manner, a given Research Council is able to accumulate many new and constructive ideas, while involving the scientific community "in the field" with the development of scientific research policy.

In general, the main items on the agenda for the regular annual conference for any given Research Council include the following:

a. Discussions of the Council's report on its achievements during the preceding year.

b. Discussions of the reports, conclusions, and recommendations of the various committees concerning current and proposed research projects.

c. Proposals for new research trends or for new committees, seminars, etc.

d. The Council's views on matters referred to it by the Council of the Academy or its President.

5. Research Projects.

a. Sources.

The research items which are discussed in the Council of the Academy or in the fourteen Research Councils can originate from various sources, namely,

1) Top level political decision-makers concerned with new scientific and technological research requirements for the general development plan.

2) Directives from the public sectors concerning any production or social problems.

3) Requests from ministries, institutions, production, executive, or scientific organizations for studying problems which they face in operations or production, asking for the correct means or methods for control and improvement.

4) Requests from scientific institutes for support in carrying out certain types of academic research.

5) World trends in scientific research and technological achievements.

b. Presentation.

The concerned Research Council, through an ad hoc committee, prepares a preliminary study of the subject including background information and relevant data. It then submits

a working paper to the Bureau of the Council of the Academy giving a clear recommendation to show whether:

1) The subject constitutes a national problem to which the Academy must respond; in this case, the committee must lay out the necessary research program to solve it (including problems of finance and necessary follow-up efforts) and must also suggest which Research Council should undertake responsibility for the program.

2) The subject deserves research and constitutes a problem in a specific sector of activity which is of interest to one or more of the specific research organizations in the country. The committee then points out procedures which can lead to solutions to the problem, and forwards these procedures to the concerned party or parties who will then either follow these recommendations or execute the program in their own fashion. Similarly, the committee can recommend that the Academy take the responsibility for the execution of the needed research by seeking financing from potential users of the research.

3) The subject does not fall within the activities of the Academy. In such cases, justifications for this decision must be clearly stated.

c. Decision.

The working paper is discussed by the Bureau of the Council of the Academy before being submitted to the Council itself for decision.

If the Council of the Academy approves the committee's recommendation that the subject deserves consideration, the matter is then forwarded to the appropriate Research Council, to one of the permanent Subject Committees, or to a new committee for that particular subject.

The concerned Council assigns one or more ad hoc committees to study the subject according to a determined timetable. In any case, the following steps are usually followed:

1) The pre-project documents, programs, possibilities of execution, and financial and personnel requirements are all discussed in detail. This discussion leads to a complete proposal for the research projects which will be necessary to provide solutions to the problem. In addition, a proposal for a permanent Subject Committee is presented.
2) The committee forwards the project proposal to concerned institutions and scientific personnel to evaluate the plan in general and to show their interest. It then studies the various reactions obtained and takes them into account in formulating the final project.
3) The project is again presented to the relevant Research Council with clear notes about the kind of actions taken on the various questions and problems raised by the different organizations and scientific reviewers.
4) The Council's proposed plans concerning the subject are included in its report to its general annual conference before submitting them to the Council of the Academy.
5) In some cases, where a quick decision is needed and the requirements for the execution of the proposed program of research are available, the recommendations of the Research Council are submitted directly to the Council of the Academy.

Research proposals--which are submitted by individuals and which aim at benefiting from known scientific results in fields of application, or at developing one of the basic

or applied scientific disciplines that can have direct impact on the problems of socio-economic development projects, or those proposals which need to be developed to a level sufficient to cope with the international advancement of science and technology--are referred to a special committee of outstanding scientists of various disciplines chosen from among the members of the Council of the Academy and the Research Councils. This committee studies, discusses, and decides on all requests for research projects of the above-mentioned nature.

6. Research Contracts.

a. Project Protocol.

In order to complete the form of contract that is required for national and principal research projects, the project protocol should include detail for each of the following items:

- introduction and background information.
- aims and objectives.
- expected benefit.
- main directions and procedures.
- definite programs for various phases.
- time plan for executing the project.
- suggested time of initiation after completing or furnishing all requirements and research facilities.
- responsible organization(s).
- cooperating organization(s).
- names and curriculum vitae of the research team and the role of each in detail. Their approval and that of their employers to participate in the research project are necessary.
- name of the principal investigator (team leader) and co-leader.
- frequency of submitting progress technical reports (three to six months).

- the budget requirements distributed among various items of expenditure and over the years of project duration. Foreign currency component, in amount and distribution, must be specified.
- detailed list of necessary scientific instruments and main equipment.
- the principal information which the Subject Committee calls for in the technical progress reports.
- criteria which the Subject Committee proposes for the report evaluation.

b. Contracting.

When the form of the project protocol is finally adopted by the concerned Research Council, it is signed in three copies by the principal investigator, the rapporteur of the Subject Committee, and endorsed by the Chairman of the Council. It is then forwarded with all annexes to the vice-president-in-charge, indicating clearly approval for contracting.

After presentation to the President of the Academy, the protocol and its annexes are forwarded to the Secretary General of the Academy (the contracting office) for preparation of documents and signatures by the three parties.

The contract is made of eight exactly similar copies, and the project protocol with its annexes are considered as integral parts of the contracts. These copies are distributed as follows:

- The responsible organization (First Party) . . . . . .one copy
- The vice-president-in-charge. . . . . .two copies
- The principal investigator (Second Party). . . . . .one copy
- The Secretary General of the Academy (Third Party) . . . . . .two copies

- The Chairman of the concerned Council. . . . . .one copy
- The rapporteur of the Subject Committee. . . . . .one copy

The Secretary General of the Academy, through the contracting office, informs the above-mentioned parties with copies of all financial and other administrative correspondence connected with the project, starting from the date of contracting.

c. Responsibilities of Parties.

The contract is to provide services for conducting research. It includes thirteen articles showing the responsibilities, authorities, and privileges of each of the three contracting parties, as summarized below:

1) The First Party; The Responsible Research Organization:
   - provides all facilities necessary for conducting the research items as defined by the second party and shown in the annexed protocol.
   - receives the rights to all unspent money, expendable and nonexpendable equipment when fulfilling the contract.

2) The Second Party; The Principal Investigator:
   - provides the plans and scientific designs in detail.
   - supervises the scientific and administrative activities specified in the research protocol.
   - selects the members of the research team, after consultation with the Academy (the Subject Committee).
   - follows up-to-date, accepted scientific and technical principles in carrying out the research.
   - submits progress technical reports at the intervals specified in the contract, and according to the recommendations given by the Subject Committee.

- submits a final report at the end of the contract, including all results, discussions, conclusions, and recommendations.

3) The Third Party; The Academy:

- provides the contracted costs, in advance.
- owns the royalty of the results, without violating the rights of the other two parties or the research team.
- may offer a bonus at the end of the contract, aside from the incentives already included in the project budget.

d. Follow-up.

- The principal investigator submits progress reports according to the regulations specified in the contract, and in line with the framework laid down by the Subject Committee.
- The report is submitted in four copies to the vice-president-in-charge who forwards one copy each to:
  - the Chairman of the concerned Research Council,
  - the Secretary General of the Academy,
  - the office in charge of follow-up.
- If the principal investigator submits the progress report directly to the rapporteur of the Subject Committee, he must, at the same time, inform the vice-president-in-charge in writing and attach three copies of the report.
- The principal investigator should be ready to submit more copies of the report if needed by the Subject Committee.
- If the principal investigator includes a list of incentives for himself and the members of the research team, the amounts must be listed for each member on a special form attached to the report.

- The Subject Committee studies and appraises the report according to the criteria adopted in the universities. A written statement indicating the comments of the committee is submitted separately from the minutes of the committee meeting in which the report is appraised. The committee may refer the report first to a sub-committee of two or three of its members or include referees who are not members. According to the findings of the committee, the proposed incentives may be approved either as requested or after the necessary changes have been made.
- The report of the Subject Committee is forwarded to the Chairman of the Council in charge, either directly or through the vice-president.
- The Chairman of the Council refers the committee's findings to either the Council in a regular meeting, or to the Bureau of the Council, then notifies the vice-president about the decision.
- After presenting a summary of the case to the President of the Academy, the Secretary General is notified to contact the first party for releasing the approved incentives to the research team.
- The same procedure applies to any requests made by the principal investigator for major technical or financial changes in the project protocol.

Research Projects Funded by The Academy

In absence of a defined national plan of action covering all aspects of national development, the Research Councils of the Academy identify the research problems of national importance; these problems are usually multi-disciplinary in nature, requiring integrated teams of research workers These problems might be partially tackled by a given Egyptian research institute acting alone, but frequently such an approach would be inadequate to meet the requirements posed by the many different aspects of the problem.

The Council thus proposes the submission of complete research programs for such problems. These are examined by the specialized Subject Committees and approved by the Council. These projects are reviewed by the Council's Conference and by the Academy Conference. If approved by both, they are ready for implementation with the full support of the Academy.

These projects might be submitted by the members of the concerned Council, or by research workers from universities, research institutes, and other government departments or by firms from either the production or services sector. Such projects are normally mission-oriented, and their results are expected to have direct bearing on the production and/or service sectors. However, the Academy does not neglect research projects in the basic sciences, which usually aim at giving valuable experience in various fields of science.

A list of the sponsored research projects (as of the end of March 1976) is given in Annex 6. Details of selected projects are presented in Annex 7.

Joint Research Projects

The Academy of Scientific Research and Technology concludes a number of joint research projects with outside agencies. These include some of the UN Agencies and such institutes of learning as foreign universities. The projects are usually carried out in Egypt under the umbrella of the Academy with expertise and financial support from the foreign agency.

Annex 8 gives a brief note concerning these joint projects.

Scientific Agreements With Foreign Countries

The Academy concludes a number of scientific agreements with some friendly countries as represented by one of their scientific bodies. These agreements provide for:

1. Exchange of visits amongst the senior staff of the two bodies.
2. Exchange of scientific periodicals.
3. Mutual invitations to conferences and scientific activities.
4. The identification of common fields of interest in which joint research work might be carried out.

Annex 9 lists some of the countries with which the Academy has concluded scientific agreements.

Long-Term Recommendations of the 1975 Academy Conference

1. The long-term recommendations of the Academy Council are to reflect the hopes of the Egyptian population for a better future through science implementation. This requires us:
   a. To live within the international community, grasping experience wherever it is available, within the framework of our national interests.
   b. To concentrate on affecting basic changes in social behavior, to coincide with the expected changes in the new environment.
   c. To minimize the gap between urban and rural communities.
   d. To have as a final goal a technologically progressed Egyptian society.
2. A general framework for the National Socio-Economic plan for development up to the year 2000 should be prepared on the basis of available sources and expectations.
3. The educational system should be developed at its various stages to insure genuine capabilities and to provide a healthy atmosphere for research and innovation.
4. The following recommendations were stressed regarding research personnel:
   a. To establish a unified pay scale for all research personnel in the different sectors.
   b. To study the means for improving the present status of technical assistants.
   c. To assure medical care for all research workers, and means to limit the emigration of scientists.
5. All possible measures should be taken to guarantee the continuity of leading scientific capabilities in research centres and institutes.

6. Coordination and cooperation procedures between developing nations, especially Arab countries, for the development and exchange of experience in science and technology, which should include:
   a. Benefiting from Egyptian scientists abroad.
   b. Inviting distinguished foreign scientists to Egypt.
   c. Scientific leaves for training and/or qualifications.
   d. Periodical visits by Egyptian researchers to foreign institutes.
   e. Establishing a scientific attaché in Egyptian embassies.
   f. Carrying out joint research projects on a national level within the framework of bilateral agreements and scientific and technological cooperation.
   g. Holding more scientific meetings, conferences, and symposia.
   h. Establishing a central modern organ for the distribution of scientific and technological information.
7. Means to make use of the research findings, including:
   a. Documentation of research and studies carried out at research centres, universities, and institutes.
   b. Periodical circulation of research findings for short-term solution of problems.
   c. Encouragement for holding additional symposia.
   d. Encouragement of research to be conducted on a team basis, with the necessary coordination between the principal investigators of the various projects.
8. The Research Budget
   a. A formulation for the proper distribution of the scientific research budget among research projects on a national level. (See Exhibit 1.)
   b. Raising the budgets of scientific research for research centres, universities, and government research sector. (See Exhibit 2.)
9. To insure means of coordination and cooperation between the research and the applied sectors through:

Exhibit 1

Academy of Scientific Research and Technology

Expenditure on Research Projects

By Research Council

(in Thousands of LE)

Research Council	1973	1974	1975	1976	Total
1. Plant Production and Protection Research Council	----	176	64	121	361
2. Animal Resources and Fisheries Research Council	11	577	124	97	809
3. Soils and Water Resources Research Council	----	255	232	168	655
4. Environmental Research Council	----	96	67	1	164
5. Medical Research Council	----	155	81	22	596
6. Radiation Technology Research Council	----	229	101	10	340
7. Industrial Research Council	----	10	24	21	55
8. Petroleum and Mineral Resources Research Council	40	206	339	11	596
9. Energy Research Council	----	2	----	----	2
10. Building Technology Research Council	32	97	13	29	171
11. Transport Research Council	----	36	----	----	36
12. Physics and Electronics Applications Research Council	----	----	26	11	37

(continued)

Exhibit 1 (continued)

13. Basic Sciences Research Council	----	----	----	----	----
14. Social Sciences Research Council	11	----	----	----	11
TOTALS	94	1839	1071	491	3495

Exhibit 2

Academy of Scientific Research and Technology

Expenditure on Research Projects

By Institution

(in Thousands of LE)

Institution	1973	1974	1975	1976	Total
Cairo University	40	412	137	36	625
Ain Shams University	----	83	8	38	129
Alexandria University	----	155	78	30	263
Assiut University	2	61	28	11	102
Al-Azhar University	----	85	28	61	174
Zagazig University	----	29	----	----	29
National Research Center	32	48	49	22	151
Egypt Petroleum Research Center	----	----	35	4	39
Atomic Energy Establishment	----	371	139	63	573
Institute of Astronomy and Geophysics	----	1	22	5	28
Institute of Oceanography and Fisheries	11	142	30	3	186
Ministry of Irrigation	----	22	65	----	87
Ministry of Agriculture and Land Reclamation	----	----	2	----	2

(continued)

Exhibit 2 (continued)

Agricultural Research Center	----	159	41	71	271
General Organization for Reconstruction and Agricultural Projects	----	200	140	100	440
General Organization for Petroleum	----	105	70	2	177
International Center for Development and Rehabilitation	2	----	----	----	2
High Institute for Public Service	2	----	----	----	5
Social and Criminological Research Center	5	----	----	----	5
TOTALS	94	1873	872	446	3285

a. Establishment of research units within the production and applied sectors; these units should belong to the national scientific research organizations.

b. Cooperation between research scientists and production experts.

c. Participation of nationally qualified personnel in projects assigned to foreign bureaus of experts.

d. Having scientific consultants in the governorates.

10. Research documentation and information

a. To establish an organism in the Academy primarily concerned with:

1) gathering information on research in progress at the research centres and universities.

2) adopting applied research projects that are in harmony with the national interests.

3) marketing technologically feasible, applied projects and distributing the rewards between the researchers, the relevant institute, and the Academy office.

b. To document technological experience to make it handy for production programmes.

11. Appointment of outstanding scientists as secretaries general to the Research Councils.

12. Recommendations concerning the specialized Research Councils:

a. To carry out necessary steps for contracting research projects recommended by the Academy Conference during its first meeting and approved by the Academy, especially

1) projects dealing with the side-effects of the High Dam.

2) to finish the projects of the geological map of Egypt in five years instead of ten.

b. To study research projects submitted during the present meeting.

c. To give first priority to research projects that serve global development plans of desert areas.

13. To establish a specialized Council for management research.
14. Ways and means for the participation of scientists and experts in all kinds of local scientific activities, especially in conferences, councils, committees, and meetings.

III. THE NATIONAL RESEARCH CENTRE (A.R.E.)

Programs

Egypt's National Research Centre (NRC) was founded twenty years ago to promote basic and applied research especially in areas related to industry, agriculture, public health, and other fields affecting the Egyptian national economy.

This year, the new NRC leadership took the initiative and responded to the open-door policy of the country by coordinating its research programs with the national development plan and organizing the activities of all research workers in the NRC towards solving established national problems.

The new policy is geared towards gradually changing the pattern of "self-oriented" research that has prevailed over the last two decades to one where almost 80% of the research will be customer-oriented by 1980.

The research in the National Research Centre is concentrated in the following principal programs:

1. Technology Transfer.

This program is concerned with developing Egyptian technology in the different areas of the Egyptian industry such as textiles, iron and steel, food processing, the chemical and engineering industries, and others.

2. Food and Agriculture.

This program is concerned with research and development in food and agriculture, with improvement of land productivity, and with the manufacture of agricultural and animal products.

3. Health and Environment.

This program includes all the research work that will contribute to the improvement of public health, including studies on environmental pollution. In addition to the nutrition problems of the Egyptians, it is also concerned with epidemic diseases (with special emphasis on schistosomiasis), ophthalmological diseases, and the manufacture of drugs from local natural products.

4. Energy.

This program includes studies on the possible use and development of nonconventional sources of energy, especially solar energy.

5. Natural Resources.

This program has been established with the cooperation of other departments and institutions in the country to search for various ores in the land and seas of Egypt.

In addition to establishing the above five programs, NRC was reorganized into the following research divisions:

1. Textiles.
2. Environment.
3. Metallurgy.
4. Nutrition and Food.
5. Pharmaceutical and Medicinal Industries.
6. Animal Resources.
7. Basic Sciences.
8. Physics.
9. Chemical Industries.
10. Organic Chemistry.
11. Inorganic Chemistry.
12. Agriculture.
13. Medicine.
14. Engineering.

These divisions group together forty research laboratories specializing in most branches of the sciences, technology, and engineering. These laboratories employ 1112 research scientists and technologists, of whom 522 are Ph.D. graduates who have received their education and research training in almost all the developed countries of the world. This represents the largest group of qualified scientists and technologists working under one roof in Egypt. Supporting these divisions and working directly with the Director of NRC, four major offices were established, namely: Technical, Programming, Marketing and Sponsor Relations, and Research and Development.

The Technical Office is responsible for preparing the monthly and yearly progress reports of the Centre and screening all technical information from the various divisions.

The Programming Office is responsible for reviewing, screening, and approving the research programs performed in NRC laboratories, establishing priorities in consultation with and after the approval of NRC administration, and reviewing contracted projects with government agencies, companies, and other customers.

The Marketing and Sponsor Relations Office is responsible for marketing research and other NRC services such as training programs for study, and the follow-up and implementation of scientific, cultural, and technological agreements.

The Research and Development Office is in charge of the follow-up of the execution and implementation of the contracts included in the five principal research programs. It is also responsible for the preparation of reports about the progress in each program.

This year, all researchers are participating in contracted projects whose goals and objectives are set and approved by the NRC management; budgets are allocated to each project according to priorities, and each must be a part of one of the principal established programs.

Projects

1. Technology Transfer Program Research Projects

Code No.	Title
TT/1	Design of a furnace for firing rice hulls.
TT/2	Production of basic refractories from local Egyptian ores.
TT/3	New substitutes for conventional building materials.
TT/4	Development of new types of glasses.
TT/5	Isolation of polyphenolics and tannins from some local plants and their evaluation and utilization in Egyptian tanneries.
TT/6	Wet processing of different textiles.
TT/7	Development of spinning processes and their preparations.

TT/8 Synthesis of some new polymers and their evaluation for industrial application.

TT/9 Studies on some synthetic resins, pigments, and fillers used in paints and brake lining.

TT/10 Polymerization of methyl-methacrylate in water.

TT/11 Effect of rubber ingredients on its properties and the elaboration of radiation-resistant rubbers.

TT/12 Mass and heat transfer, and the hydrodynamics in gas-liquid contact equipments.

TT/13 Development of new procedures for organic microanalysis.

TT/14 Dielectrics and application of microwaves to molecular physics.

TT/15 Studies on problems in theoretical physics.

TT/16 Applications of absorption and emission spectra in the field of atomic and molecular physics, and the improvement of their equipments.

TT/17 Application of electron microscopy in fine structure elucidation of thin films and some local ores.

TT/18 Preparation of vanadium pentoxide catalyst from fly-ash.

TT/19 Studies on the semiconducting properties of inorganic compounds.

TT/20 Biosynthesis of macromolecules.

TT/21 Preparation of enzymes for diagnostic purposes and industrial uses.

TT/22 Metabolism in experimental animals subjected to anti-cancer drugs in relation to breast cancer in humans.

TT/23 Computer applications as an element in systems engineering design.

TT/24 Design and processing of prototypes of various electrical machines and microwave networks.

TT/25 Beneficiation of some low-grade Egyptian ores.

TT/26 Extractive metallurgy by different metallurgical processes.

TT/27 Metal forming and working.

TT/28 Studies on the heat treatment and surface protection of metals.

TT/29	Applications of mechanical engineering in the fields of automotive and fluid mechanics engineering.
TT/30	Studies on the corrosion of metals and alloys.
TT/31	Electrochemical water desalination.
TT/32	Re-activation of the nickel catalyst used in the hydrogenation of edible oils, and the bleaching of the oil.
TT/33	Physico-chemical studies on heterogeneous catalysts and activated charcoals.
TT/34	Chemical studies on organic systems with expected biological activity.
TT/35	Preparation of phosphorus insecticides.
TT/36	Synthesis of pesticides of medicinal and agricultural importance.
TT/37	Preparation of new carbamates with expected biological activity.
TT/38	Studies on cellulose and hemi-cellulose chemistry.
TT/39	Preparation of pulps from local materials.
TT/40	Lignin chemistry and its uses in industry.
TT/41	Preparation and characterization of various inorganic and organic insulating and semiconducting materials.
TT/42	X-ray diffraction in various organic compounds and in local ores.
TT/43	The physics of some metals and alloys.
TT/44	Biochemical engineering.
TT/45	Factors affecting the production of alums from desert clays.

2. Health and Environment Program Research Projects.

Code No.	Title
HE/1	Common eye diseases in Egypt: diagnosis and treatment.
HE/2	Effect of organic and inorganic pollutants on the water quality of streams and drains.
HE/3	Studies on air pollution in Egypt.
HE/4	Immunological control of parasitic diseases including schistosomiasis.

HE/5	Bilharziasis in Egypt.
HE/6	Pharmacological studies on drugs commonly used in Egypt.
HE/7	Anthropometric studies on growth and development of Egyptian children.
HE/8	Clinical, genetic, biochemical pathologic, and immunologic studies on some common diseases, and the physiology of fatty liver.
HE/9	Evaluation of medicinal plants and crude drugs and assessment of their content of biologically active compounds and technological aspects of dosage-form design.
HE/10	Chemical and biochemical studies on microbial and sea algae products.
HE/11	Utilization of natural and waste products in drugs.

3. Agriculture and Nutrition Program Research Projects.

Code No.	Title
AN/1	Studies on protein energy deficiency among Egyptians.
AN/2	Soil conditioners and water uses.
AN/3	Mineral and organic fertilization and its relation to soil fertility and productivity.
AN/4	Soils map of Egypt.
AN/5	Biological and ecological studies on endo- and ecto-parasites of local farm breeds with special reference to prevention and treatment.
AN/6	Studies on reproductive efficiency in buffaloes and sheep.
AN/7	Feed requirements for local breeds of animals and improvement of new sources of feedstuffs.
AN/8	Effect of plant diseases and their chemical control on crop quantity and nutritional value.
AN/9	Studies on pests attacking some economic crops and means of their control.

AN/10 Studies on local vegetable oils and their by-products.

AN/11 Increasing the productivity of field crop plants.

AN/12 Handling, storage, and ripening of horticultural crops.

AN/13 Evaluation of conventional crops and introduction of new ones with higher productivity under the prevailing environmental conditions.

AN/14 Increase of productivity of vegetable crop plants.

AN/15 Studies on various medicinal and essential oil-containing plants for improving their yield and constituents.

AN/16 Studies on biochemical changes in various plants of economic value.

AN/17 Genetical and cytological studies on various Egyptian crops.

AN/18 Bacterial and fungus toxins in food.

AN/19 Chemical and technological studies for the improvement of milk industry in Egypt.

AN/20 Studies for the improvement of the food industry in Egypt.

AN/21 Increase the productivity of milk-producing animals.

AN/22 A study of the effect of starters on soya-bean milk.

4. Natural Resources Program Research Projects.

Code No.	Title
NR/1	Geological, mineralogical, geochemical, geophysical, and mechanical investigation of various Egyptian rocks and the possibility of their economical beneficiation.

5. Energy Program Research Projects.

Code No.	Title
E/1	Measurements on solar energy and other meteorological variables.

6. Projects Financed by the Academy of Scientific Research and Technology

Code No.	Title
AC/1	Behaviour of Egyptian cottons.
AC/2	Efficiency of various insecticides against the American boll-worm, Heliothis ormigera.
AC/3	Heat insulating composite materials.
AC/4	Radiation levels for medical sterilization.
AC/5	Water heating by solar energy for domestic uses.
AC/6	Establishment of a power electronics laboratory.
AC/7	Use of graphite as a heat and erosion-resistant material.
AC/8	Solid-pollutants in Helwan and Shubra el-Khema.
AC/9	Effect of Nile-silt deficiency on soil characteristics and their fertilizer requirements.
AC/10	Protein production from algae.
AC/11	Phosphoric acid preparation using hydrochloric acid.

7. Projects Financed by Local Customers

Code No.	Title	Customer
C/1	Purification of bentonite ores.	Sina-Manganese Co.
C/2	Activation of bentonites.	Sina-Manganese Co.
C/3	Production of graphite schamott stoppers and nozzels.	Egyptian Company for Ceramics.
C/4	Beneficiation and purification of common-salts from undesirable impurities.	Mist-Chemicals
C/5	Slurry thinners.	Alexandria-Portland Cement Co.
C/6	Purification of Nile water entering Rod-El-Farag Water Works.	Rod-El-Farag Water Works

C/7	Isolation of anti-tumor agents from Egyptian Wika plants.	Cairo-Pharmaceuticals
C/8	Toxicity of pyrazolones in experimental animals.	Cairo-Pharmaceuticals
C/9	Cement slurry thinners.	Tora-Portland Cement Co.
C/10	Production of anti-oxidant lube oils.	Cooperative Petroleum Co.

8. Projects Financed by Foreign Agencies

Code No.	Title	Customer
F/1	Chemical and radiation modification of cotton textiles to improve their dyability and anti-creasing properties.	Isotope Centre, Arab Le gue
F/2	Micro- and macro-organisms of disease and fouling, and corrosion in marine environments.	Institute of Naval Research, Washington, D.C., U.S.A.
F/3	Water quality studies on the River Nile and Lake Dam.	Univ. of Michigan.
F/4	Protein production from algae.	Dept. of Algal Research and Technology, Dortmund. BRD
F/5	Relationship between the application of certain insecticides and the induction of American boll-worm.	American Cyanamid
F/6	Distribution and inactivation of parasitic and bacterial pathogens in edible fish.	FDA, U.S.A.
F/7	Investigation of selected wild Egyptian plants for coumarin constituents.	IFS

F/8	Research to establish an economic process for the production of solasodine and pergestrone under Egyptian conditions.	IFS
F/9	Trace elements and plant nutrition problems in Egypt.	German Agency for Technical Cooperation, BRD.
F/10	Utilization of solar energy in electricity generation through simple thermal cycle.	Univ. of New Mexico and the Univ. of Maryland, U.S.A.
F/11	Utilization of solar energy for cooling.	German Agency for Technical Cooperation, BRD.
F/12	Solar power plant in Egypt.	German Agency for Technical Cooperation, BRD.
F/13	Toxins in beans and other leguminous plants.	FDA, U.S.A.
F/14	Afla-toxin residues in Egyptian food and feed derived from plant and animal sources.	FDA, U.S.A.

9. Training Programs

In 1975, the National Research Centre arranged for training courses for a number of workers in different fields. These are shown below.

a. Computer training course

78 participants have enrolled in this course.

36 participants have been qualified.

Duration of the course was 150 hours.

b. Training course for technicians working at the NRC

This course was conducted to improve the quality and standard of technicians in electrical, electronics, mechanics, and glass

fields. It was held in Centre of Scientific Equipment at the NRC premises. Duration of this course was three months.

c. Electrophoresis

Twenty-one research scientists working at NRC have attended a three-week course in electrophoresis.

d. German Language course

An eight-month course in the German language has been arranged for staff members of NRC. 74 persons have attended this course.

e. English Language course

A three-month course in the English language has been given to 50 persons working in NRC.

f. Civil defence

The President of NRC advised that a training program for civil defence be started. Accordingly, all people in charge have been enrolled in a three-month training course dealing with the equipment to be used and the precautions to be considered in civil defence.

g. Training program for participants from industry and the universities

Participants from industry, the universities, and high institutes in Fgypt have been trained at the NRC in different research areas.

The number of participants from industry together with the training subjects and duration of training are shown in Exhibit 3.

Exhibit 3

Training Programs of The National Research Centre

Subject	Number of participants	Duration in weeks
Metallurgy	34	16
Glasses and Ceramics	24	11
Dyeing and Finishing	22	5
Chemistry and Technology of Pulp and Paper	5	2
Detergents	12	3
Rubber and Plastic Technology	11	3
Paint Technology	11	3
Food and Dairy Technology	18	15
Nutrition	2	2
Total	160	130

h. Training courses for participants from Saudi Arabia

Ten participants from El-Raid University, Saudi Arabia, were enrolled in training courses in different fields of research. Duration of these courses was 176 weeks.

IV. OTHER EGYPTIAN SCIENCE AND TECHNOLOGY INSTITUTIONS

Institute of Oceanography and Fisheries

1. Historical Introduction.

Since 1962, the different governmental institutes, viz., the Marine Biological Station of Al-Ghardaga and the Hydro-Institute of Alexandria have been assembled as Institute of Oceanography and Fisheries, affiliated to the Ministry of Scientific Research (now the Academy of Scientific Research and Technology).

2. Objectives.

These can be summarized as the following:

a. Undertaking scientific, applied, and economic research for the conservation of fishery resources and their development.
b. Discovering new fishing resources and their development.
c. Carrying out research to determine the best ways to utilize fish.
d. Establishing fish farms under governmental or private auspices.
e. Supervising and cooperating in fish statistics works.
f. Technical advice to relevant private and governmental bodies regarding laws and regulations related to fishing management.
g. Sharing in the preparation of governmental plans for fishery development.
h. Undertaking geological, geomorphological, etc., surveys for clarifying the ways and means for the protection of shores from erosion.
i. Undertaking training programmes for research and technical assistants.

3. Divisions.

The Institute is at present comprised of four branches:

a. Mediterranean Sea Branch at Alexandria, with three stations at Matariya, Baltim, and Max.
b. Red Sea Branch at Al-Ghardaga, with three stations at Al-Ghardaga, Suez, and Port-Tawfik.

c. Inland-Water Fisheries and Fish Culture Branch, Cairo, with stations at Nile Barrages, Serow, Lake Quarun, and Lake Nasser.

d. Shore Protection Research Branch, Alexandria, with two stations at Abu Kir and Ras El-Bar.

Thirteen research departments serve the first three branches, while another six serve the fourth.

4. Research Trends.

a. Carrying out research programmes designed to provide a detailed survey of the A.R.E. waters in the Mediterranean and neighbouring lakes.

The research activities include studies of both physical and chemical oceanography, marine geology, and hydrobiology, as well as studies of the biology of the fish species of economic importance. Special attention has been given to pollution problems in Lake Mariut.

b. Carrying out research activities designed to raise the commercial fish production in both artificial ponds, natural and man-made lakes, and in inland water masses.

c. Besides the main fields of interest, attention is paid to the ecology of the coral reefs and the exchange of fauna between the Red Sea and the Mediterranean through the Suez Canal.

d. Taxonomy, ecology, and development of invertebrates, particularly crustaceans, molluscs, echinoderms, and polychaetes are also some of the concerns for the possible future benefit of the countries in the region of the Red Sea.

e. Ways and means of protecting the Mediterranean shores.

5. Publications.

The Institute issues the "Bulletin of the Institute of Oceanography and Fisheries" which is exchanged with more than 500 foreign institutes.

6. Staff.

Director: Prof. Dr. Aboul-Fotouh Abdel-Latif

Scientific Staff:	188
Technicians:	76
Administrative and Clerical:	60
Workers:	166
Total	490

Institute of Astronomy and Geophysics

1. Background.

It is one of the oldest scientific institutions in Egypt; it has been in operation at Helwan since 1903. It deals with two main branches: astronomy and geophysics.

2. In the Field of Astronomy.

It had a Reynolds 30-inch reflector telescope at Helwan. With such a telescope, several scientific programs have been carried out on the comets, galaxies, and planets.

In 1963 a 74-inch telescope was erected at Kottamia (about 40 km east of Helwan). With such a telescope and the increasing number of Egyptian scientists (together with generally favourable conditions for astronomical observations), several programs of an international nature have been conducted with various foreign institutes, including Greenwich, Manchester, Basel, U.S.A., and U.S.S.R. These were in the fields of clusters, galaxies, interstellar matter, variable stars, radial velocities, the moon, and the planets.

In addition, other studies are currently being conducted on zodiacal light, tracking of artificial satellites using laser ranging, and solar physics.

3. In the Field of Geophysics.

a. In Geomagnetism: The first permanent magnetic station was erected in 1907 at Helwan for continuous registration of the elements of the geomagnetic field. In 1960 it was replaced by a new magnetic station at Misallat (about 70 km S.W. of Cairo) due to the electrification of the nearby Cairo-Helwan railway line.

Different magnetic surveys were made for Egypt at different epochs by:

1) N. E. Hurst during 1904-1918, for the epoch 1910 and 1920.0.

2) M. Fahim during 1957-1966 for the epoch 1965.0.
A new survey of the country was started in 1974 for the epoch 1977.0.

b. In Seismology: At present the Institute has four seismic stations:

One of them is within the American standard network and was erected at Helwan in 1962. The second, also at Helwan, was erected in 1973, and is a Japanese visual registering station with a frequency analyzer. The other two were erected in 1975 at Aswan and Mersa Matrouh with Soviet-made equipment. Research is currently being done on the seismicity of Egypt, seismic waves, rock magnetism, solar/terrestrial relations, lunar variation of the geomagnetic field.

Helwan Institute has taken part in the following activities:

1) Observation of Haley's Comet in 1910 and 1930, and Kahoutek in 1974.
2) The solar eclipse of 1952 in the Sudan.
3) Tracking of artificial satellites since 1968.
4) The IGY during 1957-58, the IQSY during 1964-1965, world Magnetic Survey Project in 1965.

4. Staff

Director: Prof. Dr. M. Fahim
Vice-Director: Prof. A. Asaad

Scientific staff:	47
Technicians:	36
Administrators:	48
Workers (Labourers):	63
Total	194

The Egyptian Petroleum Research Institute

The Egyptian Petroleum Research Institute (EPRI) is the newest of the specialized institutes set up by the Academy of Scientific Research and

Technology in accordance with its policy to create new independent research institutes as the need for them arises and as the number of the research workers in a given field grows (or is planned to grow) to reach the size necessary for the given institute to become an effective and productive entity.

Located in the VII Region of Nasr City, a suburb of Cairo, about 15,000 sq. meters of buildings have been built on a total ground area of 25 acres. These include an administration building which houses the administrative offices, a main conference hall, and four small lecture halls equipped with automatic translation and film projection facilities, a central library, printing shop, cafeteria, infirmary, and many other facilities.

Three large three-story blocks situated behind the administration building contain the research laboratories and offices of the Institute's seven divisions. These include the Exploration, Production, Crude Oil Evaluation and Analytical Physics, Refining and Catalysis, Petrochemicals, Product Application and Process, and Design and Development Divisions.

Auxiliary buildings include the main workshop with its mechanical, electrical, glass-blowing, and carpentry activities, a power station housing a 500 KVA stand-by generator, air compressors, an air conditioning refrigeration unit and the electrical power transformers, a cold storage building, and a main stores building.

Water is supplied from Nasr City via an underground storage tank which is pumped to a 650 cubic meter above-ground storage tank to insure a constant water supply for the Institute's requirements and fire safety network.

Yet to be constructed and installed are the Institute's computer facilities, a main pilot house, engine testing facilities, and garages.

Construction started in January 1971 and transfer of the personnel and equipment to the site began in January 1976. The number of employees at the Institute now total 250; this number is expected to grow to about 450 over a three-year period.

The Institute is administered by a 12-man board, chaired by Eng. Ramzy El-Leithy, Chairman of the Egyptian General Petroleum Authority (EGPC), with five members from the petroleum industry, five members from the Institute's staff, and one member representing the Ministry of Higher Education. The

Institute has a Director (Dr. Bahram Mahmoud), a Deputy Director (Dr. Fathy Ebeid), and a Secretary General (Dr. Mohamed Rushdy).

The aim of the Institute is to engage itself in research programs destined to help the petroleum industry in its development and to give it the services required that it would otherwise have been forced to seek abroad.

The Institute is presently engaged in a number of activities which, to cite only a few, include processing of seismic data in view of setting up a data base, production of drilling muds from local materials, pressure-volume-temperature studies, evaluation of local crude oils, evaluation of catalysts, production of lube-oil additives, production of proteins from gases, quality control of asphalts and other petroleum materials, and several projects in the petrochemical field.

Future programs will include the setting up of a Scientific Information Center with a data base and retrieval system facilities, specialized training courses, an up-scaling of laboratory research work and techno-economic feasibility studies. The ultimate aim is, in time, to convert the Institute into an Energy Institute.

The size and the favourable location of the Institute with its high level of scientific and technological competence should render it one of the main research centers of the Middle East area, extending its services and facilities to adjoining Arab and African countries in view of implementing the A.R.E.'s plan to expedite transfer of technology and to enhance the general plan to increase the GNP.

National Institute for Standards (NIS)

1. In 1963 the National Institute for Standards was established. Its objectives and responsibilities are detailed as follows:

   a. Maintenance of the national standards for measurements of the physical units, and their use for the purpose of measurement and calibration.

   b. Undertaking related research work.

   c. Giving advice, upon request, to industry and public services in problems related to measurements.

d. Undertaking research work on metrological problems in collaboration with interested organizations and industries.

e. Providing the Egyptian Organization for Standardization (EOS) with essential scientific requirements for an adequate quality-control system in industrial production.

f. Calibration of high-precision measuring devices for scientific, industrial, and technological laboratories.

g. Offering training opportunities for metrologists in the above laboratories.

h. Developing safety tests.

i. Approval of prototype measuring instruments.

2. The Institute consists of the following four departments:

a. Electricity Department which consists of frequency, electricity, and photometry laboratories.

b. Applied Physics Department, which consists of heat, radiation, and acoustics laboratories.

c. Mechanics Department which consists of mass, length, and engineering dimensional metrology laboratories.

d. Testing Department which consists of safety, organic materials testing, and metallic materials testing laboratories.

3. Personnel.

Director: Dr. M. M. Ammar

Research staff:	22
Assistant Researchers:	45
Specialists:	40
Technical assistants:	30
Administration personnel:	45
Labourers:	33
Total	215

Exhibit 4

Egyptian Petroleum Research Institute

Labour Force

Job Description	Prior to 1973	73	74	75	Total
Research Professor	3	--	5	--	8
Assistant Professor	7	--	4	--	11
Researcher (Ph.D.)	3	4	5	9	21
Associate Researcher (M.Sc.)	31	--	8	8	47
Research Assistant	19	6	--	--	25
Technicians	9	--	4	--	13
Administrators	5	--	2	--	7
Engineers	--	2	5	5	12
Clerks	9	5	5	12	31
Technical Assistants	4	15	19	37	75
Drivers	--	--	--	7	7
Garage Administrators	--	--	--	1	1
Garage Watchmen	--	--	--	1	1
Watchmen	--	--	--	1	1
Technical Workmen	--	--	--	6	6
Office Boys	4	1	2	9	16
TOTAL	94	33	59	96	282

V. PROJECT IDENTIFICATION DOCUMENT

TECHNOLOGICAL RESEARCH AND DEVELOPMENT PROJECT - EGYPT

Relevancy of the Problem

Egypt's population is estimated to have been 36.4 million at mid-1974 and growing at the rate of 2.2 percent to 2.5 percent annually. About 800,000 more people a year are born onto the narrow strip of land along the Nile Valley and around the Delta, the most densely populated inhabited area in the world. Cultivated area per capita has been falling for at least the last 75 years; increasing rural congestion has spawned an increasing migration to urban areas; the labor force increases at a faster rate than the population; and urban migration has caused a shift in employment from the formerly more absorbent agricultural sector to the less elastic industrial and service sectors of an urban economy. Rural congestion, urban crowding, unemployment and underemployment, deteriorating infrastructure, and insufficient social services of increasingly poorer quality are only a few of the human problems of Egypt. Increased production and increasing labor productivity are needed to provide employment for a growing labor force, savings for investments and social services, and products and materials for the physical and social welfare of a population fast growing toward 70-80 million people.

To provide for the needs of its growing population, Egypt must devise an economic growth strategy which can produce yearly growth rates of 6-8 percent. In the Egyptian context such a high growth rate can come only from industrialization aimed at import substitution and production for export markets; and creation of a type of infrastructure which stimulates the introduction of technology that increases productivity--for instance, electrification and resultant mechanization and industrialization. A development strategy based in large part on technological modernization will exploit the several potential development advantages which are available for Egypt's economic growth: human resources, favorable market position, and a large, relatively well-advanced resource and industrial base.

(a) There is a large domestic market, abundant low wage labor and a pool of high-level manpower such as engineers, agriculturalists, and educators

who have some experience with modern technical and managerial technologies.

(b) Egypt is related to other Arab markets not only by geographic proximity but also by a web of cultural, political, and intellectual influences. Given the relatively more advanced state of industrialization and the size and skill-levels of her manpower, there are opportunities for Egypt to provide industrial exports to neighboring Arab markets to attract Arab investment and to provide an industrial base for foreign firms seeking access to Arab and African markets. Likewise, the economics of plant location, combined with the intellectual and technical influence derived from a long-term policy of accepting African students in Egyptian universities and secunding high-level manpower to African governments and universities, give Egypt a certain comparative advantage vis-a-vis African markets.

(c) A large agricultural sector provides food and fiber for traditional industries; natural materials feed local industries in chemicals and building materials; completion of iron and steel and aluminum plants now under construction will provide substantial capacity in basic metallurgical production to feed a growing engineering goods industry. Gross value of manufacturing output totalled over $2.6 billion in 1973 and employed over one million workers.

These potentials for development will not be fully realized unless large investment are made, foreign technologies are imported and adapted, the rate of technological innovation is increased, and structural changes are made in economic planning, the system for deciding resource allocation and the management of public enterprises.

Over the last several years, the necessary high levels of investment for the import of productive technologies have not been made. A war economy and heavy involvement in prestige projects severely curtailed development investments. Now there is a great deal of money available to Egypt for investment in a development program; whether or not the money is actually transferred to Egypt depends on the government's ability to prepare what the World Bank calls "a suitable portfolio of projects." In the past the quality of project analysis for investment decisions has been affected by a highly centralized and bureaucratized process for economic decision-making which too frequently chose projects and alloted resources on the basis of prestige factors and exigencies of a war economy, rather than on the basis of economic criteria and social need.

Economically rational investment decisions were further restrained by a series of pricing and subsidization policies which distorted relative values of the factors of production. Now there is movement to redistribute development and planning authority to provincial and local governments; to decentralize decision-making in a number of public sector enterprises; to hold public enterprise accountable for economic profitability including the real cost of subsidies and control measures; to rationalize allocation and incentive systems through price policy reforms. As this restructuring is forced to implementation, the demand for skills, know-how, and experience for conducting feasibility studies and project evaluations, organizing regional planning activities, and selecting among alternative program strategies will grow. There also will be a need for socio-economic analysis and technology assessments to evaluate the "trade-offs" for measuring well the social and economic milieu into which new technologies will be interjected.

The importation and adaptation of foreign technologies--the rate of technological innovation--has been limited by many factors.

-- Much of the foreign currency financing that has been made available to Egypt for imports has been in terms of bilateral trade agreements or "tied" purchases that restricted choices of technologies and rationalizations of plant resources.

-- Many of the pricing policies and administrative regulations governing public sector enterprises are not conducive to innovation, e.g., factor costs are not truly valued and the appropriateness of a technology is determined by a relatively cheap price for capital and foreign exchange; price policies and subsidized production frequently combine to discourage innovative change; and there is little competition among producers--even in their export items Egyptian industry is spared harsh comparison with international standards because most of their manufactured products are sent to Eastern markets where the quality of Egyptian manufacturers is quite acceptable.

-- When selecting and adapting a new technology for Egypt, one finds that there is a lack of information about available technologies and processes; there are large technical and economic disparities between supplying firms and Egyptian buyers, thus making rational choice, competent adaptation, and complete installation of the desired technology a "chancy" affair; and there are few indigenous technological centers willing to do adaptive R&D work for industry.

-- Perhaps the most important constraint to more rapid technological innovation is that the highly theoretical education and academic basic science research orientation of Egyptian scientists and technologists is a poor match for the low level of technological sophistication and practical research needs of local enterprises.

-- At the level of production/service units, managerial and technical competence to implement new technologies is often lacking--it is a case of few foremen, supervisors, front-line operators, and other middle-level skills.

From this review, it is obvious that in Egypt, as in other developing countries, the use of technology for economic and social development is not constrained by an absence of appropriate scientific and technological knowledge, but rather the critical limiting factors are those associated with organizational complexities, managerial and technical competence, the system of incentives and regulations governing production decisions in enterprises, and the selection and adaptation of available knowledge. Thus, the task of mobilizing Egypt's scientific and technological resources for purposes of development is not one of improving scientific quality or building more performance capacity; it is instead a task of providing a means by which scientific and technological resources can consider and interact with the economic, technical, managerial, and organizational limitations that determine the rate and extent of technological innovation in industry and the service sectors.

The Problem

There has been established in Egypt over the last 30 years a large and relatively complete structure for scientific and technological research and development; one UNESCO expert report estimated it to be comparable in scientific and economic size to those of New Zealand, Yugoslavia, Brazil, and Spain. There are between 5,000 and 6,000 scientists and engineers working in hundreds of R&D units in universities, technical ministries, the National Research Center, autonomous technical organizations, and "captive" labs attached to specific industries such as textiles and petroleum. All essential science service units exist, such as standards and testing labs, information and documentation center, instrumentation repair and maintenance centers, management and productivity centers, natural resource surveys, and mapping. There is a superstructure for science policy and planning consisting of the National Council for Education,

Scientific Research, and Technology; the Ministry of Scientific Research and Atomic Energy; and the Ministry of Higher Education. There is also an organization for national coordination and program control and financing--the Academy of Scientific Research and Technology. It is difficult to imagine a development concern that could not be located in or attended by one of the units that already exists in this structure.

The overwhelming concern of the many T-R&D units is in basic rather than applied research; engineering design and process development is weak, and most of the structure's output is truncated R&D, i.e., research and some laboratory development that is disconnected from further activities in the innovation chain such as engineering design, manufacturing prototype, techno-economic feasibility studies, and marketing analysis. Consequently, neither the process nor the product of this very large T-R&D structure has had much effect on the level of technological content and innovation in industry or in development plans and programs.

There appear to be two related causes for the weak impact T-R&D has had on Egyptian development problems. First, T-R&D activities are neither planned nor funded against the objective of solving specific development problems. T-R&D activities are funded from central government budgetary sources on an annual basis--straight institutional support. There is no mediating technical agency that monitors budget requests for duplication of effort and purchases of equipment, relative balance between elements, or cost-benefit analysis of the distribution of funds. Practically every T-R&D unit has some degree of organizational autonomy and, therefore, budget requests are treated singularly, usually with allocations being made on the basis of availability of funds and past allotments rather than on merits of work performed or project objectives. Thus, the T-R&D units admit little outside influence on the way in which operational goals are set and resources allocated. Since most T-R&D units have grown up in very close cooperation and association with the universities, the internal organization and reward systems that have evolved in R&D units are very much like those of the universities. Being professionally autonomous, each researcher decides what work he will pursue and acknowledges only peer judgment as to the "usefulness" of his work; promotion and wage scale are dictated by university

degree and professional standing in the field (meaning publications), etc. With this type of internal arrangement, the T-R&D units respond to the orientation of their staffs, in most cases, university-trained graduates who are more familiar with the theoretical than the practical due to lack of equipment during university training and due, perhaps, to their own inclination to pursue the rewards of basic research rather than applied research. The result is fragmentation of efforts, orientation toward basic and academic research, and a large number of R&D projects of unrelated objectives being conducted in accordance with the resources and timeframe of individual laboratories.

Secondly, T-R&D is not related to other functions of the innovation process which must be coursed if R&D results are to be finally utilized in some production/service process. There is a weakness in the science and technology structure at the level of engineering design and prototype manufacture--the pilot plant stage where laboratory bench results are tested and modified for actual manufacture and/or operation. Technologists contend that this "missing link" of the technology innovation chain is the reason why few R&D products are ever developed to the point of being utilized in local enterprises. They argue that local Egyptian industrialists, managers, and administrators are prohibited from utilizing the product/services of local R&D, because they: (a) undervalue the benefits of technological innovation and are not technically conversant with either variants of technology or modern management criteria; (b) are prohibited or discouraged from innovation by administrative policies and regulations which are basically disincentives; (c) are disparaging of Egyptian technological capabilities and prefer direct import of foreign expertise and technology; and (d) are distrustful of T-R&D unit's desire or ability to work on their real problems because of so many past failures with these same units. Given these attitudes, T-R&D researchers contend that managers and administrators have to see products and processes in hand, and have hard facts on economic and technical feasibility of an innovation before they will invest in its installation or adoption and, therefore, pilot plant facilities are needed.

Two other factors probably explain at least as much about why T-R&D is truncated at the development phase as does the lack of pilot plant facilities. Laboratory R&D is only the first phase of technological innovation and it is the cheapest. In the United States the relative costs f r basic research, applied

research, and project development are on the order of 1:5:19--or percentage ratios of 4 percent, 20 percent, and 76 percent. Net investment needed to actually move an R&D project to full production stage is on the order of ten times the total R&D expenditures. The substantial jump in costs from basic and applied research to project development is probably of such a magnitude that action organizations will not move to the development phase unless they are sure that funding is available for later investments. The second additional factor of explanation is implied by the first--a lack of coordination and interaction between T-R&D units and implementing action agencies and enterprises. Given the relative costs of moving a piece of research through its applied and development phases and then into production, the researcher must spend more effort to secure "development interest" of an end-user before the R&D is undertaken. Contract research, joint industry-laboratory research advisory boards, and in-house R&D capabilities are only a few of the means by which end-user and R&D producer can coordinate their actions. All three devises are used in Egypt, but with only limited effects.

This analysis of the problems suggests several approaches to altering the performance of the T-R&D sector so that it would be more responsive to the needs of technological modernization. In the course of reviewing this problem, A.I.D. was presented with requests for assistance which represented three alternative points of intervention or approaches for effecting a change in the performance of the T-R&D sector: a) The orientation of research preferences, experience and competence of scientists, engineers and technologists; b) The autonomy of research units to set R&D objectives and allocate resources; and c) the points of contact--the interface--between T-R&D and industrial and service sector investment programs.

a) It was suggested that the R&D community's penchant for basic, theoretical research and ignorance of applied fields is a resultant of the very theoretical training received in Egyptian universities. Therefore, A.I.D. was requested to finance the creation of new "applied" programs in universities that would provide a practical balance to the present theoretical orientation--an emphasis on experimentation, the use of laboratories, pilot plants and testing facilities, and research on actual problems of industry <u>in situ</u>. This involved curricula changes, large amounts of equipment and facilities, and

uncertain commitment on the part of industry to cooperate. It would be a dubious solution at best since it ignored the fact that the structure and incentives of the present T-R&D sector controlled the behavior of the practicing researchers as much as they controlled the system; that it was costly; that it involved higher education with all its problems of numbers and policies; and that it therefore involved much more than a concern for the operation of the T-R&D sector.

b) There has been a trend to create T-R&D units for every industry and technical ministry. The cognizant industry/ministry administration would control the R&D unit's performance and provide its budget, thereby assuring that the R&D work would be directly related to the industry's business. This approach assumes that industry/government appreciates the value of T-R&D and will support the unit to its full marginal value; that industry administrators know how to manage internal R&D capability; and that the scientists and researchers will be willing to accept such "outside" control. It also ignores the fact that there are many T-R&D needs which transcend single industry/ministry jurisdiction, and that the pattern of organization suggested here is limited to monopoly functions, such as petroleum industry or electrification. It does not suit industries composed of many small, perhaps private, plants such as construction or textiles. It also concentrates on building more capacity--more institutes--to do R&D. There is already a surfeit in the country. The question is performance, not capacity. The greatest pay-off for investment in the sector will come from the marginal increments that result in the release of the pent-up potential of the already available capacity.

c) An immediate concern of many T-R&D units was to become "customer-oriented" in the sense of receiving project purpose and budget from an outside end-user. To this end we found concern for such assistance as creation of techno-economic and marketing study capability, program management, and institutional reorganization of research units. The concern was to establish a relationship which would move the T-R&D sector to apply itself to the problems of the potential user of T-R&D. Conversely, the T-R&D sector expressed concern that industrial and governmental decision-makers and administrators must also move toward acceptance of T-R&D as a profitable and necessary input factor for their operations. We elected to support this approach because it utilizes the

general decision-making structure of both the T-R&D sector and that of the end-user industries and agencies to arrange their own accommodation to a meaningful relation. The approach concentrates on two areas: (1) providing the mechanisms that allow interaction between program decisions of the T-R&D sector and investment/expenditure decisions of industry and development agencies of the government, and (2) manipulating a system of influences and incentives external to the T-R&D units which may cause them to select and allocate resources to more research projects of an applied nature.

The Project

The single most pervasive linkage between R&D design and industrial/ministerial programming is the Egyptian Academy for Scientific Research and Technology. Fourteen special research councils of the Academy composed of representatives from universities, autonomous laboratories and institutes, the National Research Center, industries, and ministries meet periodically to review, evaluate, and approve plans for priority R&D. This mechanism needs strengthening from several points of view, not the least of which is the need for a methodology by which the Councils can set priorities, allocate resources, and evaluate progress for a complete goal or mission-oriented R&D program. The Academy in turn lacks the staff, talent, and organization to prepare for the Councils studies which provide alternative research approaches, proper monitoring and evaluation of projects, and training in analyzing R&D requirements and benefits of any given investment/development program. If through the design of well-conceived and complete R&D programs the Academy can be the mechanism of interaction between T-R&D projects and end-user programs, then there will be established a series of standards against which the performance of individual T-R&D units can be judged. If the R&D program is then supported with sufficient funds to achieve the set goals, the T-R&D units will be enticed to alter their performance behavior in order to participate in the funding. That is, if the T-R&D/Industry relation is initiated by the Academy's R&D plans, and the dialogue is ordered continued through the project criteria the Academy will establish for participation in the plan, and the plan is well funded, then we expect that the T-R&D units will take many steps to orient their performance to the plan's criteria and the output-end-user relationship will have been established.

Goal:

The Technological Research and Development structure will be operated in such a way that its performance and production will provide technological analysis and appropriate technologies for development programs designed to improve the physical and social welfare of Egyptian populations.

Project Purpose:

1. Create within the Academy of Scientific Research and Technology:
   a. the capacity for producing feasible problem-oriented research and development strategies and programs which are derived from industrial and governmental plans for program spending and investment.
   b. the ability to produce project design criteria and guidelines.
   c. the organization and staff capable of mounting, managing, and evaluating such R&D strategies.

2. Effect changes in the organization, procedural, and technical arrangements of selected T-R&D units, particularly the National Research Center, so that they might effectively direct mission-oriented R&D programs related to development problems.

3. Conduct major T-R&D programs which are designed to affect important development problems and/or constraints.

The first aspect of the project we are developing focuses on assistance to the Academy in formulating and adopting modern, comprehensive techniques, criteria, and organizational arrangements for T-R&D design and evaluation. It is an attempt to introduce into the T-R&D structure the idea and the reality of mission-oriented research and development.

Our objective is to create within the Academy an ability to devise research methodologies and programs, that is, a plan for research which states the program objective, sets achievement goals, and then identifies and gives priorities to the research required to achieve the goals. Such a research program provides a framework for selecting, initiating, and monitoring research projects. It provides a means of rationalizing project priorities and resource allocations among many possible areas of research.

A well-documented research program systematically defines the problem area and indicates all important causal relations. It then reviews the

literature and the present state-of-knowledge. Thirdly, it describes the environment within which a solution must be set and identifies constraints to utilizing a number of possible solutions. Finally, it identifies those research approaches which appear to be most promising given the present state of knowledge, the relative difficulty of achieving successful results, and the environmental constraints to certain solutions.

When such a plan for research is combined with a standard list of criteria for designing research projects within the framework of the strategic plan--then we are approaching a complete, well-designed research program which will produce a package of useful research results. With a plan and the criteria for project design as guides, the T-R&D units are able to present projects and funding requests which, when completed, will collectively provide R&D that makes an impact on development programs.

With such a research program, the Academy will be able to indicate to the technical ministries, the Ministry of Finance, and its own R&D units, where there are gaps and shortfalls which must be made up if the program objectives are to be met. It is at this point that the Academy may begin to collect a modicum more of influence over resource allocation to and within the T-R&D sector. When the Academy is able to demonstrate that information management can be translated into organizational influence, we expect that other managers of T-R&D will seek assistance in their own program design and management. The Academy should then have the capability to disseminate the techniques of research design. Through workshops, classes, publication of standards and criteria, exchanges of research results, and similar mechanisms, the Academy may convince others to adopt similar styles of R&D management.

Through program design we can provide assistance to several areas:

- management information: its generation and manipulation.
- techno-economic studies of problem/solution alternatives.
- project monitoring and evaluation.
- organization of multi-disciplinary and inter-organizational programs.
- criteria and standards for judging program feasibilities.

In a second part of the project we expect to work with the National Research Center and other T-R&D units to design and implement research projects which respond to the requirements of a well-designed research program. The NRC,

like other units must make substantial structural change to reorient its performance to problem-related R&D. Formation of research teams is hindered by administrative regulations which inhibit mobility of resources and the sharing of facilities; documentation and information on foreign technologies, applied research, and studies are still outdated and insufficient; there is no capability in techno-economic analysis which can guide the selection of alternate research approaches; there is little experience with effective working linkages with end-users and program implementors; and there is a lack of prototype design/testing facilities. These, among others, are some of the barriers to effective performance on a mission-directed research program.

The NRC will serve as a central focus for experimentation with organizational and managerial arrangements that produce improved R&D/industry relations and performance in mission-oriented research programs. It will become a center of technical assistance to other T-R&D units that wish to reorganize their own programs toward more applied, end-user responsive work. Substantial technical assistance will be provided to the NRC, and from there be extended to other units.

A third and most important part of the project will deal with individual R&D units in universities, technical ministries, and semiautonomous R&D organizations. The Academy itself is not a research organization--it has no executing laboratories totally under its control. The actual R&D is performed by a number of laboratories and organizations--each varying in the degree of autonomy it has to select R&D projects and allocate internally its funds; each varying in the types and intensities of constraints/incentives for its R&D to be relevant to Egypt's development problems. Only by changing the current performance of these units will the T-R&D needed for an increasing rate of technological innovation in Egyptian development plans be available. No one project can hope to identify all the reasons why these R&D units do not now perform effectively nor devise a series of policies to correct the inhibiting variables. However, a series of incentives contained in a project process can serve as an alternative reward system which allows each unit to reconsider and possibly change its own structure and performance to conform more to development needs for R&D. By providing (i) R&D strategies which are derived from and integrated with development programs and thus hold promise of implementing R&D results; (ii) a series

of project design criteria and guidelines, backed by a new capability in R&D management and evaluation; (iii) technical assistance in laboratory organization and management; and (iv) contract grants for actual conduct of approved T-R&D, the project expects that many units will be induced to reorient their structure and performance.

This part of the project, then, will provide dollar funds to the Academy and/or the National Research Center to use in contract research with separate R&D units. Dollar and local currency funds will be granted to T-R&D units which are willing and capable of conducting certain R&D projects that fit the criteria and methodology set by the Academy to achieve the goals and objectives of its R&D plans. These funds will be used for the purchase of equipment, materials, technical assistance, observation-training in the United States, professional time, and expenses for work in the field.

Thus, the project will operate at several levels of organization:

1. Research Management and Design.

At the level of the Academy, the project will provide technical assistance through the United States National Academy of Sciences and other organizations to develop a capability to design research plans; to contract, monitor, and evaluate projects which complete the research plans; and to collect and analyze information for setting effective science policy.

2. Institutional Development.

i) At the level of the National Research Center, the project will provide technical assistance in the areas of project management, techno-economic studies, institutional management, industrial liaison and marketing analysis. It is expected that during the project the NRC will assume the leadership role in providing other R&D units with technical assistance in these areas.

ii) The project will provide the Academy and/or the NRC with a substantial dollar fund to use in conjunction with counterpart local currency for the conduct of applied research related to problem areas which have high priority within the development programs of the country. Using these funds the NRC will undertake specific R&D projects, and priority projects will be contracted and/or subcontracted either by the Academy or NRC to universities and

other institutions that are interested and capable of conducting applied research according to the Academy's research design and project criteria. The dollar funds will be used to provide training in the United States, technical assistance, literature and documentation acquisition, equipment and pilot plant facilities needed to undertake specific applied R&D projects.

3. Technology Transfer Studies.

The project will provide technical assistance and research funds for Massachusetts Institute of Technology and University of Cairo to jointly create within the University of Cairo an ability to conduct project feasibility studies and general systems analysis of alternative development strategies and programs, for example, in housing, construction industry, transportation, village mechanization, power, etc.

Major Assumptions:

1. Purpose to Goal.

   a. The Special Research Councils in the Academy are composed of representatives from all sectors of T-R&D producers and users; their function is to set area priorities for research and approve R&D programs of the Academy. This mechanism must function as the connection between development need and R&D plans. The capabilities being established in R&D design and management will be compatible with this system.

   b. There will continue to be R&D project funds available to the Academy to contract for R&D against an objective, i.e., mission-oriented research.

   c. The Academy has sufficient influence over T-R&D units so that the type of design criteria and management methods employed by the Academy will be considered for adoption at other levels of management and coordination of T-R&D. (Spread effect.)

2. Outputs to Purpose.

   a. The newly created Ministry of Scientific Research and Atomic Energy and the Academy still have not agreed on a division of duties and control over institutions. We assume the Academy in all cases will keep its role as planner, coordinator, and funding source for development-oriented R&D.

Financial Requirements:

1. Technical Assistance Contracts.

MIT/Cairo University	$200,000 x 5 years	$1,000,000
NAS/Academy	$200,000 x 3 years	$ 600,000
Industrial Research and NRC	$150,000 x 3 years	$ 450,000
Others	$100,000 x 3 years	$ 300,000
		$2,350,000

2. Pilot Plant-Equipment (NRC).

First Year $1,000,000

3. Project Funds for Research.

Equipment

Training

Library materials and documentation

First Year $1,000,000

Second Year $3-5 million

4. Local Currency.

First Year ??

Second Year (GOE) 1 million

Funding of the R&D projects could best be handled by "capitalizing" the Academy so that as R&D strategies are developed, the funds to contract projects research are available. The nature of R&D work and the product seem to dictate this type of funding.

(a) While we can define rather clearly during preparation of the PP the areas in which the Academy will develop R&D strategies and programs, we cannot anticipate before hand the nature, number, size, or extent of research projects that will be needed to achieve the objectives of the R&D programs. Therefore, the ProAg would not show the expenditure schedule for project items such as equipment, training and library materials.

(b) Since each R&D product is a unique piece of work--seldom comparable among themselves--we cannot set an arbitrary figure of costs per project, or division among inputs for a "standard size" project.

(c) R&D work varies in its degree of originality and consequently the time needed to produce a certain product varies. Therefore, in the initial phases of planning a research project, costs can only be approximated. As progress is made, there must be a flexible funding source which can accommodate extensions and curtailments of projects.

(d) According to the product desired, R&D projects show different patterns of expenditure releases--funds are not drawn-down uniformly throughout the several project stages.

To accommodate these particular conditions for R&D work it seems that the most efficient form of financing for AID would be to set up a research fund against which the Academy can let contracts for agreed upon projects as R&D programs are developed and implemented.

VI. U.S. NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED TO NATIONAL NEEDS PROGRAM

During recent years the National Science Foundation has developed improved capabilities to stimulate research efforts more immediately and directly related to problems of society and the environment. This section presents a discussion of the U.S. National Science Foundation's Research Applied to National Needs (RANN) program, adapted almost verbatim from Guide to Programs, National Science Foundation, Fiscal Year 1975 (pp. 17-27). The section is included in order to describe a major organizational procedure by which the United States has attempted to meet national need requirements, a procedure comparable in some ways to that being contemplated in Egypt.

The problems, challenges, and opportunities to which the scientific community must respond in meeting national needs require careful and objective analysis, expansion of the pool of directly relevant knowledge, and considered efforts to make this knowledge available to interested users. Specific national needs provide the basis for program objectives, and organization and management of the research supported under these programs. The principal program efforts included under the Research Applications Directorate, NSF, are presented under the collective heading Research Applied to National Needs (RANN). The major coordinated research programs administered under RANN in 1974 were Energy, Environment, Productivity, and Exploratory Research and Problem Assessment.

To focus research on national needs, the Research Applications Directorate in 1973 reorganized a former program structure for RANN. Previously existing programs [Advanced Technology Applications, Environmental Systems and Resources, and Social Systems and Human Resources] were realigned to direct major thrusts toward solving problems in the areas of environment and productivity. The Energy program and the Exploratory Research and Problem Assessment program remained essentially unchanged.

The new programs were Environment and Productivity. The part of the Technology Applications program that was concerned with disasters and natural hazards (earthquake engineering and fire research), together with

Environmental Systems and Resources, has become the Environment program. The balance of Technology Applications, along with Social Systems and Human Resources, became the Productivity program.

The organizational structure of the Directorate was changed to align with the new program structure. In addition, the Office of Experimental Research and Development Incentives was transferred to the Research Applications Directorate.

Two additional Research Applications programs--Intergovernmental Science and Experimental R&D Incentives--are also included in the program descriptions on the following pages. Before submitting a proposal for research support, research institutions are urged to consult descriptive brochures on RANN, the Intergovernmental Science and Research Utilization programs, or Experimental R&D Incentives.

The following criteria were utilized in developing the ongoing major coordinated research efforts of RANN:

- Importance--the significance and urgency of the problem area or the potential consequences for the Nation are great;
- Payoff--the benefits to be realized are significantly higher than the anticipated research and implementation costs;
- Leverage--science and technology can have a unique and substantial impact on the problem;
- Readiness--the effort is timely and scientifically ready and the skilled manpower is available;
- Capability--Federal, academic, and industrial capabilities exist to mount a successful research program;
- Need for Federal Action--the research is not being conducted by private industry because the identifiable incentive is not sufficient or the market is fragmented;
- Unique Position of NSF--the NSF can most effectively serve the research needs of the Government because the problem;

(a) falls between or outside areas of responsibility of other agencies;

(b) spans the areas of responsibility of other agencies; or

(c) relates to meeting longer range and special requirements of other agencies and the Nation.

Eligibility

Proposals may be submitted by colleges, universities, and profit and nonprofit organizations. These proposals may provide for collaborative arrangements with other universities, nonprofit and/or profit-making organizations.

Industry and other organizations are eligible to participate on the same basis as academic institutions in research related to national needs. Universities will continue to receive primary support in the areas of research suited to their special expertise. Unsolicited proposals are expected to offer a unique technical contribution and show strong relevance to program objectives to merit full evaluation. Such proposals are subject to cost-sharing. Proposals are solicited as necessary. Awards resulting from solicited proposals may provide full costs, with cost-sharing or fee negotiated as appropriate. Joint proposals from universities, nonprofit institutions, and industry are encouraged to bring broader capabilities as well as interdisciplinary skills to the support of the NSF Research Applications program.

Deadlines

Unsolicited proposals may be submitted at any time and should first be submitted in preliminary form for negotiation and discussion. Approximately six months are required for consideration of proposals. Program announcements, program solicitations, and requests for proposals may be issued from time to time in targeted areas. Such announcements will specify a deadline for submission.

Energy

The energy program supports research in areas which lead to the implementation and utilization of new energy concepts and options. The research is an interdisciplinary undertaking in which matters concerned with technology, environment, social aspects, legal, economics, and technology assessment are investigated.

The three general objectives in energy are to sponsor research on:

- Analysis of future, intermediate, and long-range needs and various strategies for meeting these needs.

• Environmental, economic, and social impacts of energy production, and use and means for assessing and ameliorating detrimental impacts.

• Neglected or otherwise underexploited technologies which may have significant impact on the energy problem.

Specific areas of emphasis include:

• Solar Energy--Research in solar energy explores and develops the technologies needed for terrestrial applications of solar energy. The areas of research are solar heating and cooling of buildings, production of electrical power from solar, thermal, and photovoltaic radiation, generation of clean fuels by bioconversion of organic materials, and generation of power utilizing wind and ocean thermal gradients.

• Geothermal Energy--Research in geothermal energy will help to assess and prove the potential of geothermal energy as an energy resource.

• Energy Conversion and Storage--Research applied to the development of improved technologies for conversion and energy resources to usable form, and improved energy storage.

• Energy Systems--Research deals with the analysis and synthesis of alternative means (including conservation) of meeting U.S. energy requirements while satisfying environmental quality constraints; the analysis of energy R&D opportunities; and mathematical modeling of major sectors of the energy industry.

• Energy Resources--Research seeks to expedite the development of novel and innovative technology that will allow the energy resources of the United States to be used in an effective and economical way.

• Advanced Automotive Propulsion--Research to acquire an understanding of basic fuel combustion and energy conversion processes as they relate to the design of engines with greater efficiencies, while maintaining low air polluting emissions.

• Energy and Fuel Transportation--Research seeks to develop improved methods to solve the complex problems posed by the transportation of energy from production to consumption sites including novel power transmission technologies, and the application of computer methodology to operating, planning, modeling, and optimizing these systems.

Environment

This program will develop scientific data and strategic frameworks to deal with environmental and natural resource problems, and with disasters and natural hazards. Included will be the complex trade-offs between economic and social development and environmental quality, and socio economic response to natural hazards.

1. Managing the Natural Environment.

a. Regional Environmental Management.

The purpose of this program is to study regional environments and resources in order to establish the scientific basis for their management and use. A major aim of the Regional environmental Management Program is the enhancement of man's capacity to select from the universe of development and management strategies those which most effectively achieve environmental quality objectives within the context of other societal goals. Objectives of the program are:

- Define environmental problems, including those unique to a particular region and those common to many regions.
- Identify resources impacted and ecosystem relations to predict consequences of alternative schemes to correct environmental problems.
- Evaluate economic and legal mechanisms as management options available to decision-makers, the specific environmental effects of these options, and the potentially detrimental effects of other forms of public policy.
- Synthesize management schemes utilizing the necessary environmental, economic, and social information.
- Evaluate management schemes in relation to other policies designed to meet other societal objectives.

Major research efforts include studies of environmental aspects of:

- Coastal Zone Management
- Urban/Rural Environmental Management
- Land Use Allocation

b. Environmental Aspects of Trace Contaminants.

This program is designed to develop an understanding of the impact on man and the environment of many known and potential environmental trace contaminants, such as manufacturing by-products, agricultural and household wastes, oil and hazardous materials spillage and dissipation, and elements of the bio-geochemical environment for the purpose of understanding and control. Specific objectives are:

- Determine the levels of toxic substances in the environment, how and where they accumulate, and how they are destroyed.
- Assess the effects of these levels on animal (including man) and plant communities.
- Relate these findings to methods of control by current practices or new methods.

In order to attain these objectives:

- Toxic or hazardous substances must be separated from complex mixtures, identified, and measured.
- The movement and rates of flow of contaminants through the environment must be traced from their sources to their ultimate sinks.
- Target organisms along, and at the end of, the routes of flow and their sensitivity to toxic agents must be determined.
- The complex relationships between biotic communities and the effects of the biologically available toxicants must be understood.
- Research results must suggest improved monitoring systems, and ultimately lead to technological, legal, and economic abatement or control measures.

The major research elements are:

- Trace Contaminants in Biota and Food Chains
- Concentrations, Routes, and Rates of Flow
- Chemical Changes in Trace Contaminants
- Techniques for Measuring Specific Environmental Pollutants.

c. Environmental Effects of Energy.

The objective of this program is to develop the scientific knowledge base needed to help in efforts to reduce conflicts between increased energy production and environmental quality. Alternative means will be sought to reduce the environmental impacts of energy extraction, generation, transportation, and consumption. Emphasis is placed on environmental effects susceptible to new control technology, as well as on indirect environmental consequences of energy extraction, transportation, and use.

Specific objectives of this program are to:

- Analyze environmental contaminants and land use consequences of energy resource extraction.
- Evaluate environmental effects and develop criteria for siting to minimize effects of fuel processing, central power stations, and other conversion facilities.
- Analyze the environmental effects of alternative uses of energy for transportation and industrial productivity.

2. Disaster and Natural Hazard Research.

The subprograms in this area are Earthquake Engineering, Fire Research, Weather Modification, and Socioeconomic Response to Natural Hazards. The natural hazards to be considered are primarily dynamic in nature and include earthquakes, tsunami and wind-induced waves, and unwanted fires.

a. Earthquake Engineering.

The basic objectives of this program are to:

- Develop economically feasible design and construction methods for building earthquake-resistant structures.
- Develop methods of analysis which integrate acceptable structural risk with the natural hazard potential of proposed construction sites for the purpose of improved structural design and land-use decisions.
- Develop an improved understanding of social and economic consequences of individual and community policy decisions on earthquake-related issues.

b. Fire Research.

The following objectives indicate the scope of the research:

- Increase the basic knowledge on the mechanisms of ignition and flame spread.
- Study specific classes of materials, particularly n materials for burning and the products of combustion.
- Obtain basic information on fabric flammability and associated hazards leading toward the setting of standards.
- Study flame spread mechanisms in structures.
- Develop models of flame spread.
- Develop knowledge of the mechanisms of flame suppressants.
- Seek improved means for fire detection, alarm, and control.

c. Weather Modification.

The overall purpose of the Weather Modification Program is to study those atmospheric mechanisms which can be or are being influenced by man to modify natural weather patterns and evaluate the impact of their modification upon society.

The specific objectives may be defined as follows:

- Develop a level of understanding of the mechanisms of hail formation in severe convective storms which will lead to a more reliable method of hail suppression.
- Develop a more adequate knowledge of the ice nucleation mechanism in the atmosphere which will result in a capability to measure and predict the consequences of a seeding operation.
- Develop sufficient understanding of the mechanisms by which human habitation may produce anomalies in the weather patterns that adverse effects may be forecast in advance and corrective action taken to minimize the impact.
- Develop new and more accurate concepts of how, when, and under what circumstances weather can be modified by artificial means.
- Increase our understanding of the social, economic, legal, and ecological impact of operational weather modification practices upon society.

d. Socioeconomic Response to Natural Hazards.

The purpose of this research is to evaluate the benefits and costs of different combinations of adjustments that can be applied to specific natural hazards. Studies will assess the effectiveness and comparative value of prediction and warning, disaster preparedness, physical protection, land-use management, insurance, and relief.

Productivity

The objectives of the RANN program of Productivity are to increase performance and output in the public and private sectors and to identify the impacts of public policies on productivity.

1. Public Sector Productivity.

To improve public sector productivity, RANN directs major activities to the following areas:

- Productivity Measurement--There will be increased emphasis on the implementation and validation of measures by which to assess the effectiveness and efficiency of major Government functions such as fire protection, street maintenance, solid waste collection, etc. Work will be carried out on integrating the improved measurement methods into the budgetary processes of municipal governments.
- Advanced Communications Technology--Experiments will continue on investigating the use of two-way cables in improving urban administration and service delivery. Work will also continue on alternative forms of communications to enhance citizen-government feedback. The use of teleconferences to reduce energy and transportation requirements will be explored.
- Technology Utilized by Local Government--Research to develop performance specifications and other means for improving equipment procurement processes in local government will continue. The objective of this research is to provide local governments with improved criteria and procedures for making procurement choices.

- Finance and Service Delivery--Research on alternative organizational responsibilities for the delivery of urban services will be continued in the areas of solid waste, fire, police, and public health. Research on revenue sharing will be expanded to consider the costs and benefits of alternative mechanisms to provide assistance to State and local governments. Research will also begin on alternative Government programs for stimulating and guiding industrial development in given States and cities.

2. Private Sector Productivity.

The second element of the RANN Productivity program is directed at improvements in private sector productivity. Federal support of research on private sector productivity is needed when private R&D performers cannot capture the benefits of R&D investments because of market conditions and structures; when the benefits of research occur beyond the planning horizons of the private sector; when the risks and uncertainties of the research are high; or when private market resources are inadequate and there will be a significant national benefit from the research.

- Advanced Industrial Processing--A major emphasis of the program is on research to incorporate enzyme technology in the food and pharmaceutical industries to attempt to lower processing and production costs.

- Production Research and Technology--The objective of this research is to develop and examine the new technological options for U.S. manufacturing and to assess their cost-effectiveness. Research focuses on the application of programmable automation to the discrete product industries, for example, durable goods. "Programmable automation" refers to using general-purpose machines and special computer programs to enhance productivity in industries, such as machine tools, which produce limited quantities of different kinds of goods.

- Excavation Technology--The objectives of this program are to increase excavation rates and to reduce the costs of subsurface excavation and construction. In the near future, two methods of ground disintegration (thermal-mechanical and water-fit techniques) will be advanced to the proof-of-concept stage and their cost-effectiveness compared.

- Instrumentation Technology--This program is directed at lowering unit cost in production, diagnoses, and manufacturing quality control. Textile processing is a major thrust, with specific applications in contour weaving.
- Public Policy and Economic Productivity--The objectives of the research on public policy and economic productivity are to examine the effectiveness of current policy instruments affecting productivity and inflation and to assess the benefits and costs of alternative policies and programs.
- Macro-Economic Performance--Research will be carried out on possible "structural" economic influences in inflation because of recent difficulties in explaining inflation through aggregate supply and demand relations. In addition, a series of industry-by-industry studies of the dynamics of foreign trade will be carried out together with a coherent and systematic examination of public policies and programs (R&D expenditures, anti-trust policies, tariffs, patent laws) as they affect trade.
- Economic Growth in an Environment of Scarcity--Research will be undertaken to determine how scarcity affects the search for and production of resource substitutes. The consequences for prices, employment, and efficient organization will be assessed.
- Government Management and Regulation of the Economy--Research will reexamine the adequacy of anti-trust policies as a means of influencing economic performance as well as the benefits and costs of alternative forms of regulation.

The benefits and costs of alternative forms of Government procurement with emphasis on State and local levels will be assessed, since Government procurement of goods and the standards for procurement have an important effect on the quantity and quality of goods produced by the private sector. In addition, new techniques for forecasting economic performance will be analyzed and evaluated.

Exploratory Research and Problem Assessment

This program supports exploratory research and assessment projects to determine which national problems may be amenable to amelioration through the

application of science and engineering capabilities. Assessments will help to define the role of science in dealing with societal problems and will also examine the impact of science and technology on society. Principal goals are to define adequately the broad context of particular societal problems; and to identify those research opportunities and strategies which are critical to dealing with the problems. In this way, new areas of potential research investment for RANN or other agencies can be identified and the prospects for a more extensive program assessed. Major components of the program are:

1. Technology Assessment.

Technology assessment is the systematic study of the effects on society that may occur when a technology is introduced, extended, or modified, with special emphasis on the impacts that are unintended, indirect, or delayed.

Technology assessment may be viewed as one aid to the generation of public policy options with regard to the management of technology and as an input in the decisionmaking process. Assessment of physical, biological, and social technologies are all suitable for consideration under this program.

2. Selected Research Topics.

Problem assessment and technology assessment studies may extend across the full range of national and social issues. Exploratory research is limited to areas which have been identified as gaps in Federal and private research activity, which have high potential payoff for the Nation, and which otherwise satisfy the general RANN criteria.

The range and type of problem areas planned for this research program include:

a. Minority Group Problems.

Research will explore alternative mechanisms and methodologies for obtaining improved information on the nature and extent of problems affecting the disadvantaged minorities; on identifying policy-significant characteristics of minority communities; on exploring the interactions between society and programs which have special impacts upon minority populations; and on utilizing the talents of minority scientists and leadership in determining research priorities and in designing and conducting research projects.

b. The Consumer and the Marketplace.

Problem assessments and exploratory research on the interacting roles of the consumer and the marketplace. Emphasis will include issues of consumer safety and protection, consumer information, and consumer behavior. Special consideration will be given to areas of interest to Federal regulatory agencies.

c. Social Implications of an Aging Population.

Problem assessments and exploratory research on the societal consequences of a changing age distribution. The emphasis will be on the longer term social aspects of gerontology.

d. Technology-Related Transnational Problems.

Problem-oriented multi-disciplinary research will be applied systematically to selected technology-related transnational policy issues which need urgent attention by the United States and the international community.

e. New Problems and Projects.

Other research will be undertaken to provide needed assessment and exploratory research in response to creative, innovative ideas and approaches, where the societal problem satisfies the general RANN criteria but falls outside of the above-defined areas or the programs of RANN.

Intergovernmental Science Programs

The National Science Foundation awards grants to enable State and local levels of government to develop new and improved programs and institutions for the systematic application of science and technology to governmental problems, and for the utilization of research resulting from NSF applied research programs.

The objectives of the Intergovernmental Science Programs are to:

- Advance the understanding of public issues and problems having scientific and technological content at the State and local levels of government.

- Improve the capability of State and local government institutions for defining their research and technology needs and seeking ways to facilitate the application of research to civil sector problems.
- Demonstrate innovative science and technology planning and decision-making processes relevant to State, local, and regional problems.
- Promote and strengthen Federal-State-local government and private sector research and utilization relationships.
- Stimulate public and private sector user capability to implement RANN (Research Applied to National Needs) results.

The proposed activity must involve a problem of general interest to State and local governments. Preference will be given to innovative approaches to the development of models for governmental use of science and technology. Activities supported may include development of mechanisms, manpower, and education programs (involving State and local government officials), technology assessment and forecasting studies, research utilization and information transfer, and exploratory studies to help develop science and technology-related innovative policies and programs for State and local governments. Institutional support may be provided to assist in establishment of centers for governmentally related science and technology applications. Conferences and seminar projects at the State, regional, and national levels, and projects to collect and analyze data on State and local scientific and technical resources may also be supported.

Experimental Research and Development Incentives

The National Science Foundation supports a program designed to provide experimental evidence concerning various incentives which the Federal Government might use to increase the application and use of science and technology in the civil sector. The objectives of the program are:

- Identify institutional barriers to innovation.
- Test appropriate Federal action which might reduce such barriers.

The program will provide a focus in the Federal structure for testing various means of accelerating the rate of technological innovation in the private and public sectors of the economy. The program will support background studies to identify and understand barriers and blockages to the technical

innovation process in selected areas of application, and experiments designed to investigate incentives intended to overcome these blockages. Each experiment will support tests of the effect of a specific incentive mechanism on a barrier or set of barriers which inhibit the innovative process.

Areas of current program interest include:

- Testing and validation by Federal laboratories and approved private testing laboratories of new products that significantly extend the current state-of-the-art and which have their primary market in the public sector, i.e., municipal, city, county, State, and regional governmental public services.

- Cooperative R&D activities between colleges and universities on the one hand and industries, industrial associations, professional societies, profit and nonprofit R&D institutions, Federal laboratories, or State and local governmental entities on the other hand. The cooperative R&D proposal may include two cooperating institutions or multi-institutional arrangements. The proposed research activity should be for product, process, or service development of primary interest to the nonacademic institutions and in which one or more academic departments have a parallel or collateral interest.

- Urban and public sector technology transfer mechanisms that involve and explore improving the effectiveness of the roles of:
  - Universities,
  - Public service institutions,
  - Non-Federal governmental jurisdictions,
  - Research institutes,
  - Corporations and Federal laboratories.

Institutions interested in this area may submit proposals alone or jointly to support projects to test the effectiveness of incentives and technology transfer mechanisms to improve and accelerate the application of technology (products, processes, or service systems) to needs in the public service sector of the economy. In fiscal year 1975, projects will be limited to assessment and evaluation studies.

- Planning and definition studies in the area of financial incentives to technological incentives.

VII. SUMMARY OF NATIONAL SCIENCE FOUNDATION REPORT ON INSTRUMENT REQUIREMENTS[1/]

Introduction

A fact-finding team was sent to Cairo by the National Science Foundation during September 13-20, 1974. A summary of their report by Mr. Gilbert B. Devey, Program Manager, Research Applications Directorate of NSF follows:

Three excellent opportunities exist for the United States to provide rapid and significant assistance at modest cost to the development of a modern applied science and technology capability in Egypt. These are:

a. Provide continuing consultation on program development and management to the Academy of Scientific Research and Technology through the mechanism of a joint United States-Egypt Applied Research Advisory Board.

b. Make available sufficient U.S.-owned Egyptian pounds to restore and modernize the instrumentation facilities of the National Research Centre (NRC) and the Scientific Instruments Centre (SIC) (detailed plan in preparation).

c. Provide sufficient funds (US $) to support U.S. researchers in cooperative applied research projects of the highest priority in meeting the national needs of Egypt.

Applied Research Advisory Board (ARAB)

The Academy of Scientific Research and Technology is now in the process of developing a focus on applied research projects to meet the national needs of Egypt. New institutes administratively independent of the NRC are being formed; institutes for materials and for electronics are now being planned, and the formation of a textile research institute seems to have been discussed. These organizational shifts portend major changes in the programs of the NRC and the SIC.

[1/] Derived from Gilbert B. Devey, Instrument Requirements for the National Research Centre and the Scientific Instruments Centre, (Washington: National Science Foundation, September 1974).

The emphasis now being placed on applied research by the management of the Academy has not been accepted fully by a significant portion of the professional staff of the NRC. This became obvious in meetings with the President of the Academy (Dr. Abou-El-Azm) in which NRC researchers were present. At the first review session with Dr. Abou-El-Azm, we made a strong recommendation that instrument refurbishing and modernization be accomplished only when the action is clearly and directly pertinent to an important national need; the path from research objective to the utilization of successful results should be identified clearly. The NSF RANN project guidelines were described to illustrate one approach for coupling research projects to national needs. Dr. Abou-El-Azm responded enthusiastically to the RANN approach.

Several reasons for the strong residual allegiance to basic research are:

a. The present administrative structure is tied closely to the university community (with graduate students working in NRC laboratories on thesis projects).

b. Promotions (at least to mid-career) are controlled by the same statute as for the university, and the number of scientific papers that are published by an individual is more important than research projects successfully completed by an individual or by a team.

c. Inadequate facilities exist to encourage a significant amount of experimental research.

d. Institutional mechanisms for coupling to the user (industry) are weak or nonexistent.

e. There is inadequate back-up support (technicians) for the professional staff.

In response to a comment that applied research should not be supported to the detriment of basic research, Dr. Abou-El-Azm stated that the conduct of basic research should continue to be emphasized in the university setting but that programs supported by the Academy should focus on applied research projects of importance to Egypt.

The growing applied orientation within the Academy could benefit greatly from continuous access to expert advice in the development and management

of applied research projects. This could be accomplished by a U.S.-Egypt Applied Research Advisory Board.

Instrumentation Requirements

The minimum instrumentation capability essential to the conduct of scientific research does not exist in NRC laboratories nor in the SIC. Refurbishment of existing instruments and the subsequent modernization of facilities should be completed without delay and at the highest priority. Without achieving this minimum advance, it is not a question of whether the Academy projects will flourish, but rather it is only a question of when the new program collapses.

Specific recommendations (details in complete report):

a. Sufficient U.S.-owned Egyptian pounds (approximately $250,000) should be made available immediately for conversion into hard currency, for the purchase of the spare parts and repair services needed to place high priority instruments into satisfactory condition. [The NRC/SIC would prepare a detailed proposal for this purpose as already discussed with the NSF Fact-Finding team.]

b. Provisions should be made to modernize the instrument facility, with each request related directly to a high priority national need. Estimates have not been made of the cost involved, but it is reasonable to anticipate that a sum of $1.5 million for new instruments and $1.0 million for equipment associated with proof-of-concept (pilot plant) experiments will be justified easily, considering the scope of the overall program.

c. U.S.-owned Egyptian pounds should be used in support of the activities of a "quick-fix" technical team for on-site repair work at NRC/SIC, for individual tutorial visits of key NRC/SIC personnel to U.S., Indian, and UNIDO centers, for workshops in Egypt, and for varied technical services. This is estimated to amount to $110,000 during the first twelve-month period.

Cooperative Projects

Sophisticated instrumentation commonly found in a number of U.S. institutions could be used with great effect to help the NRC in selected

areas. One such project was identified and a proposal prepared during our visit at NRC. The project would use instrumentation at the University of Florida to analyze materials indigenous to Egypt for the purpose of locating new sources of ngredients for brickmaking. Another casualty of the Aswan Dam is the lack of silt for brickmaking.

Another project described by Dr. Mahmoud, Petroleum Research Institute, involves the establishment of a documentation center (data bank, information retrieval system, computer services, conference center, etc.) for the entire Academy of Sciences and would serve as a regional resource for the Middle East and Africa.

It is recognized that cooperative research projects already exist and that others are being considered for support. The reason to highlight such projects in this report is to emphasize the need to relate all such projects to the instrumentation capability expected to exist and to ascertain that an important national need is involved.

VIII. THE SCIENTIFIC INSTRUMENT CENTER,[1/] CAIRO

Technological development is now inseparable from instrumentation; this is as true in industry and medicine as it is in fundamental and applied research. Development cannot await the establishment of a scientific instrument industry, and so an ever-increasing quantity of instrumentation is being imported. The proper maintenance and repair of these instruments is essential to their proper functioning; without it, their life will be all too short.

In developed countries, this essential task of maintaining and repairing instrumentation is handled at several levels. In each user establishment, whether a commercial factory, a research establishment, or a university laboratory, technicians with good basic training are recruited to care for the particular equipment in use on that site. Operators handbooks and service manuals are supplemented where necessary by short visits to the manufacturer's establishment where diagnostic, routine, and preventive maintenance can be demonstrated.

Foreign suppliers are represented by technically competent agents, who themselves normally undergo a course of training in the overseas manufacturer's plant, and who also carry a full complement of essential spare parts of the instruments which they supply. Any unusual requirements which are not available in the user country can be air-shipped on request.

The whole of this complex and complicated operation takes place within the normal private enterprise system of the country involved, and calls for no special action by Government or Government departments.

In Egypt, like some other developing countries, the sources of supply of scientific instruments are diverse, which implies the necessity of having agents for every producer or of establishing a central organization to deal with such problems on a scientific and technical basis and to extend its activities to the problem of instrumentation as a whole. To have agents for every producer is quite difficult and therefore establishment of the Scientific Instrument Center was the best practical approach.

The Scientific Instrument Center (Cairo) was established in 1956 as a section of the National Research Center, to cater for the repair and maintenance

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1/ Prepared by Medhat El-Alaily, Director, The Scientific Instruments Center.

of the National Research Center equipment at first, and then to service equipment for other research institutes and universities.

Since its inception, the Scientific Instrument Center has received assistance from UNESCO by means of expert assignments, fellowships, and equipment, according to the need of the Center at that time.

During the following decade, the large increase in the use of instrumentation in various fields led to a reappraisal of the Scientific Instrument Center. In 1964, it was established by a presidential decree as an integral part of the (then) Ministry of Scientific Research. With the passage of time, the demands for the services of the SIC diversified considerably. Although repair and maintenance was its primary role, it was also called upon to manufacture specialized equipment for research projects, spare components, and assemblies for the modification of existing instruments, and to undertake the training of specialists and technicians in various techniques within the broad field of instrumentation.

The capabilities of the Scientific Instrument Center are becoming increasingly of interest to other sectors of the national economy. Since its incorporation within the Academy of Scientific Research and Technology in 1971, it has begun to work (implicitly if not explicitly) at the national level in its direct services and at the regional level in its training activities.

The Scientific Instrument Center is potentially of interest to the National Research Center, the Institutes associated with the Academy of Scientific Research and Technology, to universities, and to the Ministry of Health, the Ministry of Agriculture, the Ministry of Industry, the Ministry of Irrigation, the Ministry of Interior, the Ministry of Higher Education, and the Ministry of Education.

SIC receives annually about 3,000 requests for goods and services in the domain of repair and maintenance, design, construction, and consultation. This number is expected to increase substantially in the coming years.

Regarding its training activities, SIC has trained more than 300 specialists and technicians from different organizations in the country. On the regional levels, SIC with the cooperation of the Arab League of Educational, Scientific, and Cultural Organization held four training

programs for about 200 technicians for eleven Arab countries in fine-mechanics and glass-blowing. Furthermore, training programs will be held in the fields of optics and electronics. Through bilateral agreement between the Center and some Arab countries, several technicians have been trained in all fields of specialization of the Scientific Instrument Center.

The Scientific Instrument Center occupies a floor area of 1,800 square meters within the compound of the National Research Center, Dokki, Cairo. The existing building consists of four stories (including ground level) and plans exist for the addition of another story. The estimated book value of installed plant and equipment is approximately 200,000 Egyptian pounds. The number of personnel employed in the SIC is about 310 comprising:

Graduates	65
Technicians	90
Workers	110
Administrators	25
General service	20

The Scientific Instrument Center is a part of the Academy of Scientific Research and Technology. The director of the SIC reports to the President of the Academy. It has no independent budgeting, and its hard currency allocation is unpredictable.

The SIC is composed of five technical departments: electronics, electrical, optics, glass-blowing, and mechanics. Each department is divided into several laboratories comprising some or all of the following: repair and maintenance, design and development, manufacturing, and testing and measuring.

The future activities planned for the Scientific Instrument Center are as follows:

1. Training Activities.
   a. To cooperate with the ministries in the establishment of a training program for instrumentation engineers and technicians.
   b. To cooperate with the Arab League Educational, Culture, and Science organization in the development of the present training programs to cover more fields of specialization.

c. To carry out more training programs on specialized subjects through bilateral agreements with Arab countries.

2. Development, Design, & Manufacture Activities.

a. Develop, design, and manufacture some scientific instruments, special devices, and components required for scientific research experiments and other purposes, that are not within the technical capability of local industry.

b. Supporting the scientific and teaching instrument industry by:

1) Development of some kinds of these instruments.

2) Design and production of prototypes.

3) Giving assistance for commencing production of previously developed instruments of which it has already produced prototypes.

c. To have a permanent staff of qualified engineers, technologists, and technicians by training under experts or through fellowships.

3. Repair and Maintenance.

a. To give best technical services in scientific instrumentation repair, maintenance, and recalibration, that would not be given in place of use.

b. To carry out routine servicing and maintenance in place of use through contracts with different organizations in the country.

c. To train a cadre of competent engineers and technicians under experts and through fellowships to cope with the increasing and complex instruments being imported.

d. To assist in the fast establishment of a network of efficient local repair and maintenance shops as required by the needs of research centers and Ministries.

4. To maintain a consultant engineering group that would be in continuous contact with researchers, Ministries, and industry to give the necessary consultation on scientific instrument technology.

5. To assess and execute the policy of the country's future needs of scientific instruments and to establish a supply channel for rapid procurement of essential spare parts.

As mentioned before, scientific instruments constitute an essential ingredient of the technological development of a country. They are expensive to buy and unless kept in good working order cannot contribute to the fulfillment of the national plan.

ANNEXES
TO
VOLUME II

Annex 1

Names of the Senior Staff of the Academy

A. The Academy

Dr. Abdel-Moneim A. Abou El-Azm	President.
Dr. Ahmad G. Abdel-Samie	Vice-President.
Dr. Abdel-Fattah H. Dawood	Vice-President.
Dr. Mohammad B. Fayez	Secretary General.
Dr. Ahmad I. Naguib	Director, Technical Staff Office and Scientific Relations.

B. Research Centres, Institutes and Other Organization Supervised by the President of the Academy

1. National Research Centre (NRC)

Dr. Mohammad Kamel Mahmoud	Director.
Dr. Fahmy M. Ramadan	Secretary General.

a. Theodor Bilharz Institute of Endemic Diseases

Dr. Aly Zein El-Abedine	Director.

b. Central Metallurgical Research and Development Institute (C.M.R.D.I.)

Dr. Ahmad A. Abdel-Azim	Director.

c. Opthalmological Institute

Dr. Abdel-Mohsen M. Soliman	Director.

Annex 1 (continued)

2. Atomic Energy Establishment (AEE)

Dr. Kamal Eldin A. Effat	Director.
Dr. El-Shazly M. El-Shazly	Deputy Director.
Dr. Ibrahim Fathy Hammouda	Deputy Director.
Eng. El-Sayed Amin El-Khashaab	Secretary General.

a. National Centre for Radiation Technology Research

Prof. Dr. Hamed M. R. El-Kady	Director.

3. Institute of Astronomy and Geophysics

Dr. M. Fahim Mahmoud	Director.
Dr. Adly S. Assad	Deputy Director.
Dr. Roushady A. Cobros	Secretary General.

4. Institute of Oceanography and Fisheries

Dr. A. Abdel-Latif Mahmoud	Director.
Dr. Ahmed M. Eissawi	Deputy Diector
Dr. Ahmed E. Bayoumi	Deputy Director.
Dr. Mounir M. Ishak	Secretary General.

5. National Institute of Standards (NIS)

Dr. Mohammad M. Ammar	Director.
Mr. Aly El-Bagourny	Secretary General.

6. Egyptian Petroleum Research Institute (EPRI)

Dr. Bahram H. Mahmoud	Director.
Dr. Fathi M. Ebeid	Deputy Director
Dr. Mohammad I. Roushdy	Secretary General.

7. Scientific Instruments Centre (SIC)

Eng. Medhat El-Alaily Director.

8. Patent Office

Eng. Ahmad Aly Omar Director.

9. National Information and Documentation Centre (NIDOC)

Mr. Aly R. El-Hadidy Director.

Annex 2

Names of the Academy Council Members

Dr. Abdel-Moneim A. Abou El-Azm	President of the Academy, Chairman of the Council.
University Chancellors	
Dr. Soufi Abu-Taleb	Chancellor, Cairo University.
Dr. Mohammad L. Dewidar	Chancellor, Alexandria University
Dr. M. Nagi El-Mahallaw	Chancellor, Ain Shams University
Dr. Mohammad H. El-Nashshar	Chancellor, Assiut University
Dr. Mohammad H. Fayed	Chancellor, Al-Azhar University
Dr. M. Abdel-Moneim El-Badrawy	Chancellor, Mansura University
Dr. Hashem Nassar	Chancellor, Tanta University
Dr. Mohammad Tolba Eweida	Chancellor, Zagazig University
Dr. Abdel-Razek Abdel-Fattah	Chancellor, Helwan University
Directors Scientific Centres and Unions	
Dr. Mohammad Kamel Mahmoud	Director, National Research Centre
Dr. Ahmed M. Khalifa	Director, National Social and Criminology Research Centre.
Dr. Kamal El-Din A. Effat	Director, Atomic Energy Establishment
(To be nominated)	Representative of the Egyptian Science Association.
Representatives of Ministries	
Dr. Ahmad I. El-Shabassy	Chairman, Board of Directors, Executive Coundil for Improvement, Ministry of Agriculture and Land Reclamation.
Eng Hassan A. Abdel-Fattah	Vice-President of the General

	Organization for Industrialization, Ministry of Industry.
Dr. Abdou M. Sallam	Chairman, Board of Directors, General Organization for Sera and Vaccines, Ministry of Health.
Mr. Abdou-Abdel-Khabear	Under-Secretary of State, Ministry of Finance.
Mr. Abdel-Raouf Farag	Under-Secretary of State, Ministry of Planning.
Eng. Abdel-Hamid Abdallah	Under-Secretary of State, Ministry of Irrigation.
Mr. Abdel-Moniem M. Ali	First Under-Secretary of State, Ministry of Agriculture
Dr. Abdel-Fattah Ismail	Ex-First Under-Secretary of State, Ministry of Higher Education.
Dr. Fouad E. El-Sayed	Under-Secretary of State, Ministry of Education
(To be nominated)	Under-Secretary of State, Ministry of Social Affairs.
Eng. Mohammad Ramzi El-Leithy	Chairman, Board of Directors, Egyptian General Organization for Petroleum.
Eng. Mohammad K. Hamed	Chairman, Board of Directors, Electricity Authority of Egypt.
Dr. Mustafa M. El-Hefnawy	Chairman, Board of Directors, General Organization for Building, Housing and Urban Planning Research.

Dr. Wagih Shendy	Under-Secretary of State, Ministry of Economy and Economic Co-operation.
Dr. Yehia I. Taha	Under-Secretary of State, Ministry of Transport.

Academy Vice Presidents and Secretary General

Dr. Ahmed G. Abdel-Samie	Vice-President.
Dr. Abdel-Fattah H. Dawood	Vice-President.
Dr. Mohammad B. Fayez	Secretary General.

Members on their Own Merits

Dr. Ahmed E. Darwish	Ex-Minister of Health.
Eng. Ahmed A. Kamal	Ex-Minister of Irrigation.
Dr. Hussein M. Said	Ex-Minister of Higher Education.
Eng. Soliman Abdel-Hay	Ex-Minister of Transport.
Dr. Mohammad Morsi Ahmed	Ex-Minister of Higher Education.
Dr. Mahmoud Ali Hassan	Ex-Minister of Industry.
Dr. Mahmoud Mohammad Reyad	Secretary General, Arab League Organization for Telecommunications.
Eng. Taher M. Abu-Wafa	Technical Counsellor, Ministry of Irrigation.
Dr. Mostafa M. Hafez	Ex-Counselor, Academy of Scientific Research and Technolocy.
Dr. Emad E. H. El-Shishiny	Ex-Vice-President, Academy of Scientific Research and Technology.

The Bureau of the Academy Council

Dr. Abdel-Moneim A. Abou-el-Azm	Chairman
Dr. Ahmad Gamal Abdel-Samie	
Dr. Abdel Fattah H. Dawood	
Dr. Mohammad B. Fayez	
Mr. Abdou Abdel-Khabeer	
Mr. Abdel-Raouf M. Farag	
Dr. Moustafa Mahmoud Hafez	

Technical Secretariat to the Bureau of the Academy Council

Dr. Aboul-Foutouh Abdel-Latif Mahmoud	Director, Institute of Oceanography and Fisheries.
Dr. Ahmed Sameeh El-Nockrashy	Prof., Fats and Oils Laboratory, NRC.
Dr. Ahmed Aziz Kamal	Director, Computer Centre, Cairo University.
Dr. Ahmed Mohammad Badran	Director, Diabetes Research Institute.
Dr. Hamed M. Roushdi El-Kady	Director, National Radiation Technology Research Centre.
Dr. Hassan Fahmy Imam	Prof., Faculty of Engineering, Cairo University.
Dr. Hanafi Aly M. Deebes	Assoc. Prof., Institute of Astronomy and Geophysics.
Dr. Hamdy Abdel-Aziz Morsi	Researcher, Botany Laboratory, NRC.
Dr. Talaat Ibrahim Rihan	Assoc. Prof., Faculty of Science, Mansura University.

Dr. Talaat Ahmed El-Tablawi	Assoc. Prof., Electronics Laboratory, NRC.
Dr. Osman Mahmoud Galal El-Din	Assoc. Prof., Nutrition Laboratory NRC.
Dr. Emad El-Din M. Sultan	Secretary General, National Centre for Social and Criminological Research.
Dr. Mohammad Anwar M. El-Deeb	Assoc. Prof., Water Pollution Control Laboratory, NRC.
Dr. Mohammad Hassan Fadl	Assoc. Prof., Paper and Cellulose Laboratory, NRC.
Dr. Mohammad Abdel-Rahman El-Hawary	Prof., Faculty of Engineering, Cairo University.
Dr. Mohammad Hilal Abdel-Kader	Prof., Egyptian Petroleum Research Institute.
Dr. Mohammad Aly Ghobashy	Head, Optics Division, Scientific Instrumentation Centre.
Dr. Mohammad Fahim Mahmoud	Director, Institute of Astronomy and Geophysics.
Dr. Nour El-Din Abdel-Hamid	Prof., Faculty of Engineering, Cairo University.

President's Technical Staff Office

Dr. Ahmad Sameeh El-Nockrashy	(Biochemistry and Nutrition)
Dr. Hamdy Abdel-Aziz Morsi	(Plant Physiology)
Dr. Hanafy Aly Debes	(Geophysics)

Dr. Talaat Ibrahim Rihan	(Organic Chemistry, Petroleum Chemistry)
Dr. Mohammad Anwar M. El-Deeb	(Water Pollution)
Dr. Mohammad Aly Ghobashy	(Optics)
Dr. Mohammad Hassan Fadl	(Applied Organic Chemistry)
Dr. Mohammad Hilal Abdel-Kader	(Petroleum Chemistry)
Dr. Ahmad Ibrahim Naguib, Supervisor	(Microbiology)

Annex 3

The Specialized Research Councils and Subject Committees

A. Plant Production and Protection Research Council

Chairman: Dr. Mohammed Bakr Ahmed
Prof., Plant Physiology, Faculty of Agriculture,
Cairo University

Deputy Chairman: Dr. Hussein M. Said
Ex-Minister of Higher Education.

Secretary General: Dr. Hamdy Abdel-Aziz Morsi
Associate Research Prof., Botany Laboratory, NRC

Members

Research Institutes and Universities: 22
Technical and Production Sector: 7

Subject Committees:

1. Loss in Crop Yield due to Vertebrate Pests

Chairman: Mr. Ahmad Talaat Aziz
Director, Egyptian Organization of Rice Mills.

Secretary General: Dr. Abdel Moneim Maher Aly
Plant Protection Department,
College of Agriculture,
Assuit University

Members: 8

2 Agriculture College
1 Agriculture Research Center (ARC)
1 Zoology Dept.
1 College of Veterinary Science
1 College of Science
1 Organization of Rice Mills
1 Building Research Council

2. Medicinal Plants

Chairman: Dr. Mohammed Saad Eldin Karawia
Prof., College of Pharmacy
Cairo University

Secretary General: Dr. Amin Mahmoud El-Gamasy
Deputy Dean (Horticulture Dept.)
Agricultural College
Ain Shams University

Members: 7

2 Ministry of Agriculture
3 University representives
1 Pharmacy College
1 Organization for Industrialization

3. Fruit Fly

Chairman: Dr. Mahmoud Hafez Ibrahim
Prof., College of Science
Cairo University

Secretary General: Dr. Ahmad M. Awadallah
Plant Protection Institute
Agriculture Research Center (ARC),
Ministry of Agriculture

Members: 9

4 University representatives
1 Industrial R.C.
1 ARC
1 Radiation Technology Institute

4. American Boll-Worm

Chairman: Dr. Mahmoud Hafez Ibrahim

Secretary General: Dr. Ahmad Galal Metwalli
Plant Protection Institute, ARC,
Ministry of Agriculture

Members: 8

6 University representatives
1 NRC
1 ARC

5. Cotton Leaf and Boll-Worm

Chairman: Dr. Mahmoud Hafez Ibrahim

Secretary General: Dr. Ahmad Galal Metwalli

Members: 13

7 University representatives
2 ARC
1 Radiation Technology Research Council
1 Industrual R.C.
1 Basic Sciences R.C.
1 Social Sciences R.C.

6. Nematode Control

Chairman: Dr. Ahmad Hassanein El-Kelf
Dean, College of Agriculture
Al-Azhar University

Secretary General: Dr. Bakir Abbas Oteifa
Prof., College of Agriculture
Cairo University

Members: 9

6 University representatives
1 Ministry of Agriculture
1 Basic Sciences R.C.
1 Soils and Water Resources R.C.

7. White Ants

Chairman: Dr. Mahmoud Hafez Ibrahim

Secretary General: Dr. Abdel-Hakim M. Kamel
Director, Plant Protection Institute
ARC, Ministry of Agriculture

Members: 8

5 University representatives
1 NRC
1 ARC
1 Regional Center for Radio-Isotopes

8. Local Production of Potatoes for Seeding

Chairman: Dr. Mahmoud S. Attia
Under-Secretary of State, Ministry of Agriculture

Secretary General: Dr. Esmat Khaled Allam
Prof., Plant Pathology
Ain Shams University

Members: 11

7 ARC
1 University representative
1 Basic Science R.C.
1 Radiation Technology R.C.
1 Agricultural Products Export Co.

9. Forage Crops

Chairman: Mr. Saad Hagras
Deputy MInister for Agriculture

Secretary General: Mr. Monir Ismail Faria
Crops Institute, ARC

Members: 8

2 Crops Institute, ARC
2 Animal Nutrition Institute, ARC
2 University representatives
1 Industrial R.C.
1 Animal Resources and Fisheries R.C.

10. Water Weeds

Chairman: Dr. Mohammed A. Kassas
Former Head, Botany Dept.
Cairo University

Secretary General: Dr. Hamdy A. Morsi

Members: 13

4 University representatives
2 ARC
1 Ministry of Irrigation
2 Fisheries Research Institute
1 Basic Sciences R.C.
1 Environmental R.C.
1 Soils and Water R.C.
1 Industrial R.C.

B. Animal Resources and Fisheries Research Council

Chairman: Dr. Mohammed El-Hady El-Maghraby
Member of the National Council for Production and Economic Affairs

Deputy Chairman: Dr. Abdel Moneim Mohammed Aly
First Under-Secretary of State,
Ministry of Agriculture

Secretary General: Dr. Aboul-Foutouh Abdel-Latif Mahmoud
Director, Institute of Oceanography and Fisheries

Members

Research Institutes and Universities: 34
Technical and Production Sector: 9

Subject Committees

1. Productivity of Sheep

Chairman: Dr. Khalid Abdel-Salam El-Shazly
Deputy Minister for Agriculture

Secretary General: Dr. Ahmad Hassan Farid
Prof., College of Veterinary Science
Cairo University

Members: 7

3 University representatives
2 Animal Health Institute, ARC
1 Veterinary Laboratories, ARC
1 Desert Institute, ARC

2. Raising Fishery Resources

Chairman: Dr. Ali El-Maghrabi
Head, Oceanography Dept., College of Science
Alexandria University

Secretary GeneralL Dr. Ramadan Moustafa El-Sherif
General Company Fish Market

Members: 7

5 Oceanography and Fisheries Institute
2 University representatives

3. Raising Poultry Production

Chairman: Dr. Ahmad Abdel-Hamid Basiouny
Prof., College of Veterinary Science,
Cairo University

Secretary General; Dr. Hassan El-Sayed Ayoub
College of Agriculture
Ain Shams University

Members: 10

5 ARC
4 University representatives
1 Poultry Organization

4. Raising Cattle Productivity

Chairman: Dr. Mohammad Salah Eldein Barrada
Director of Research
Animal and Poultry Institute, ARC

Secretary General: Dr. Fahmi Ibrahim Awad
Prof., College of Veterinary Science
Cairo University

Members: 13

8 University representatives
1 NRC
1 Atomic Energy Establishment (AEE)
3 ARC

C. Soil and Water Resources Research Council

Chairman: Eng. Taher M. Abu-Safaa
Technical Counsellor, Ministry of Irrigation

Deputy Chairman: Dr. Ahmad I. El-Shabassy
Chairman, Board of Directors,
Council for Land Improvement
Ministry of Agriculture and Land Reclamation

Secretary General: Eng. Aziz Hanna Labib
Counsellor, Ministry of Irrigation

Members

Research Institutes and Universities: 16
Technical and Production Sector: 9

Subject Committees

1. Soil Survey and Classification to Prepare Soil Atlas

Chairman: Dr. Rifky Mohammad Anwar
Director, Organization for Construction and
Agriculture Research

Secretary General: Dr. Hassan Mahmoud Hamdy
Prof. emeritus, College of Agriculture
Ain Shams University

Members: 10

5 University representatives
1 Land Reclamation and Development Organization, ARC
1 Desert Institute, ARC
1 Plant Production and Protection R.C.
1 Petroleum and Mineral Resources R.C.
1 Basic Sciences R.C.

2. Soil Amelioration and Economics of Land Reclamation

Chairman: Dr. Ahmad Ibrahim El-Shabassy

Secretary General: Dr. Moustafa Hassan Hilal
Associate Prof., Soils and Water Laboratories, NRC

Members: 7

2 University representatives
1 Land Reclamation and Development Organization, ARC
1 Petroleum and Mineral Resources R.C.
1 Basic Sciences R.C.
1 Applications of Physics and Electronics R.C.

3. Water Desalination

Chairman: Dr. Mourad Ibrahim Yousef
Head, Geology Dept., College of Science, Ain Shams University

Secretary General: Dr. Ahmad Fouad El-Kholy
Prof., Atomic Energy Establishment (AEE)

Members: 7

1 University representative
1 ARC
1 AEE
1 Industrial R.C.
1 Petroleum and Mineral Resources R.C.
1 Energy R.C.
1 Basic Sciences R.C.

4. Underground Water Reservoirs

Chairman: Dr. Abdou Ali Shata
Director, Desert Institute ARC

Secretary General: Dr. Mahmoud Abdel-Halim Abu-Zeid
Director, Research Institute for Water Management and Control, Ministry of Irrigation

Members: 7

1 University representative
1 Ministry of Irrigation
1 NRC
1 Petroleum General Company
1 Plant Production and Protection R.C.
1 Petroleum and Mineral Resources R.C.
1 Basic Sciences R.C.

5. Post-High Dam Effects

Chairman: Eng. Ahmed Ali Kamal
Ex-Minister of Irrigation

Secretary General: Dr. Samir Naghmoush
General Director, Land Reclamation and Development Organization, ARC

Members: 17

5 Ministry of Irrigation
1 University representative
1 Soils and Water Institute, ARC
10 Research Council representatives (one each from the following Research Councils: Industrial, Plant Production and Protection, Animal Resources and Fisheries, Petroleum and Mineral Resources, Basic Sciences, Medical, Environmental, Energy, Social Sciences, and Building Technology)

D. Environmental Research Council

Chairman: Dr. Hassan M. Ismail
Ex-Counsellor
Cairo University

Deputy Chairman: Dr. Mostafa M. Hafez
Ex-Cousellor, Academy of Scientific Research and Technology

Secretary General: Dr. Mohammad Anwar El-Deeb
Associate Prof., Water Pollution Control Laboratory, NRC

Members

Research Institutes and Universities: 16
Technical and Production Sector: 5

Subject Committees

1. Water Pollution

Chairman: Dr. Fahmi M. Ramadan
Head, Environmental Research Division, NRC

Members: 11

2 Institute of Oceanography and Fisheries
3 NRC
5 University representatives (3 sanitation engineers, a civil engineer, and an oceanographer)
1 Ports and Harbours Dept.

2. Solid Wastes

Chairman: Eng. Mohammad Agamia
Counsellor, Ministry of Housing and Reconstruction

Members: 6

2 NRC
1 University representative
2 Ministry of Housing and Reconstruction
1 Industrial Planning Organization

3. Air Pollution and Environmental Health

Chairman: Dr. Mahmoud Sami Abdel-Salem
Prof., Air Pollution Control, NRC

Members: 9

5 University representatives
1 Ministry of Housing and Reconstruction
1 Ministry of Labour
1 Ministry of Health
1 NRC

E. Medical Research Council

Chairman: Dr. Ahmed E. Darwish
Prof., Faculty of Medicine
Alexandria University

Deputy Chairman: Dr. Abdou M. Sallam
Chairman, Board of Directors, Egyptian General Organization for Sera and Vaccines
Ministry of Health

Secretary General: Dr. Ahmed M. Badran
Director of the Diabetes Research Institute

Members

Research Institutes and Universities: 27
Technical and Production Sector: 3

Subject Committees

1. Nutrition Problems

Chairman: Dr. Fathi El-Zayat
Vice President, Al-Azhar University

Secretary General: Dr. Osman Mahmoud Galal-Eldin
Associate Prof., Nutrition Laboratory, NRC

Members: 5

5 University representatives

2. Health and Disease Map for the Arab Republic of Egypt (A.R.E.)

Chairman: Dr. Mahmoud Mohammad Mahfouz
Ex-Minister of Health

Secretary General: Dr. Abdel-Moneim Fouad
Statistics Dept., Ministry of Agriculture

Members: 7

1 Ministry of Health
1 Statistics and Computer Center, Cairo University
4 College of Medicine
1 Planning Institute (Health Planning)

3. Dentistry

Chairman. Dr. Lofty Mahmoud Abu-El-Ela
Dean, College of Dentistry
Alexandria University

Secretary General: Dr. Samiah Ahmed El-Sayed Darwish

Members: 4

3 College of Dentistry
1 Ministry of Health

4. Sera, Vaccines, and Blood Substitutes

Chairman. Dr. Abdou Mahmoud Sallam
Director, General Organization for Sera and Vaccines
Ministry of Health

Secretary General: Dr. Mahmoud Khairi El-Marsaphy
El-Nasr Pharmaceuticals Co.

Members: 4

1 University representative
1 UNDP expert, Organization for Sera and Vaccines
1 Army Medical Corps
1 Blood Bank Director, Red Crescent Society

5. Non-Tuberculosis Chest Diseases

Chairman: Dr. Sayed Abdel-Hamid El-Warraky
Prof., College of Medicine,
Ain Shams Univeristy

Secretary General: Dr. Mohammad Esmat Mahmoud
Prof., College of Medicine
Al-Azhar University

Members: 6

6 University representatives

6. Bilharzia

Chairman: Dr. Ahmed El-Sayed Darwish
Ex-Minister of Health

Secretary General: Dr. Ahmad Ali El-Garem
Prof., College of Medicine
Cairo University

Members: 18

9 University representatives
1 Theodor Bilharz Institute of Endemic Diseases, NRC
3 Ministry of Health (Institute of Endemic Diseases)
1 Social Sciences R.C.
1 Environmental R.C.
1 Radiation Technology R.C.
1 Building Technology R.C.

7. Pharmaceutical Research

Chairman: Dr. Abdou Mahmoud Sallam
Ex-Minister of Health

Secretary General: Dr. Shafik Ibrahim Balbaa
Ex-Dean, College of Pharmacy
Cairo University
Secretary General, Supreme Council for Universities

Members: 9

4 University (medical) representatives
5 University (pharmacy) representatives

8. Rheumatic, Heart, and Diabetes Diseases

Chairman: Dr. Moustafa Hafez Ghanem
Prof., College of Medicine,
Alexandria University

Secretary General: Dr. Hamdy Mahmoud El-Sayed
Prof., College of Medicine
Ain Shams University

Members: 8

3 Ministry of Health
2 University representatives
3 Others

9. Study of Hearing Problems

Chairman: Dr. Ali Hassan El-Mofty
Prof. and Dean, College of Medicine
Ain Shams University

Secretary General: Dr. Abdel-Guelil Fakhr
Director, Institute of Hearing
Ministry of Health

Members: 5

3 University representatives
2 Others

10. Tuberculosis

Chairman: Dr. Abdel-Aziz Sami
Former Dean, College of Medicine
Cairo University

Secretary General: Dr. Omar Lofty
Director General, Sera and Vaccines Laboratory
Ministry of Agriculture

Members 10

3 University representatives
3 Ministry of Health
1 Social Sciences R.C.
1 Animal Resources and Fisheries R.C.
1 Industrial R.C.
1 Environmental R.C.

11. Burns

Chairman: Dr. Ibrahim Gamil Badran
Vice-President
Cairo University

Secretary General: Dr. Hosni Hegazi
Director, Institute of Burns
Ministry of Health

Members: 3

1 Army Medical Corps
2 University representatives

12. Health Administration

Chairman: Dr. Ramses Abdel-Aleem Gomaa
Under-Secretary of State,
Ministry of Health

Secretary General: Dr. Hassan Sayed Hussein
Director, Economic Health Services
Ministry of Health

Members: 9

3 University representatives
4 Ministry of Health
1 Ministry of Agriculture (Statistics Dept.)
1 Institute of Planning

F. Radiation Technology Research Council

Chairman: Dr. Mahmoud M. Mahfouz
Ex-Minister of Health

Deputy Chairman: Dr. Kamal A. Effat
Director, Atomic Energy Establishment (AEE)

Secretary General; Dr. Hamed M.R. El-Kady
Director, National Center for Radiation
Technology Research

Members

Research Institutes and Universities: 25
Technical and Production Sector: 13

G. Industrial Research Council

Chairman: Dr. Mahmoud Ali Hassan
Ex-Minister of Industry

Deputy Chairman: Dr. Mohammad Kamel Mahmoud
Director, National Research Center

Secretary General: Dr. Ahmad Mohammed Eid
Director General of Metallurgical Projects
General Organization for Industrialization

Members

Research Institutes and Universities: 19
Technical and Production Sector: 13

Subject Committees

1. Wrapping and Packaging Materials

Chairman: Dr. Hassan Mohammad Ashmawy
Former Chairman, Board of Directors,
Food Industries Organization

Secretary General: Eng. Ali Zein-El-Abedin Ali
Food Industires Organization

Members: 8

1 NRC
3 Industry representatives
1 Industrial Planning Organization
1 Petroleum and Mineral Resources R.C.
1 Plant Production and Protection R.C.
1 Other

2. Chemical Industries

Chairman: Dr. Abdel-Meguid Osman
Vice-President
Assuit University

Members: 6

4 NRC
1 University representative
1 Chemical Planner

3. Metal Industries

Chairman: Dr. Sammir Mohammad Tahir
Consulting Engineer, Ex-Director
General Organization of Metallurgical Industries

Members: 4

1 NRC
2 Industry representatives
1 Industrial Planning Organization

4. Engineering Industries

Chairman: Eng. Hassan Abdel-Fattah Ibrahim
Vice-President, Industrial Planning Organization

Members: 7

2 Army representatives
2 University representatives
3 Industry representatives

5. Food Industries

Chairman: Dr. Hassan Mohammad Ashmawy
Prof. emeritus, College of Agriculture
Cairo University

Members: 9

5 NRC
3 Industry representatives
1 Regional Center for Radio-Isotopes

6. Weaving and Textile Industries

Chairman: Dr. Abdel-Moneim Ali El-Bourai
Manager, El-Bevda Dyers Co.

Members: 2

1 Director, NRC
1 Director General, Egyptian Standards
Ministry of Industry

7. Behavior of Egyptian Cotton Towards Chemical Treatment and Modern Technology

Chairman: Dr. Abdel-Moneim Ali El-Bourai

Secretary General: Dr. Mohammad Kamel Mahmoud
Director, NRC;Former Head
Textile Division, NRC

Members: 7

2 University representatives
1 NRC
1 Textile Industry Planning Organization
1 Basic Sciences R.C.
1 Radiation Technology R.C.
1 Plant Production and Protection R.C.

8. The Use of Hydrochloric Acid in Phosphoric Acid Production

Chairman: Dr. Mohammad Yousef Bakr
Prof., College of Engineering
Alexandria University

Members: 5

1 Petroleum and Mineral Resources R.C.
2 Industry representatives
2 Industrial Planning Organization

9. Treatment of Wastes from Chemical Industries and the Use of Wastes of Food Production

Chairman: Dr. Hassan Mohammad Ashmawy

Secretary Generzl: Dr. Mahmoud Yousef Saada
Associate Prof., Pilot Plant
Laboratory, NRC

Members: 7

10. 2 Ministry of Agriculture
1 NRC
Plant Production and Protection R.C.
Animal Resources and Fisheries R.C.
Environmental R.C.
Basic Sciences R.C.

H. Petroleum and Mineral Resources Research Council

Chairman: Eng. Mohammad Ramzi El-Leithy
Chairman, Board of Directors
Egyptian General Organization for Petroleum

Deputy Chairman: Dr. El-Shazli Mohammad El-Shazli
Deputy Director, AEE

Secretary General: Dr. Hassan Fahmy El-Said Imam
Prof., Faculty of Engineering
Cairo University

Members

Research Institutes and Universities: 13
Technical and Production Sector: 21

I. Energy Research Council

Chairman: Eng. Mohammad Kamal Hamed
Chairman, Board of Directors
Egyptian Electricity Authority

Deputy Chairman: Dr. Ibrahim Ahmad Sakr
Prof., Head. Solar Energy Laboratory, NRC

Secretary General: Dr. Mahmoud Hegazy Hassan Saleh
Director, Department of Studies
General Egyptian Electricity Organization

Members

Research Institutes and Universities: 14
Technical and Production Sector: 11

Subject Committees

1. Non-Conventional Sources of Energy

Chairman: Dr. Fouad Taher Mohammed
Deputy Chairman, Rural Electrification Project

Members: 4

3 University representatives
1 NRC

2. Utilization of Solar Energy

Chairman: Dr. Khalil Hassan Khalil
Prof., College of Energy
Cairo Univeristy

Members: 5

2 Ministry of Electricity
2 University representatives
1 NRC

3. Ideal Utilization of Energy Resources

Chairman: Mahmoud Abdel-Bakey El-Kousheiry

Members: 10

5 Ministry of Electricity
2 AEE
1 NRC
1 General Company for Petroleum
1 University representative

J. Building Technology Research Council

Chairman: Dr. Ibrahim A. El-Demerdash
Ex-Dean, Faculty of Engineering
Cairo University

Deputy Chairman: Dr. Mostafa El-Hefnawy
Chairman, Board of Directors,
General Organization for Housing, Building, and Urban Planning Research

Secretary General: Dr. Aly El-Hossainy Zaalouk
Housing, Building and Urban Planning Research Centre

Members

Research Institutes and Universities: 20
Technical and Production Sector: 19

Subejct Committees

1. Construction and Building Economics

Chairman: Eng. Yousef Abdel-Kader El-Gammal
Ex-Chairman, Board of Directors
General Organization for Civil Constructions

Secretary General: Eng. Ali Ibrahim Abu-Yousef

Members: 12

3 University representatives
2 Ministry of Housing and Reconstruction
2 Building Research Institute
1 Ministry of Industry
1 Industrial R.C.
1 Transport R.C.
2 Other

2. Reconstruction of the Egyptian Village

Chairman: Dr. Moustafa El-Hefnawy

Secretary General: Eng. Moustafa Kamal Hamdy
Director, Housing and Utilities Dept.
Land Development Organization
Ministry of Agriculture

Members: 9

3 Ministry of Housing and Reconstruction
2 University representatives
1 Environmental R.C.
1 Industrial R.C.
2 Other

3. Public Utilities

Chairman: Eng. Abdel-Rahman Hassan Hassanein
Technical Counsellor
Ministry of Housing and Reconstruction

Secretary General: Dr. Mohammad Yousef Bakr
Prof., College of Engineering
Alexandria University

Members: 10

3 Water Board
3 University representatives
1 Drains and Sewerage Systems
1 Ministry of Housing and Reconstruction
1 Environmental R.C.
1 Industrial R.C.

4. Reconstruction of Cities

Chairman: Eng. Salem Nasr Habib
Chairman, Greater Cairo Planning Committee

Secretary General: Eng. Mohammad Kamal Hassan
Director, Urban Planning, General
Organization for Urban Planning
Ministry of Housing and Reconstruction

Members: 7

3 General Organization for Urban Planning
2 University representatives
1 Governor of Cairo
1 Supreme Council for Arts and Letters

5. Reinforced Concrete

Chairman: Dr. Sayed Mortady
Prof., College of Engineering
Alexandria University

Members: 11

8 University representatives
1 Ministry of Housing and Reconstruction
1 Industrial R.C.
1 Petroleum and Mineral Resources R.C.

K. Transport Research Council

Chairman: Eng. Soliman A. Al-Hay
Ex-Minister of Transport

Deputy Chairman: Dr. Ahmed A. Abou-Ismail
H.E. Minister of Finance

Secretary General: Dr. Mohammad A. El-Hawary
Prof., Faculty of Engineering
Cairo University

Members

Research Institutes and Universities: 6
Technical and Production Sector: 25

Subject Committees

1. Passenger Carrier Treatments

Chairman: Eng. Ahmed Zaki
Chairman, Board of Directors
East Delta Road Transport Co.

Members: 3

3 Road Transport Co.

2. Fluvial Transport

Chairman: Dr. Mohammad Amry Okeil
Head, Shipbuilding and Marine Engineering
College of Engineering
Alexandria University

Members: 4

2 Fluvial Transport Organization
2 Other

3. Containers

Chairman: Eng. Soliman Metwalley Soliman
Chairman, Board of Directors,
Roads and Bridges Organization

Members: 5

1 Port of Alexandria Authority
1 Transportation Planning
1 University representative
1 Railways representative
1 Inland Transport representative

L. Physics and Electronics Applications Research Council

Chairman: Dr. Mahmoud M. Reyad
Secretary General, Arab League Organization for Telecommunications

Deputy Chairman: Dr. Mahmoud Mokhtar Abdel-Rehim
Ex-Dean, Faculty of Science
Cairo University

Secretary General: Dr. Faika F. Hanna
Prof., Head, Physics Research Division, NRC

Members

Research Institutes and Universities: 22
Technical and Production Sector: 3

Subject Committees

1. Physics Applications

Chairman: Dr. Mahmoud Mokhtar Abdel-Rehim
Chairman, National Committee of the International Union of Pure and Applied Physics

Secretary General: Dr. Raafat Kamel Wassef
Prof., Head, Physics Dept.
College of Science
Cairo University

Members: 9

4 University representatives (science)
1 University representative (engineering)
1 NRC
1 Industrial R.C.
1 Basic Sciences R.C.
1 Soils and Water Resources R.C.

2. Electronics

Chairman: Dr. Mohammad Abdou Al-Said
Director, Telecommunications Research Center (PTT)

Secretary General: Dr. Abdel-Moneim El-Sherbeiny
Associate Prof., College of Engineering
Ain Shams University

Members: 10

5 University representatives (engineering)
1 AEE
1 Arab League Telecommunications Organization
1 Director of Research Development, Center of Electronic Industries
1 Industrial R.C.
1 Basic Sciences R.C.

M. Basic Sciences Research Council

Chairman: Dr. Mohammad Moursi Ahmad
Ex-Minister of Higher Education

Deputy Chairman: Dr. Abdel-Aziz A. Sharaf
Prof., Head, Pharmacognosy Laboratory, NRC

Secretary General" Dr. Mohammad Fahim Mahmoud
Director, Institute of Astronomy and Geophysics

Members

Research Institutes and Universities: 27
Technical and Production Sector: 1

Subject Committees

1. Physics

Chairman: Dr. Mohammad Abdel-Maksoud El-Nadi
Vice-President, Mansura University

Members: 5

3 University representatives (College of Science)
1 AEE
1 Institute of Astronomy and Geophysics

2. Biology

Chairman: Dr. Hussein M. Said
Prof. emeritus, College of Science
Cairo University

Members: 7

2 University representatives (botany)
2 University representatives (entomology)
1 University representative (zoology)
1 Director, Institute of Oceanography and Fisheries
1 Technical Military Academy

3. Geology

Chairman: Dr. Mohammad Kamal El-Akkad
Dean, College of Science
Tanta University

Members: 4

3 University representatives
1 Director, Institute of Oceanography and Fisheries

4. Mathematics and Operations Research

Chairman: Dr. Mohammad Morsi Ahmed
Secretary General, Association of Arab Universities

Members: 7

3 University representatives (science)
1 University representative (engineering)
1 AEE
2 Technical Military Academy

5. Basic Medical Science

Chairman: Dr. Abdel-Aziz Ahmed Sharaf

Members: 7

2 Medical College
1 Veterinary College
1 University representative (natural products)
1 University representative (entomology)
1 University representative (zoology)
1 University representative (plant pathology)

6. Chemistry

Chairman: Dr. Abdel-Meguid Osman
Vice-President, Assiut University

Members: 5

1 University representative (natural products)
1 University representative (organic chemistry)
1 Biochemist (medical)
1 Technical Military Academy
1 Central Metallurgical Research and Development Institute, NRC

N. Social Sciences Research Council

Chairman: Dr. Ahmed Mohammad Khalifa
Director, National Center for Social and Criminology Research

Deputy-Chairman: Dr. Mohammad Safey-Eldin Abou-el-Ezz
Director, Institute for Arabic Studies

Secretary General: Dr. Emad-Eldin Mohammad Sultan
Secretary General, National Center for Social and Criminological Research

Members

Research Institutes and Universities: 24
Technical and Production Sector: 8

Subject Committees

1. Scientific Methodology in Social Survey

Members: 11

3 University representatives (arts and letters)
3 Social Service representatives
1 National Institute of Management Development
1 National Center for Social and Criminological Research
1 Environmental R.C.
1 Transport R.C.
1 Industrial R.C.

2. Rural Development

Members: 13

6 University representatives (including arts and letters, laws, social service, and education)
1 Industrial R.C.
1 Environmental R.C.
1 Medical R.C.
1 Petroleum and Mineral Resources R.C.
1 Soils and Water Resources R.C.
1 Ministry of Social Welfare
1 Ministry of Local Government

Annex 4

The Principal Committees

Scientific Publications and Information Committee

Chairman

Dr. Mostafa M. Hafez	Ex-Counsellor, Academy of Scientific Research and Technology.

Deputy-Chairman

Dr. Ahmad Anwer A. Badr	Prof. of Library Sciences, Faculty of Arts, Cairo University.

Secretary General

Mr. Aly R. El-Hadidy	Director, National Information and Documentation Centre (NIDOC).

Members: 13

Scientific Personnel Committee

Chairman

Dr. Ahmed M. Khalifa	Director, National Centre for Social and Criminological Research.

Deputy Chairman

Dr. Abdel-Fattah H. Dawood	Vice-President of the Academy.

Secretary General

Dr. Ahmed S. El-Nokrashi	Prof., Fats and Oils Laboratory, NRC.

Scientific Culture and Educational Aids Committee

Chairman

Dr. Emad Eldin El-Shishini	Ex-Vice-President, Academy of Scientific Research and Technology.

Deputy-Chairman

Mr. Abdel Moneim El-Sawi	Chairman, Board of Directors El-Tahrir Publishing House.

Secretary General

Dr. Mohammed Saber Selim	Chairman of Science Section, Arab League Education, Culture and Science Organization.

Members: 33

Scientific Relations Committee

Chairman

Dr. Hussein M. Said	Ex-Minister of Higher Education.

Deputy-Chairman

Dr. Ahmed I. Naguib	Director, Technical Staff Office and Scientific Relations.

Secretary General

Dr. Yousef Morsi Hussein	Head, Science Policy Research Unit of the Academy.

Members: 12

Annex 5

Advisory Board

Dr. Ibrahim Helmy Abdel Rahman	Ex-Director, UNDP
Dr. Abdel-Razzak Sidki	Ex-Director, FAO Middle East Regional Office
Dr. Abdel-Fattah Morsi	Deputy Director, FAO Middle East Regional Office
Dr. Abdel-Guelil El-Emery	Deputy Director, International Bank for Reconstruction and Development.
Dr. Abdel Moneim El-Shafey	UN, Economic Consultant.
Dr. Abdel-Aziz El-Sayed	Ex-Director, General ALECSO.
Eng. Salah Amer	Counsellor, Arab League Organization for Telecommunications.
Dr. Aly El-Greitly	Counsellor, Arab-African Bank
Dr. Mostafa K. Tolba	Director, UNEP.
Eng. Amin Helmy Kamel	Director, Arab League Industrial Organization.

Annex 6

Academy of Scientific Research and Technology
Titles of Research Projects

I. Plant Production and Protection Research Council

A. Projects contracted during 1974 and 1975

1. The control of fruit fly in the Faiyoum province by irradiated sterilized flies.
2. Ecological studies on the cotton leaf worm.
3. Ecological and physiological studies on the cotton boll-worm.
4. The effects of insecticides and hand-picking of egg masses, as means of controlling cotton pests, on the growth and yield of cotton, and the quality of fibres.
5. Studies on the control of insect and animal pests of cotton by treating soils with insecticides, with reference to their side effects.
6. Mass rearing of cotton leaf worms and boll-worms.
7. Laboratory and field studies on the ecology of American boll-worm.
8. Laboratory studies on the efficiency of different insecticides in controlling the American boll-worm.
9. Field studies on the efficiency of different insecticides in controlling the American boll-worm.
10. Survey of the natural parasites and predators of the American boll-worm, in an attempt to use them for biological control of the insect.
11. The life cycle and behaviour of the American cotton boll-worm during different seasons of the year.
12. Vertebrate pests; rodents.
13. Vertebrate pests; birds.
14. Effect of chemical pesticides on fiber quality of Egyptian cottons.

B. Projects to be contracted in 1976

1. Vertical development in agricultural production through nematode control (contracted).
2. Production of improved potato seeds locally.
3. Improvement of medicinal and aromatic plant production.

C. Approved pre-projects

1. Survey of naturally growing medicinal plants.
2. Development and improvement of aromatic-oil production.
3. The development of fodder production.
4. Breeding of cotton varieties resistant to boll-worms and some piercing and sucking insects.

D. Suggested research projects

None

II. Animal Resources and Fisheries Research Council

A. Projects contracted in 1974 and 1975

1. Early weaning of buffalo calves in relation to productive traits.
2. The effect of locally-produced milk - replacers on the productivity of the Egyptian buffalo.
3. The economical, nutritional and managerial aspects of intensive sheep production.
4. Genetical improvement of milk yield and meat production from native cattle through the use of frozen semen from selected bulls.
5. Studies on the sterility and low fertility of the Egyptian buffalo.
6. Economical study of meat production in Egypt with reference to meat importation.
7. Field study on the hygenic status of farm animals distributed in the pilot village of Shobak Basta.
8. The causes of diseases in the newly born calves.
9. Improving the productive efficiency of Egyptian farm animals through the use of frozen semen.

10. The causes of mortality in young lambs, and the means of control.
11. The pseudo-tuberculosis in sheep.
12. Genetical improvement of egg production from Fayoumy chicken.
13. Poultry viral diseases of economic importance in Egypt.
14. Investigations on sardines and other pelagic fish along the Mediterranean coast between Rasheed and El-Salloom.
15. Developing 80 acres of El-Abbassa Lake into a pilot fish farm.
16. Fish raising in rice fields.
17. Improving the efficiency of shore fishing practices in the northern lakes.
18. Developing fish production from Lake Quaroon.

B. Projects to be contracted in 1976

1. The role of agricultural extension in farm development.

C. Approved pre-projects

None

D. Suggested research projects

1. Improvement of milk yield and meat production from goats.
2. Improving meat production from native cattle breed through cross-breeding program.
3. Improving the nutritional and economical efficiency of turkey production.
4. The establishment of a reference flock for selection experiments in egg production.
5. Poultry diseases in Egypt.
6. Econometric studies on the _____ of hatching costs in the Fayoum governorate.
7. The effect of pesticide toxicity on the fertility and sterility of farm animals.
8. Raising the nutritional value and efficiency of roughage for animal feeding.

9. Determination of Sevin and Phosvel residues in some plant and animal materials.
10. Documentation of animal and fisheries research.
11. The economics of hatching industry and poultry production in Egypt.

III. Soils and Water Resources Research Council

A. Projects contracted in 1974 and 1975

1. Experimental farm for testing the optimum use of desalinized water for irrigation.
2. Flash evaporation method for desalinization of sea water.
3. Water resources in the Mediterranean coastal zone, west of Alexandria.
4. The underground water reservoir in the agriculture extension area west of the Nile delta.
5. Determining the safe yield from the underground water reservoir in the Nile delta and valley.
6. Changes of taste and odour of water in Lake Nasser.
7. The consequences of the loss of Nile silt, as a result of the High Dam, on the characteristics of different soils and their fertilizer requirements.
8. Effects of the excessive use of irrigation waters; magnitudes and influences on agricultural production.
9. Studies on the agricultural horizontal development projects on the different-textured soils.
10. Effects of changing the irrigation systems on soils of upper Egypt; with particular reference to the formerly Basin-irrigated areas.

B. Projects to be contracted in 1976

1. Trace elements and clay minerals in the delta area of Egypt.
2. Preparation of the soils map of Egypt.
3. Improvement of sandy soils, and the economics of their reclamation for irrigation agriculture.

4. The economics of possible crop rotations after the High Dam.

C. Approved pre-projects

1. The development of irrigation systems and their suitability for sandy soils.
2. The optimum management of the High Dam for both agriculture and electricity requirements.
3. The utilization of the High Dam in the light of the proposed projects in the Upper Nile.
4. The effect of the High Dam on the underground water.
5. Design of stable profiles of water channels after the construction of High Dam.
6. Mathematical models for water requirements.

D. Suggested research projects

1. Soil conservation.
2. Drainage of agricultural lands.
3. National policy of fertilizers and fertilization.
4. Causes of soil degradation.

IV. Environmental Research Council

A. Projects contracted during 1974 and 1975

1. The pollution of the Mediterranean sea shore at Alexandria.
2. Pollution in Lake Mariut; magnitude and the means of treatment and control.
3. Solid wastes at Helwan and Shoubra El-Kheima; their problems and possible economic uses.
4. Air pollution in Shoubra El-Kheima industrial area.
5. Air pollution in Alexandria City.

B. Projects to be contracted in 1976

1. The various environmental and health effects of air pollution in Egyptian mines.
2. Study on the exhaust control of internal combustion engines.

C. Approved pre-projects

1. Fixation of sand dunes.

2. Study on the effect of molluscicide used for controlling bilharziasis on the ecosystems in El-Fayoum governorate.
3. Environmental interactions of some pollutants.
4. Pilot project for the treatment of some industrial liquid wastes from Shoubra El-Kheima factories.

C. Suggested research projects

1. Oxidation ponds for the treatment of sewage effluent.
2. Improving the efficiency of filters, used for the purification of drinking water, for removing microorganisms.
3. Study of noise pollution in Cairo City.
4. Environmental factors affecting nonspecific respiratory diseases in Alexandria.

V. Medical Research Council

A. Projects contracted in 1974 and 1975

1. The effect of health education on the control of bilharziasis.
2. A study of immunological changes in bilharzial liver cirrhosis.
3. A pathological study of urinary and intestinal bilharziasis.
4. A comparative study of chemotherapy versus molluscicides and their effect on incidence of bilharziasis.
5. Immunological aspects in bilharziasis.
6. An ecological study on snail vector of schistosomiasis.
7. Evaluation of intensity of infection in bilharziasis and comparison of ova count in urine and stools with tissue biopsy.
8. A study of the efficacy of new cyclic compounds of Antimony.
9. Combat of animal tuberculosis in Fayoum Governorate.
10. Combat of tuberculosis in Kafr El-Sheikh.
11. Combat of tuberculosis in Assiut area.
12. Combat of tuberculosis in Qualube area.
13. Central combat of tuberculosis in Egypt.

14. Laboratory investigations of tuberculosis in Egypt.

B. Projects to be contracted in 1976

None

C. Approved pre-projects

None

D. Projects under consideration

1. The effect of pesticides on drug interaction in Egypt.
2. Survey of the prevelance of bilharziasis in the general population.

E. Projects recommended by the Academy

1. General and prophylactic survey for rheumatic fever and rheumatic heart disease in Egypt.
2. Epidemiology of rheumatic diseases in school age children in Egypt.
3. Epidemiology of coronary artery disease in Egypt and a study of risk factors, especially diabetes.
4. Preparation of pure bilharziasis antigens and possiblity of production of a vaccine.
5. Use of proteins left after preparation of blood derivatives in the preparation of coagulation factors.
6. Possibility of preparation of albumen from expired dried plasma.
7. Production of plasma alternatives and antihemophilic agents.

F. Projects recommended by the Medical Research Council

1. Morbidity and health map of Egypt.
2. Early detection and acute and chronic glaucoma.
3. Epidemiology of opthalmias in Egypt.
4. Eye injuries, especially industrial.
5. Field study of nutritional problems in Egypt.
6. Environmental, nutritional and socioeconomic factors affecting child development.
7. Nutritional aspects of epidemic diseases, endemic diseases,

cardiovascular diseases, gastrointestinal diseases and diabetes in Egypt.

VI. Radiation Technology Research Council

A. Projects contracted during 1974 and 1975

1. Effect of exposure to varying levels of ionizing radiation on the bacterial load of the locally produced bandages, dressings, surgical sutures, gloves and medical packagings.
2. Testing of the efficiency of the bacteriological and virological sterility of medical and surgical appliances and pharmaceutical containers sterilized by ionizing radiation.
3. Effect of high radiation levels used for sterilization on the chemical, physical and mechanical properties of medical appliances and pharmaceutical containers made of plastics, rubber and latex.
4. Effect of local conditions of preparation and packaging on the level of microbial contamination of bandages and dressings and how far it affects the choice of optimal radiation level required for their sterilization.
5. Investigation of the optimal radiation levels alone or coupled with other technological treatments to inhibit sprouting and rotting and improving storageability behaviour of fresh and processed onions, garlic and potato crops.
6. Studies on organoleptic, physical, chemical and microbiological changes in potatoes, onions, and garlic crops treated by radiation alone or combined with other technological treatments.
7. Investigation of any of the physiological, biochemical, anatomical or genetical changes that might be induced in experimental animals on the organ, cellular and subcellular levels due to excessive feeding on radiation preserved foodstuffs.

8. Effects of radiation on the most important pests infesting the stored grains and their products.
9. Effects of radiation on grain technology.
10. Effect of radiation-treated grains and their products on public health.
11. Improvement on technological properties of natural and synthetic textiles through radiation-chemical treatments.
12. The use of radiation-chemical treatments to improve the hardness and upscale the economical and technological value of locally produced woods.
13. Installations of laboratory equipment needed for studies and research in the fields of radiation technology, i.e., medical sterilization, food preservation and industrial technology.
14. Improvement of the technological and production properties of Egyptian cotton by radiation.
15. Increase of the productivity of main crops by radiation.
16. Increase of quantitative and qualitative productivity of wheat crop and upscaling of the nutritive value of its products using radiation.
17. Increase of productivity of rice crop and improvement of the specific properties of its varieties by radiation.

B. Projects to be contracted in 1976

1. Pharmacodynamic testing of radiation sterilized drugs and how far they are chemically and pharmacologically affected by ionizing radiation.
2. Histochemical changes in experimental animals due to intensive feeding on radiation preserved food.
3. Studies on radiation effects on bladder cancer in bilharziasis aiming at upscaling of radiosensitivity.
4. Deinfestation of imported cottons by radiation.
5. Radiation modification of technological properties of synthetic polymers.
6. Strengthening and upscaling of resistance of concrete

using radiation-chemical treatments.

7. Erection and commissioning of an irradiation rabbit system in Egypt's first research reactor.

C. Approved pre-projects

None

D. Suggested research projects

1. Improvement of oil-seed crops other than cotton-seed oil by radiation.
2. Increase of protein content in wheat and legumes by radiation.
3. Pest control in crops by breeding and radiation-induced mutations.
4. Study of the possible use of ionizing radiation in the preparation of sterilized pharmaceutical containers for optical purposes.
5. Concluding the undergoing studies concerning research projects aiming at solving national problems approved by the Academy Council.
6. To survey the main national problems confronting the social and economical development plan in the scope of work of the Council.

VII. Industrial Research Council

A. Projects contracted 1974 and 1975

1. Behaviour of Egyptian cotton toward chemical treatment and modern technology.
2. Estimation of the nutritional value of food-industry wastes as source of fodder for farm animals and poultry.
3. Production of paper pulp from the desert plant Thymelaca hirsuta L.

B. Projects to be contracted in 1976

1. The use of hydrochloric acid for phosphoric acid production (contracted).
2. The potentialities of developing vitamin production from

microorganisms through microgenetics.

3. Genetic and selection studies to develop highly efficient microorganisms for producing proteins from industrial wastes and petroleum derivatives.

C. Approved pre-projects

1. Studies on the nutritive value of sugar-industry wastes; pith and bagasse.

D. Suggested research projects

1. Separation of proteins from less common sources such as cotton seeds, leaves and algae.
2. Welding of polymers.
3. The mining of mineral salts from Lake Qaroun and other Egyptian lakes.
4. The causes of colour fading impaired by oxide pigments added to paints or floor tiles.
5. Production of fluorine salts for aluminum industry.
6. Estimation of losses due to corrosion of metals and alloys in the chemical, petroleum and metallurgical industries and in power stations.
7. Corrosion of lead cables.
8. Increasing the life of "Nasser" motor produced locally.

VIII. Petroleum and Mineral Resources Research Council

A. Projects contracted during 1974 and 1975

1. The geological maps of Egypt.
   a. subsurface structural map.
   b. gravimetric map.
   c. aerial radiometric and aerial magnetic map.
   d. magnetic field map.
2. Prospection for Nile silt substitutes in brick industry.
3. Production of protein from spirolina algae using petroleum materials.

B. Projects to be contracted in 1976

None

C. Approved pre-projects

1. Concentration of low grade phosphate ores.
2. Improving specifications of petroleum products and the production of petroleum additives.
3. Preparation of geological time-units map.

D. Suggested projects

1. Uses of petroleum materials for soil amelioration.
2. Location of new raw materials for road, railway and airport construction.
3. Studies on the iron ores in Bahariya oases.

IX. Energy Research Council

A. Projects contracted during 1974 and 1975

1. The use of solar energy in water heating for domestic uses.

B. Projects to be contracted in 1976

None

C. Approved pre-projects

1. Utilization of solar energy for distillation of salty waters.
2. Utilization of wind energy for electric power generation.

D. Suggested research projects

1. High capacity electric batteries.
2. Electric cars.
3. Electric buses.
4. Pumping of water using solar energy.
5. Contribution to research into fast breeder reactors.
6. Establishment of "Energy Documentation Center."
7. Establishment of "Center for Rationalization of Energy Utilization."
8. Cryogenic cables.
9. Energy storage by hydrogen.
10. Participation in magnetohydrodynamics, fuel cells, nuclear fusion studies.

X. Building Technology Research Council

A. Projects contracted in 1973, 1974, 1975

1. Information and documentation center for rural studies.
2. The utilization of manpower supplies in rural areas for the promotion of construction capabilities.
3. Production of alums and their fluxes locally.
4. Low-cost housing.
5. Removal of algae from Nile water.
6. Design of rural houses and re-planning of the village, in Egypt.
7. Construction by prefabricated units.
8. Effect of salty water on reinforced concrete foundation structures.
9. Evaluation of some local raw materials for the production of alums.

B. Research projects to be contracted in 1976

None

C. Approved pre-projects

1. Limit design for statically indeterminate structures.

D. Suggested research projects

1. Floor space index and tall buildings in greater Cairo.

XI. Transport Research Council

A. Projects contracted in 1974 and 1975

1. Determination of mathematical models and parameters for technoeconomic planning of freight transport in Egypt.
2. Development of Egyptian inland and overseas modes of transport for containerization.

B. Projects to be contracted in 1976

1. Optimization of present and new Egyptian harbours to suit current freight trends.

C. Approved pre-projects

1. The impact of speed and kind of vessels on water struc-

tures and earth embankments of inland waterways.

2. Parameters of passenger transport.

D. Suggested research projects

None

XII. Physics and Electronics Applications Research Council

A. Projects contracted during 1975 and 1976

1. Development of computer network for real time applications.
2. Digital data communication system.
3. Electrolytic conversion and storage of solar energy.
4. Improvement and reduction of costs of locally produced electric insulators.

B. Projects to be contracted in 1976

1. Geophysical map using wireless waves.
2. Propagation of microwaves and measurement of interfering signals and noise over Great Cairo.
3. Production of nonstandard microwave components.
4. Laser communication links.
5. Design and fabrication of microwave hybrid integrated circuits.
6. Linear integrated circuits for communications.
7. Establishment of laboratory for growth of single crystals for industrial applications.
8. Crystal growth of photovoltaic cells for the utilization of solar energy.

C. Approved pre-projects

None

D. Suggested research projects

1. Development of digital circuit system.
2. Training in the use of computers and automatic control methodology in industry in the A.R.E.
3. Fabrication of strategic electric components.
4. Application of microwave power.

5. Development of multiplexing equipment.
6. Establishment of crystal and thin-film laboratory for electronic industries.
7. Application of nondestructive tests by ultrasonic waves in industry.

XIII. Basic Sciences Research Council

A. Projects contracted during 1974 and 1975

None

B. Projects to be contracted in 1976

None

C. Approved pre-projects

None

D. Suggested research projects

None

XIV. Social Sciences Research Council

A. Projects contracted during 1974 and 1975

None

B. Projects to be contracted in 1976

None

C. Approved pre-projects

None

D. Suggested research projects

None

Annex 7

Details of Selected Projects

Project No. 01. 07/74

Title: Ecological Studies on American Boll-worm Heliothis Species in Egypt

Justification

American boll-worm is a secondary pest infecting many Egyptian crops such as corn, sorghums, tomatoes and sometimes cotton, causing serious losses to the Egyptian economy.

Objectives

1. To study and evaluate the different biological and ecological factors affecting the growth and attack of the American boll-worm on cotton in the different Egyptian localities.
2. To find permanent solutions to eradicate or reduce its harm to the cotton crop.

Research Plan

1. Conduct a general survey of Heliothis host plants in Beheira, Gharbeiya, Faiyoum and Beni-Suef Governorates.
2. Estimate the Heliothis population density before and during the cotton season.
3. Study the relationship between its population density and environmental conditions.
4. Study the behaviour and number of generations on cotton and other host plants throughout the year.

Responsible Organization

Plant Protection Research Institute, ARC,
Ministry of Agriculture and Land Reclamation.

Principal Investigator

Dr. Mohammad Mahmoud Ibrahim
General Director of the Plant Protection Department,
Ministry of Agriculture and Land Reclamation.

Duration: 3 years.

Budget: L.E. 45 000. (3 000 Foreign currency).

Project No. 01. I2/13/74

Title: Vertebrate Pests (Birds & Rodents)

Justification and Objectives

1. Studies on Factors affecting population density of rodents, bats and wild birds as pests, their damage and different methods of control.
2. Laying the foundation of wild life in Egypt as one of the important natural resources.

Research Plan

A. Birds as Pests

1. To study the main factors that turn wild birds into pests.
2. To identify the main species of resident and migratory wild birds attacking crops with regard to geographical distribution and nature of their nests.
3. Study the propagation behaviour, population density and its relation to ecology.
4. Studying the mechanical and chemical protection methods of different field crops.
5. Studying ecological toxicology and competition between birds and mammals.
6. Studying the nutritive value of passers as food for man and feed for animals.
7. Studying migratory birds and their effect on crops, animals and man.

B. Rodents as Pests

1. Determine the population density of rodents in rural and urban areas throughout the year.
2. Study the relation of the rodents behaviour to the change in environment in newly reclaimed and semi-desert areas.
3. Evaluate the integrated methods for rodent control.
4. Evaluate the effect of available pesticides and rodenticides on different species.
5. Studying the different types of rodent parasites.

6. Present storing conditions of food and their effect on the population density of rodents.
7. Control the bats attacking fruits and their biology.

Responsible Organization

Assuit University, Faculty of Agriculture.

Co-operating Organizations

1. Agriculture Research Centre, Plant Protection and Animal Health Institutes, and the Zoological Gardens, Ministry of Agriculture and Land Reclamation.
2. Faculties of Veterinary Mediciene, Cairo and Zagazig Universities.

Principal Investigators

1. Prof. Dr. Hassan A. Hafez, General Director of Zoological Gardens, Ministry of Agriculture and Land Reclamation.
2. Prof. Dr. Abdel-Moneim Maher Ali, Head Plant Protection Department, Assuit University.

Duration: 3 Years.

Budget: Birds sub-project: L.E. 56 600.
Rodents sub-project: L.E. 45 000.
(3 000 Foreign Currency).

Project No. 02. 03/74

Title: Studies of the Economics of and the Different Nutritional and Managerial Methods for Intensive Sheep Production

Justification

To cover the shortage in the animal protein diet of Egyptians.

Objective

Increase the efficiency of sheep as meat-producing animals.

Research Plan

This objective can be achieved by studying the following:

1. Genetics and Management
   a. Cross-breeding to obtain hybrid vigour.
   b. Combining abilities between breeds to obtain maximum production.
   c. Increase the lambing percentage by the introduction of prolific breeds or prolific genes.
   d. Accelerate lamb production.
2. Nutrition
   a. Study the nutritional level of the ewe at mating, mid-pregnancy, late pregnancy and at milking stages and its relationship to fertility and lambing percentage.
   b. Study the early weaning of lambs and milk substitutes.
   c. Study the optimum age for fattening lambs and its economic aspects.
   d. Study the utilization of different types of feed by adult and young sheep.
3. Physiological Studies on
   a. The possibilities of using teaser rams for detection of estrus and different systems of mating.
   b. Ovulation rates, postpartum ovulation, proper time for fertilization and the embryonic survival rate.
   c. Application of hormones for increasing ovulation rates and the subsequent effect on lambing percentage.
   d. A comparative study of natural and artificial insemination.

e. Fertility of local rams in the different seasons.

f. Causes of infertility in sheep.

g. Ram semen freezing and storage.

h. Environmental factors affecting the reproduction efficiency.

i. Optimum lambing intervals under conditions on intensive feeding.

Responsible Organization

Faculty of Agriculture, Al-Azhar University.

Co-operating Organization

General Authority for Land Development and Cultivation, Ministry of Agriculture and Land Reclamation.

Principal Investigator

Dr. E. S. Galal, Faculty of Agriculture, Ain Shams University.

Duration: 7 years.

Budget: L.E. 428 450.

Project No. 02.10 /74

Title: Study of Factors inducing Mortality in Young Lambs and Methods of Control

Justification

To produce necessary animal proteins for Egyptians and increase mutton production.

Objectives

1. Screen the sheep diseases related to infectivity nutritional, ecological, climatological and management factors.
2. Set up a zootechnical map spotting the above diseases during pregnancy in the lambhood and after weaning.
3. Attempts to combat these diseases by different methods of control i.e. chemotherapy, serotherapy, vaccine therapy etc.

Research Plan

1. First Year
   a. Screen different diseases in lambs at provincial level.
   b. Draw a zootechnical map spotting these diseases according to their causative agents i.e. bacterial, parasitic, fungal etc.
   c. Supplement the above field work by laboratory study using advanced methods and techniques and continually inspecting the flocks by both field and laboratory personnel.
   d. Introduce advanced technical methods to raise the standard of the provincial laboratory work.
2. Second Year
   a. Follow-up diseases investigated in the first year.
   b. Investigate the vaccination system adopted in the first year.
   c. Introduce the proper chemotherapy depending on specific diagnosis.

3/4. Third and Fourth Year
   a. Make an economic evaluation of the impact of the plan.
   b. Attempt to tackle the problems confronting intensive sheep production in Tahrir province and Mariut region (collective governmental farms).

Responsible Organization

Agricultural Research Centre, Animal Health Research Institute, Ministry of Agriculture and Land Reclamation.

Co-operating Organization

Organization of Land Reclamation, Ministry of Agriculture and Land Reclamation.

Principal Investigator

Prof. Dr. S. Hafez Mazhar, Ministry of Agriculture.

Duration: Four years.

Budget: Total: L.E. 19 670.

Project No. 02.13/74

Title: Poultry Viral Diseases of Economical Importance in A.R.E.

Justification

To help cover the shortage in the animal protein diet of Egyptians.

Objectives

1. Isolate and identify a number of viral diseases infecting poultry.
2. Vaccinate poultry with those isolated viruses for protection.

Research Plan

1. The First year

   Field investigations on any isolate suspected of being the causative agent and identification by serological tests. It also includes the study of the pathogenicity of the isolated viruses.

2. The Second year

   Serological tests to detect the extent of spread of these viral diseases among the poultry farms and in rural areas.

3. The Third year

   Trial of attenuation by chick embryo, or tissue culture passage to make a safe and potent vaccine against the disease appearing in the field.

4. The Fourth year

   Laboratory tests on the attenuated vaccines, and if proved safe and potent, their trial in the field under controlled conditions before the use of these vaccines for the control of those diseases.

Responsible Organization

Agricultural Research Centre, Animal Health Research Inst., Ministry of Agriculture and Land Reclamation.

Co-operating Organization

1. Faculties of Veterinary Medicine, Cairo and Assiut Universities.
2. P[illegible] Organization, Ministry of Agriculture.

Principal Investigator

Prof. Dr. M.S. El-Sabban, Director of Animal Health Research Institute, ARC, Ministry of Agriculture and Land Reclamation.

Duration: 4 Years.

Budget: Total: L.E. 28 350.

Project No. 02.14/74

Title: Fisheries Investigation of Sardines and other Pelagic Fishes Along the Egyptian Mediterranean Coast from Rashid to El-Sollum.

Justification and Objectives

1. Explore new fishery grounds for pelagic fishes, especially sardines, after the construction of Aswan High Dam.
2. Improve the present fishing techniques.

Research Plan

1. Discover new fishing grounds for sardine shoals and other pelagic fishes using light attraction and surrounding nets.
2. To study gear selectivity.
3. Carry out ecological studies of the investigated areas.

Responsible Organization

The Institute of Oceanography and Fisheries, Academy of Scientific Research and Technology.

Principal Investigator

Prof. Dr. Saad El-Wakeel, Institute of Oceanography and Fisheries.

Project Duration: 3-1/2 years.

Budget: L.E. 672 600

Project No. 03.01/74

Title: Experimental Farm for the Optimum Use of Desalted Water in Agriculture

Aims and Objectives

To carry out pilot studies for the adaptation and evaluation of new irrigation techniques such as: trickle, drip, sub-surface, per-tree (quick coupling system) and farrow irrigation on a small farm of about 10 Feddans (1 fed. = 4200 M^2) Burg El-Arab zone (Mariut Extension project) by using the available Nile water.

Responsible Organization

Atomic Energy Establishment, Academy of Scientific Research and Technology.

Co-operating Organization

Mariut Extension Project Authorities, Ministry of Agriculture and Land Reclamation.

Principal Investigator

Prof. Dr. Ahmed Fouad El-Kholy (AEE).

Duration: 5 years.

Budget: L.E. 29 000.

Project No. 03.02/74

Title: An Experimental Desalting Plant

Aims and Objectives

1. To obtain more experimental data about the performance of small desalination units. This will include measuring the residence time, vapour velocity, orifice discharge and coefficients for maximum vapour-generation in single stage flash evaporators.
2. Establishing a short-hand design procedure suitable for small desalting units; this design will be submitted to the national industry for production consideration.

The Heat Transfer and Hydrodynamics Laboratory of the Atomic Energy Establishment is initiating a programme for investigating the possibilities of designing a small desalination unit.

The design is devoted essentially to use local materials and equipment in addition to optimizing the expenses in order to keep the price of desalted water economical.

Responsible Organization

The Heat Transfer and Hydrodynamics Laboratory, Atomic Energy Establishment, Academy Scientific Research and Technology.

Principal Investigator

Prof. Dr. M. F. El-Fouli (AEE)

Duration: 3 years

Budget: L. E. 13 500 (4 000 in foreign currency).

Project No. 03.04/74

Title: Study of the Ground-Water System in the Western Nile Delta and Adjacent Areas of the North Western Desert

Aims and Objectives

The objective of the project is to undertake the necessary hydrological and hydrogeological studies for the construction of an operational ground-water model of the western Nile Delta and adjacent areas of the North Western Desert, which will be used to evaluate the consequences of present ground-water and surface water development, and provide forecasts of the results of future proposed changes of the hydrologic regime. The model will therefore be a planning tool for decision-makers involved in the development of the land and water resources of the area.

Research Plan

1. Collection of data.
2. Development of the ground-water model.
3. Operation of the ground-water model.

Responsible Organizations

Egyptian Organization for Reclamation and Agricultural projects, Ministry of Agriculture and Land Reclamation and the Atomic Energy Establishment, Academy of Scientific Research and Technology.

Co-operating Organization

1. The Ministry of Irrigation.
2. General Organization For Geological and Mining Researches, Ministry of Industry.
3. General Organization For Meteorology, Ministry of Civil Aviation.
4. Desert Institute, ARC, Ministry of Agriculture and Land Reclamation.
5. Universities.

Principal Investigator

Eng. Abd El-Rahman Darwish,

ex-Under Secretary of State, Ministry of Agriculture and reclamation

Duration: 4 years.

Budget: L.E. 80 000 (330 000 in foreign currency).

Project No. 05.01/74

Title: Effect of Health Education in Solving Bilharziasis Problem

Aims and Objectives

1. To study the effect of health education properly and scientific implementation on the knowledge, attitudes and practices of the people.
2. To study the effect of health education on the prevalence, incidence and intensity of infection.
3. To evaluate the relative effect of the different phases and different methods of health education as regards changes of attitudes and behaviour with respect to the bilharziasis problem.

Research Plan

Five villages of the same socio-economic standard, same environmental conditions and each having a rural health unit and a school, will be chosen for the study: 3 as experimental and 2 as control. The following are the steps of the study:

1. Knowledge, attitudes of all school teachers and activities about the bilharziasis problem will be tested by a questionnaire.
2. Knowledge, attitudes and practices as related to bilharziasis will be tested by an interview questionnaire for a representative sample of pupils of all schools in all the chosen villages.
3. Activities and interests of village personnel involved with the control of the bilharzia problem and all health workers in the villages chosen will be tested by another questionnaire.
4. Training of all concerned (including physicians, nurses and assistant midwives, teachers, local leaders both formal and informal) in the different aspects of the disease and the role of each in the control and health education methods and materials that could be used by each. This training will be held before the study and continuously all through the research.

   This will be undertaken in the 3 experimental villages of the study only.

5. Application and follow-up of health education activities in these experimental villages both in schools and in the public at large.
6. Evaluation of knowledge, attitude and practices of school children at the beginning of each academic year. Also urine and stools analyses will be made before the study and yearly during the study period.

Responsible Organization

Faculty of Medicine, Alexandria University.

Principal Investigator

Prof. Dr. Wasfia H. Kamel, Faculty of Medicine, Alexandria University.

Duration: 5 years

Budget: L.E. 20 000.

Project No. 05.02/74

Title: Immunological studies in schistosomiasis

A. Relations between serologic tests and cell-mediated immunity and their repercussions on intensity of infection, activity and effect of treatment on the immunologic aspects.

B. Effect of double infections; hematobium and mansoni on the morbidity and immunity and effect of treatment.

C. Relation between hepatic schistosomiasis and other concomitent infection: viral hepatitis, salmonella infection, etc....

Aims and Objectives

A. 1. Study of the new tests of cell-mediated immunity and their importance in proper diagnosis of the disease, and their role in the pathogenesis of various visceral manifestations known to affect only a special sector of the population infected with bilharziasis.

2. Trail to correlate the already established tests depending on humeral immunity to the various tests of cell-mediated immunity.

3. Trial to study the intensity of infection as judged by clinical picture, parasitic load and immunologic reactions.

4. The study will try to answer the question of activity of infection and to see if there is what is called closed or arrested infection.

5. The effect of various lines of therapy on the clinical pathological, parasitological as well as immunologic tests.

B. Study of the role played by combined infection; hematobium and mansoni on the clinical, pathological and immunologic reactions; this will denote if there is cross-protection or cross-resistance between both species. The importance of timing of infection and the dose of infecting cercaria will be performed both on human material and on experimental animals infected by either one or both species in various combinations.

C. 1. Viral hepatitis is known to occur, and is increasing in the last few years in this country. Bilharzial patients are subject to repeated infections. It has been found that viral infection occurs with hepatic bilharziasis, and it usually adds to the complications of the disease. The aim of the study is to find the exact behaviour of the virus in these cases, and whether it has a different course from that known to occur in patients without hepatic bilharziasis and how far it may affect the liver pathology and function. This study is facilitated by the availability of testing for Australia antigen.

2. Salmonella infection is common in this country, and bilharzial patients are no exception. They are known to have a modified picture and prolonged course. It is not known if this is due to pathological or immunological reasons.

Research Plan

Studies by bacteriological and immunologic techniques in human and in experimental animals.

Responsible Organization

Faculty of Medicine, Cairo University.

Principal Investigator

Prof. Dr. Abdel-Hamid Ali Atta
Head of Endemic Diseases Dept.,
Faculty of Medicine,
Cairo University.

Duration: 4 years.

Budget: L.E. 61 200.

Project No. 05.03 /74

Title: Studies on the Ecology of the Snail; Intermediate Hosts of Schistosomiasis in Egypt

Aims and Objectives

1. Studies of the various ecological factors that help in the snail distribution and promote active breeding.
2. Study of the snails, population dynamics, and their breeding seasons.
3. Studies on the rate of infection of snails with human schistosome cercariae, throughout the year and determining the factors that affect schistosome transmission.
4. Recording the natural enemies of snails in the field.
5. Determination of the snail age which is suitable for infection with schistosomes.

All these research items aim at the choice of the proper molluscicide for the snail control and adjusting the time of its application.

Research Plan

1. Snail distribution and density in different seasons and ecological conditions (old established capital, area reclaimed from the desert, rice-growing area, basin-irrigation area, tunnel-drainage area, areas reclaimed from northern lakes, area polluted by industrial waste products and Lake Nasser).
2. The breeding season or seasons of snails.
3. Monthly infection of snails with human schistosome cercariae.
4. Location of infective foci with respect to inhabited places.
5. Chemical and biological constitution of the collected samples.
6. Laboratory experiments to verify field observations.

Responsible Organization

Department of Parasitology, Faculty of Medicine, Ain Shams University.

Co-operating Organizations. Institute for Endemic Diseases and Tropical Medicine, Ministry of Health, and Faculty of Science, Cairo University.

Principal Investigator

Dr. M. S. El-Guindy,

Prof. Faculty of Medicine, Ain Shams University.

Duration: 2 years.

Budget: L.E. 15 000.

Project No. 05.04 /74

Title: Immunological Changes of Hepatic Bilharziasis.

Aims and Objectives

Re-assessment and extension of works previously accomplished on immunological changes in bilharzial liver involvement.

1. Immuno-diffusion and immuno-electrophoretic study of serum immunoglobulins Ig M, Ig A, Ig G, Ig D, Ig E, antinuclear factor, rheumatoid factor, CIA/CIB, C 4 Alpha" macroglobulin together with serum protein electrophoresis.
2. Immunopathological assessment of changes in the liver spleen lymph nodes and bone marrow.
3. Experimental study of antibilharzial drugs on the serum immunoglobulins.
4. Study of immunological changes of mice infected with bilharzia mansoni.
5. Assessment of the effect of malnutrition on the immunity process.
6. Evaluation of the effect of immunosupressants and cytotoxic drugs on antibody formation and immunity mechanism.
7. Assessment of the effect of spleenectomy on immunity mechanism.

Procedure

1. Complete haemogram and myelogram.
2. Study of serum immunoglobulins by Mancini immunodiffusion technique.
3. Estimation of rheumatoid and anti-nuclear factors.
4. Immuno-electrophoretic characterization of serum proteins.
5. Immunoflorescent study of lymphocytes.
6. Haemaglutination inhibition test.
7. PHA stimulation test of lymphocyte culture.
8. Skin sensitivity to tuberculin, dischlorobenzene and Candida albicans.
9. Examination by the ordinary light microscope, regarding any associated nutritional, malnutrition effect or evidence of

cellular immunological reaction in liver, spleen, or lymph glands.

10. Examination by florescent microscope for immunological reactions.
11. Radioimmunoassay of Ig E.
12. Liver function test.

Responsible Organizations

Faculty of Medicine, and High Institute of Public Health, Alexandria University.

Principal Investigator

Prof. Dr. Mostapha H. Ghanem,
Faculty of Medicine,
Alexandria University.

Duration: 3 years

Budget: L.E. 63 650.

Project No. 05.05 /74

Title: Comparative Study of Results of Human Treatment, Snails Control and Effect of Both on Incidence of Bilharzial Infection.

Aims and Objectives

Evaluation of the effect of antibilharzial treatment snail control on the incidence or bilharzial infection to determine the proper control measure of this endemic disease by indirect serological methods which can indicate complete cure of patients in contrast to direct methods of examination that show apparent cure only.

Research Plan

Determination of units in which treatment will be conducted or which lie in the regions of control or both together. These will include the medical units belonging to Qaliyub Research Centre under supervision of Dr. Mohamed El-Alamy. Treatment being given in this centre regularly to patients inhabiting this region and who can be called by project workers for the serological and direct examination regularly to assess the effect of treatment or control or both. The treatment will be conducted by physicians and assistants working in Qaliyub Centre.

Responsible Organization

Department of Parasitology, Faculty of Medicine, Ain Shams University.

Co-operating Organization

Ministry of Health.

Principal Investigator

Prof. M.A. Rifaat,
Faculty of Medicine,
Ain Shams University.

Duration: 4 years

Budget: L.E. 30 000.

Project No. 05.06 /74

Title: Evaluation of the Degree of Bilharzial Infection in the Body in Relation to Egg-Count in Urine, Stools and Tissues.

Aims and Objectives

To study the importance of egg-count in the urine, stools and the tissues in judging the intensity of bilharzial infection in different organs in different stages of the disease.

Research Plan

To determine Bilharzial egg-count in urine, stools and tissues; to undertake clinical laboratory endoscopic radiological, and serological investigations, liver and kidney function tests.

Responsible Organization

Endemic Diseases Department, Faculty of Medicine, Ain Shams University in collaboration with the Department of Pathology, Radiology and Clinical Pathology.

Principal Investigator

Prof. Shoukry Mohammad Shoeb,
Faculty of Medicine,
Ain Shams University.

Duration: 4 years

Budget: L.E. 10 700 (1 800 Foreign currency).

Project No. 05.08 /74

Title: Tuberculosis Research Project.

Justification and Objectives

1. To discover:
   a. Prevalence rate of pulmonary tuberculosis.
   b. Infection rate of tuberculosis.
2. To study the reliability of the different methods of diagnosis:
   a. Tuberculin testing:
      i. To ascertain the suitable T.U. dose.
      ii. To ascertain the demarcation between positive and negative reactors.
   b. Radiological examination:
      i. By mass miniature and large films.
      ii. Cost-benefit analysis of using X-ray examination as a method of diagnosis.
   c. Bacteriological examination of sputum and laryngeal swab for symptomatic patients.
   d. Study of socio-economic conditions of the patients and comparison of their condition with other normal individuals.
3. Study of results of different regimens used in treatment.
4. Results of tuberculosis control programme using different prevention methods:
   a. B.C.G. Vaccination.
   b. Chemoprophylaxis.
5. Study of the problem of defaulters.

Project No. 05.08.A/74

Title: Tuberculosis Project in Kafr el-Sheikh.

Research Plan

1. Tuberculin testing of non-vaccinated population of various age groups to estimate prevalence of infection in the community.
2. Studies on direct B.C.G. vaccination, studies on the vaccine: various types, liquid and freeze-dried, observe side-effects then estimation of value of protection gained by following the vaccinated group for a period of 10 years.
3. Case-finding programme.
   a. Active means by using mass miniature radiography.
   b. Passive method by examining only symptomatics.
   c. Case-finding by examining only sputum by direct smear examination.
4. Modern regimens for treatment of pulmonary tuberculosis application of various methods, daily regimens.

Responsible Organization(s)

Ministry of Health and its local authorities, and the Faculty of Medicine, Cairo University.

Principal Investigator

Dr. Abdel-Tawab Mohamed el-Gharably, Director, Dept. of Chest Disease, Ministry of Health with the cooperation of 15 other scientists from the Faculty of Medicine Cairo University, and the Ministry of Health.

Duration: 10 years

Budget: L.E. 76 320.

Project No. 05.08.B/74

Title: Tuberculosis Project in Assiut.

Research Plan

1. Community survey of a representative sample of the governorate, to be repeated at 4-year intervals during the 10 years of the study.

   The survey will include the following investigations:

   a. Tuberculin testing.

   b. MR.

   c. Sputum bacilloscopy to all subjects having productive cough.

   During these surveys it is aimed to evaluate:

   a. The efficiency of the different methods of discovery of new cases and their cost/benefit relationship.

   b. The degree and frequency of tuberculin positivity among the different age groups and in particular among the previously vaccinated group.

2. Thorough record of new cases after the initial survey during the years of the investigation, to estimate the morbidity rate and the trends in the infection.

3. Studies concerned with evaluation of the efficiency of B.C.G. vaccination and its side-reactions.

4. Investigating the results of the different drug regimens and how to overcome the problem of defaulters and what is the most suitable and economic method that should be recommended in the country.

Responsible organizations

Faculties of Medicine and Veterinary Medicine, Assiut University in cooperation with the local authorities of the Ministry of Health.

Principal Investigator

Dr. Mohamed Said Seoudi,
Prof., Faculty of Medicine,
Assiut University.

Duration: 10 years

Budget: L.E. 76 320.

Project No. 05.08.C/74

Title: Tuberculosis Project in Qaliyub.

Research Plan

First Phase

1. Field study by examining 5% of the total population taking the family as a unit.
2. Study on tuberculin test using different tuberculin concentrations.
   a. Comparison study between mass miniature and large films (12" x 15").
   b. Study of the large X-rays of tuberculin positive children below 5 years.
   c. Cost-benefit analysis of those using X-ray as a way of diagnosis.
3. Bacteriological examination of sputum and laryngeal swabs of symptomatic cases.
4. Social study of families of discovered cases, with non-infected families randomly chosen taking into consideration housing, income, population density, etc.

Second Phase

1. Cases discovered will be divided into groups which will be submitted to different control methods. This will be carried out with different specimens from different villages in Qaliyub area.
2. Cases discovered radiologically will be divided into two groups:
   a. Bacillary Cases: are cases with positive sputum either by direct smear or by culture, for which the following steps are taken:
      i. Bacilli will be defined whether human, bovine or atypical.
      ii. Resistance of bacilli to specific anti-tuberculosis drugs.

iii. Cases treated as follows:

(the village is the unit)

Daily treatment

- INH & Thiacetazone & Streptomycin.
- INH & Thiacetazone daily in one single dose.

Interrupted treatment

- INH & Thiacetazone.
- INH & Thiacetazone & Streptomycin.

The above two regimens are given once or twice weekly.

b. Non-bacillary cases: of which three successive specimens (sputum or largyngeal swab) are negative by direct smear and culture.

Follow-up of these cases is done bacteriologically and radiologically every six months. In case bacilli are discovered in this group, patients are shifted to the bacillary group and treated in the way as it is done in the village.

Two side-way studies are going to be conducted:

1. Study of the morbidity rate between contacts of bacillary and non-bacillary cases, and their follow-up after 12 months.
2. Study of the efficacy of B.C.G. vaccination either direct or indirect, liquid or dry.

Responsible Organizations

Faculty of Medicine, Cairo University and Ministry of Health.

Principal Investigator

Dr. Mohamed Abdou al-Alamy,
Director of Field Research,
Ministry of Health.

Duration: 10 years

Budget: L.E. 47 923.

Project No. 07.01 /74

Title: Behaviour of Egyptian Cotton Towards Modern Chemical Treatment and New Technological Processes.

Justification

To improve the original strength of cotton fibres via liquid ammonia treatment to compensate for strength losses taking place during the easy-care finishing treatments.

Objectives

1. To initiate a systematic study of different Egyptian cotton varieties to examine their behaviour towards treatment with liquid ammonia.
2. To study the use of the new spinning technique, "Open-end Spinning," on different Egyptian cotton varieties.

Research Plan

1. To study the response of commercial and new Egyptian cotton varieties to liquid ammonia treatment.
2. To examine the mechanical properties of the treated cottons and the changes in the fine physical structure of cotton by the use of X-ray and infra-red spectroscopy.
3. To study the behaviour of liquid ammonia-treated cottons to open-end spinning.
4. The above studies will help in:
   a. selection of the varieties of cotton suitable for liquid ammonia treatment,
   b. specification of these varieties,
   c. improvement of the strengths of cotton to counter-balance the losses caused by easy-care finishing treatment,
   d. suitability of the open-end spinning for these varieties of cottons, and
   e. encourage breeding of superior varieties to meet the demand for liquid ammonia treatment.

Responsible Organization

National Research Centre, Academy of Scientific Research and Technology.

Co-operating Organizations

1. Textile Department, Faculty of Engineering, Alexandria University.
2. Cotton Technology Research Institute, Agricultural Research Centre, Ministry of Agriculture and Land Reclamation.

Principal Investigator

Prof. Dr. Abdel-Aziz M. Kantouch, NRC.

Duration: 2 years

Budget: L.E. 30 000.

Project 08.01 /74

Title: Substitutes for Nile Silt in Building Materials.

Aims and Objectives

To evaluate clays and and shales adjacent to the Nile Valley to substitute for Nile silt as building materials.

Research Plan

1. To examine the prospective sites for clay materials.
2. To estimate the reserves of these sites.
3. To perform laboratory experiments on the use of these clays in making bricks.

Responsible Organization

Faculty of Engineering, Cairo University.

Co-operative Organization

Building, Housing and Urban Planning Research Institute.

Principal Investigator

Dr. M.R. Hussein,
Building, Housing and Urban Planning Research Institute.

Co-principal Investigator

Dr. H.F. Imam,
Faculty of Engineering,
Cairo University.

Duration: One year that can be renewed.

Budget: L.E. 40 000/year.

Project 08.02-05 /74

Title: Geological Map of Egypt.

Justification and Objectives (General):

To prepare a geological map that will be of great benefit not only to the petroleum and mineral industries but also to various development activities in agriculture, industry, irrigation, transport, construction and engineering projects.

Project No. 08.02 /74

Title: Sub-surface Geological Maps of Egypt.

Aims and Objectives

The main purpose of constructing these sub-surface maps is to define the facies of the mentioned geologic units, their thickness and structure at depth. These maps of scales 1:500,000 and 1:1,000,000 are regional and do help in directing the exploration for mineral resources and ground-water in Egypt.

Research Plan

The project on the sub-surface geologic maps of Egypt includes the construction of sub-surface maps showing structure contour, isopach and facies of selected geologic units, as follows:

1. Structure contour on the basement surface.
2. Structure contour, isopach and facies of the Paleozoic.
3. Structure contour, isopach and facies of the Jurassic.
4. Structure contour, isopach and facies of the Lower Cretaceous.
5. Structure contour, isopach and facies of the Upper Cretaceous.
6. Structure contour, isopach and facies of the paleocene-Eocene.
7. Structure contour, isopach and facies of the Miocene.

Construction of these maps will be based on data collected from drilled wells and measured surface sections. The source of these data comes from all the organizations which deal with the geology of Egypt, e.g. Petroleum Companies, Universities, Geological Survey, Atomic Energy .... etc.

Responsible Organization

General Petroleum Company.

Principal Investigator

Dr. A.N. El-Barkouky, Chairman,
Board of Directors,
The General Petroleum Company.

Duration: 10 years (It has been agreed to finish it in 5 years.)

Budget: L.E. 50 000.

Project No. 08.03 /74

Title: The Bougeur Gravity Map of Egypt.

Aims and Objectives

To prepare the Bougeur gravity map of Egypt.

Research Plan

1. Compilation of the previous measurements and tying the previous surveys to the international gravity base net (I.G.B.N. 71) by means of calibration lines tied to international base stations.
2. Gravimetric survey for non-surveyed areas north of latitude 27° N, by means of net-work of lines 5 - 10 km apart, with points of observations every 1 km.
3. Regional gravimetric measurements for the areas south of latitudes 27° N, on the main roads and tracks crossing the whole area and forming a closed polygon. Observations will be taken every 2-5 km.
4. Program for establishing a net of base stations of the available triangulation points of 1st, 2nd, 3rd degree beside locating other base stations to complete a uniform distribution of the net. The base net will be tied to the International Gravity Base Net 71.
5. Special study will be made for estimating the surface density for each part of the Country. For the time-being, the area is sub-divided into 4 main zones:
   a. Eastern Desert.
   b. Sinai.
   c. Delta and Nile Valley.
   d. Western Desert.

   The results will be represented by Bougeur Anomaly Maps on scales 1:500,000 and 1:1,000,000 and base stations map on scale 1:1,000,000.

Responsible Organization

General Petroleum Company.

Principal Investigator

Dr. A.N. El-Barkouky, Chairman,
Board of Directors,
The General Petroleum Company.

Duration: 10 years (Now agreed to finish it in 5 years.)

Budget: L.E. 1 000 000.

Project No. 08.04 /74

Title: The Aerial Radiometric and Magnetic Maps of Egypt.

Aims and Objectives

To construct an aerial radiometric and aerial magnetic maps of Egypt on scale 1:500,000 to be reduced eventually to scale 1:1,000,000, to help in mineral exploration on a country-wide basis.

Research Plan

The maps are based on parallel flight lines with 5 km intervals at maximum, using fixed wing aircraft on which aerial scintillometer and aerial magnetometer are mounted. The maps will be contoured and presented with contour intervals of 1% in the case of aerial radiometry and 10 γ in the case of aerial magnetometry.

Responsible Organization

Atomic Energy Establishment, Academy of Scientific Research and Technology.

Principal Investigator

Prof. Dr. E.M. El-Shazly (AEE).

Duration: 10 years (Now agreed to reduce it to 5 years.)

Budget: L.E. 1 500 000.

Project No. 08.05 /74

Title: The Normal Geomagnetic Field of Egypt for the Epoch 1975.0.

Aims and Objectives

The distribution of the elements of the geomagnetic field within an area depends on its time variation and on the geological structures within the earth's crust.

Whenever there is a structure containing magnetic materials, the geomagnetic field is increased giving rise to magnetic anomolies. Thus, in order to locate such structures it is necessary to have up-to-date maps of the distribution of the normal geomagnetic elements, and geomagnetic survey of the area under consideration reduced to epoch.

Research Plan

In this project, it is intended to carry out field magnetic surveys at 2000 "absolute stations" at about every 20-30 km. covering Egypt where all the elements of the geomagnetic field are measured and at 10,000 points at intervals of about 5-10 km., where the variation in the geomagnetic forces are measured. Using the registration of Misallat Geomagnetic Observatory, all data will be reduced with respect to time variation, to the Epoch 1975.0.

Responsible Organization

Institute of Astronomy and Geophysics, Helwan, Academy of Scientific Research and Technology.

Principal Investigator

Prof. Dr. M. Fahim Mahmoud,
Director of the Institute.

Duration: 5 years

Budget: L.E. 66 000 (36 000 in foreign currency).

Project No. 11.01 /74

Title: Mathematical Formulation of Models and Parameters for Techno-Economic Planning of Freight Transport in A.R.E.

Aims and Objectives

1. To determine the share of transport sector in the gross national product and the total investments to achieve optimum balance.
2. To reduce transport cost by best utilization of the inherent advantages of each mode in such a way that commodities reach production centres at the proper time.

Research Plan

1. To study the relationship between transport and other sectors of the economy.
2. To develop traffic generation formulae.
3. To make an inter-zonal transfer model and traffic volume matrices.
4. To develop route matrices.
5. To establish cost, length, and travel time matrices.
6. To assign traffic to transport facilities and optimization.

Responsible Organization

Transport Planning Authority, Ministry of Transport.

Co-operating Organization

Faculty of Engineering, Cairo University.

Principal Investigator

Eng. Ali F. El-Daghastani,
Deputy Chairman,
Transport Planning Authority (TPA).

Duration: 2 years

Budget: L.E. 31 000.

Project No. 11.02 /74

Title: Development of Means of Inland and Overseas Goods Transport by Using Containers.

Aims and Objectives

The use of containers in the transport of goods is considered a revolution in the new technology of world trade. Containers are also considered as an important element in the new trend of mass distribution.

Transport by the use of containers is a technological revolution in the world of goods transport from door to door, in a quick, easy and safe way. The use of containers ends the era of the conventional way of transporting goods as parcels or packages, which is expensive and unsafe as far as package contents are concerned. Containers introduced a new systematic means of goods transport which shortens the distance and time between the manufacturer and consumer across continents and oceans.

However, the use of containers might be a costly and cumbersome method if its handling is not done by the proper equipment and in large enough quantities throughout its journey by sea in ships, by air in airplanes, by land by railways, roads or inland waterways.

Each country is trying to join the era of containerization according to its means, geographical conditions and finally its general financial economy.

Thorough study, analysis and extensive research for this project at the national level gives us the green light which will lead us to fruitful results coinciding with our local conditions, and not just imitating other more developed countries.

Research Plan

1. a. A general survey of the internal and external commerce of Egypt to know the sort of goods which could be fitted in containers for internal and external transport.

   b. A survey of the volumes of cratings which contain the

different goods intended for export for the purpose of choosing the best sizes to be fitted inside the standard containers (10', 20', 30' and 40' containers) and studying the cost economy.

2. a. A general survey of the existing ports for the purpose of handling containers and proposing the necessary development as a first necessary stage.

   b. Planning for further stages of new container ports after reaching the economical volume of container transport.

   c. Study of the Egyptian maritime fleet and the possibility of using it for container transport.

   d. Study of the future needs of special container ships and their most economical size.

3. a. A survey of the existing transport means (roads, railways and inland water-ways) and studying the future needs of these means for each stage.

   b. Study of the situation of centres of production and collection to decide on the centres of container filling, collection and exchange of containers between the different means of internal transport.

   c. To fix the needs of container centres as far as mechanical handling equipment are concerned.

4. A study of the economy of the use of containers and its effect on the national economy and the effect of the use of these containers on the quantity and value of Egyptian exports and imports in the future and the cost of transport insurance.

5. a. The study of the ownership of the containers in foreign countries and the most convenient method for Egypt, as far as their handling and their contents are concerned, and the necessary documents required.

   b. The study of possibility of the manufacture of containers locally if it will prove to be economical.

6. Study of the customs rules and developing them to facilitate the movement of containers in ports and under the customs supervision during its journey inland.

Responsible Organizations

The Port of Alexandria Authority.

Co-operating Organizations

1. Faculties of Engineering and Commerce, Alexandria University.
2. Faculty of Commerce, Al-Azher University.
3. Ministry of Commerce
   a. General Union of Chambers of Commerce.
   b. General Cotton Organization.
   c. Customs Administration.
4. Ministry of Agriculture and Land Reclamation.
5. Ministry of Industry
   a. General Engineering Goods Organization.
6. Ministry of Transport and Communication
   a. Transport Planning Authority.
   b. General Organization of Transport.
   c. Suez Canal Authority.
7. Port and Lighthouses Administration, Ministry of War.

Principal Investigator

Dr. Eng. Younes Amin Omar,
Ex-Chairman,
Port of Alexandria Authority.

Duration: 2 years

Budget: L.E. 40 000 (3 000 in foreign currency).

Annex 8

Joint Research Projects between the Academy of Scientific Research and Technology and Foreign Institutions With the National Science Foundation (U.S.A.)

A. Marine fouling and corrosion, and anti-fouling and anti-corrosive coatings.
Carried out by the National Research Centre in collaboration with Naval Medical Unit No. 3 (NAMRU - 3).

B. Utilization of solar energy.
Carried out by National Research Centre in collaboration with the University of New Mexico and the University of Maryland.

C. Water Quality studies on Lake Nasser and River Nile.
Carried out by the National Research Centre in collaboration with the University of Michigan and the Environmental Protection Agency.

D. Remote sensing.
Carried out by the Academy in collaboration with the University of Oklahoma.

E. Geological and geophysical study of the Eastern Mediterranean.
Carried out by the Academy and the Woods Hole Institute of Oceanography.

F. Metabolic reactions in fungi.
To be carried out by the National Research Centre and the Department of Microbiology of the University of Illinois.

G. Distribution and inactivation of parasitic and bacterial pathogens in edible fish.
Proposed to be carried out by the National Research Centre and the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare.

H. Biochemical and physiological studies of certain tick vectors of disease agents.
To be carried out by the National Research Centre and the United States Government, as represented by the National Institute of Health, RHS, DHEW, Bethesda, Maryland.

II. With the Institute Francaise de Petrole

A. The production of protein from blue green algae.
To be carried out by the Egyptian Petroleum Research Institute in collaboration with the National Research Centre.

III. With the Academy of Sciences, USSR

A. Introduction of new varieties and species of plants and elaboration of methods of developing drought resistant crops.
To be carried out by the Agricultural Research Centre, Institutes of Soil and Water Research and Field Crops, Ministry of Agriculture (A.R.E.) in collaboration with Dokuchaev Soil Science Institute of Oil Crops USSR.

B. Introduction of varieties and elaboration of oil crops.
To be carried out by Institute of Field Crops, Ministry of Agriculture in collaboration with the Institute of Oil Crops, USSR.

C. Utilization of Egyptian nephelene cyanite as raw material in alumina production instead of bauxite.
To be carried out by the National Research Centre in collaboration with Baikov Institute of Metallurgy, USSR.

IV. With the Federal Republic of Germany

A. Utilization of solar energy for desalination and cooling.
To be carried out by the National Research Centre in collaboration with the Ministry of Economic Co-operation and Dornier System, F.R.G.

B. Production of proteins from algae.

To be carried out by the National Research Centre in collaboration with Department of Algae Research and Algae Technology G.S.F., Dortmund, F. R. G.

C. Trace elements research.

To be carried out by the National Research Centre, Ministry of Agriculture and Assiut University with the Technical University of Munich sponsored by the German Ministry of Economic Co-operation.

V. With the Democratic Republic of Sudan

A. Solar energy.

To be carried out by Solar Energy Research Institute of the Sudan in collaboration with Solar Energy Research Laboratory of the National Research Centre.

B. Building research.

To be carried out by Scientific and Technological Research Council of National Research Council, Sudan, in collaboration with the Ceramics and Building Materials Laboratory of the National Research Centre (A.R.E.).

C. Utilization of agricultural wastes.

To be carried out by Scientific and Technological Research Council of National Research Council, Sudan, in collaboration with Cellulose and Paper Laboratory of National Research Centre (A.R.E.).

VI. With the United Nations Development Program (UNDP)

UNDP subsidizes some of the projects carried out by the Academy and provides funds for a Coastal Erosion Project with the Institute of Oceanography and Fisheries.

Annex 9

List of Scientific and Cultural Agreements Between the Academy of Scientific Research and Technology and Foreign Countries

Country (date of agreement)	Joint Research	Other Fields of Cooperation
1. Afghanistan		Exchange of delegates.
2. Albania		Exchange of scientific information and publications.
3. Algiers		Exchange of publications, pamphlets, research papers and scientists.
4. Bahrain		Exchange of scientific publications and scientific organization schemes and exchange of experts.
5. Belgium		Soil and water utilization to raise agricultural production.
6. Bolivia		Exchange of pamphlets, publications, periodicals and scientific organization schemes.
7. Brazil		Exchange of books and periodicals.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
8. Bulgaria (2/26/75)	1. Food technology 2. Agriculture 3. Medicinal plants 4. Electronics 5. Agricultural and socio-economic planning. 6. Soil sciences	
9. Canada		Exchange of delegations, publications, documents and scientific journals.
10. Chad		Exchange of scientific publications and scientific organization schemes.
11. Chili		Exchange of publications, pamphlets, periodicals and scientific organization schemes.
12. Cuba (9/10/75)	1. Utilization of sugar cane bagasse in pulp, paper and rayon industries. 2. Non-conventional sources of protein for human and animal feeding. 3. Preservation of natural juices. 4. Sugar technology. 5. Medical sciences. 6. Nuclear sciences.	Documentation and exchange of periodicals.
13. Cyprus		Exchange of publications.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
14. Czechoslovakia (4/8/74)	1. Parasitology. 2. Bentonite dressing. 3. Isotopes. 4. Semi-industrial experiments. 5. Experimental surgery, biochemistry and immunology. 6. Ground-water. 7. Fisheries. 8. Control of cotton pests especially leaf worm.	1. Exchange of scientific information and documentation. 2. Scholarships for post-graduate and post-doctorate work. 3. Equipment supplied.
15. Germany G.D.R. (2/10/73)	1. Radicactive isotopes. 2. Fibre research.	1. High polymers. 2. Radiation research. 3. Science policy and management. 4. Exchange of documentation, information, scholarships for post-graduate and post-doctorate work.
16. Greece		1. Exchange of scientific periodicals. 2. Exchange of scientific visits.
17. Hungary		1. Exchange of information, documentation, patents, statistics and scientific publications and films. 2. Exchange of visits. 3. Exchange of scholarships for post-graduate and post-doctorate work.
18. India (3/14/75)	1. Insecticides. 2. Food and dairy.	1. Scientific documentation.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
India (cont.)	3. Nutrition. 4. Metallurgy.	2. Laboratory equipments. 3. Science policy. 4. Exchange of knowledge in food, dairy, fats and oils, leather tanning, pulp and paper, improvement of short cotton fiber, land reclamation, machine design, non-conventional energy sources, remote sensing project and desalination. 5. Scholarships for training and graduate studies.
19. Iraq (3/26/75)	1. Biological pest control. 2. Production of protein using petroleum products. 3. Irrigation, fertilizers, pest control. 4. Date palm pulp and paper industry. 5. Textiles and dyes. 6. Clay bricks.	Exchange of information, documentation, patents, statistics, and scientific popular films.
20. Iran		Exchange of delegations.
21. Italy (2/28/73)	Peaceful uses of atomic energy.	1. Irrigation. 2. Fisheries. 3. Agricultural development. 4. Environmental development. 5. Scholarships for training. 6. Exchange of scientists. 7. Exchange of scientific periodicals, documentation, statistics, scientific popular films and patents.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
22. Kameron (Cameroon)		Exchange of scientific information.
23. Kuwait		Desalination, fisheries, petroleum.
24. Mexico		Exchange of scientific information and periodicals.
25. Morocco		1. Exchange of scientific personnel, technical staf and administrators to achieve scientific development. 2. Combined projects. 3. Exchange of periodicals and publications.
26. Mongolia		Exchange of visits, books, periodicals and publications, films and scientific materials.
27. Nigeria		Exchange of scientists and periodicals.
28. Norway (9/22/74)		1. Scholarships. 2. Cooperation between research institutes of both countries in fields of physics, engineering, medical sciences, agriculture and pollution.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
29. Poland (11/30/74)		1. Computers. 2. Planning and census. 3. Agriculture and irrigation. 4. Metallurgy and industry. 5. Building and architecture. 6. Transport. 7. Physics and solid state. 8. Physiology of reproduction. 9. Microbiological production of antibiotics. 10. Astronomy, seismology and geophysics. 11. Scientific Instrumentation Centre, equipment supplied. 12. Exchange of visits, scholarships for post-graduate and post-doctorate work.
30. Philippines		Exchange of experts, research papers and scientific information.
31. Romania (6/18/75)	1. Petroleum refining and petrochemicals, coke. 2. Road construction. 3. Agricultural mechanization.	1. Establishing of Joint Semi-industrial Laboratories. 2. Science policy and technology transfer. 3. Patents. 4. Scholarships for post-graduate and post-doctorate work.
32. Siera Leone		Exchange of visits and information and scientific publications, science policy, fish breeding.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
33. Senegal		1. Exchange of publications, pamphlets and papers. 2. Exchange of visits.
34. Sudan (March-April, 74)	1. Control of the bollworm of cotton. 2. Fisheries and oceanography. 3. Rice research. 4. Water requirements. 5. Seed propagation and storage. 6. Environmental studies in Lake Nasser and Lake Nubia. 7. Desertification of arable land. 8. Fruit and vegetable export. 9. Solar energy. 10. Utilization of agricultural wastes. 11. Bilharzia. 12. Medicinal plants. 13. Horticulture.	1. Exchange of documentation, information and patents. 2. Atomic energy
35. Switzerland		Exchange of publications and documentation in science and technology.
36. Syria		Exchange of publications, documents, delegations, scientific and technical information.
37. Tunis		Exchange of scientists and publications.
38. Uganda (7/9/74)		1. Exchange of periodicals. 2. Exchange of experience and research findings of Uganda in River Nile, and Egypt in Lake Nasser.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
39. United Kingdom (1/12/76)		1. R&D Management and transfer of technology. 2. Medicine, veterinary sciences, pharmaceutical technology, microbiology, astronomy, chemistry, glass, electronics. 3. Scholarships for post-graduate and post-doctorate work.
40. Uruguay		Exchange of publications, information concerning scientific organization schemes.
41. U.S.A.		1. Anti-fouling paints. 2. Solar energy. 3. Lake Nasser. 4. Geological and geophysical studies of East Mediterranean. 5. Support of NRC Laboratories with equipments. 6. Low-cost housing. 7. Metabolism of fungi. 8. Remote-sensing project. 9. Parasitic microorganisms and bacteria causing disease in fish.
42. U.S.S.R. (2/3/75)	1. Electronics. 2. Agriculture. 3. Metallic ores. 4. Solar energy. 5. Socio-economic development in rural communities. 6. Building materials for rural and urban areas. 7. Astronomy.	1. Metrology and standardisation. 2. Dairy technology. 3. Maintenance and repair of scientific equipment. 4. Scholarships for post-graduate and post-doctorate work. 5. Exchange of documentation, scientific information, statistics, etc.

Country (date of agreement)	Joint Research	Other Fields of Cooperation
43. Yugoslavia (3/17/69)		1. Raising maize productivity. 2. Beet and corn gardening. 3. Biological control of pests. 4. Raising meat and milk production. 5. New methods in milk sterilization and cheese-making. 6. Rural agricultural industrialization. 7. Building research. 8. Underground-water prospecting. 9. Metallurgy. 10. Prospecting for phosphate. 11. Techno-economic study of phosphate beneficiations. 12. Dressing of Egyptian iron ores. 13. Directory of properties of Egyptian iron ores. 14. Raising durability of molds and forms. 15. Scholarships for training and graduate studies.

P.S. Cultural Agreements have been signed with the following 21 countries, but no fields of scientific cooperation have been identified yet:

Argentina, Bangladesh, Colombia, Burundi, Ethiopia, Holland, Japan, Korea, Dominican Republic, Liberia, Mali, Nepal, Peru, Saudi Arabia, Singapore, Spain, Tanzania, Vatican, Yemen D.R., Zambia, and Zaire.

Annex 10-A

National Research Centre

Central Research Laboratory: Special Services

First Priority Equipment

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard (price not available)	Manufacturer
Hotstage microscope	Mineralogical analysis (ceramics & glass)	
Compressive machine (40 ton)	Compressive strength (ceramics & glass)	
Brightness tester	Brightness (paper)	Zeiss or equivalent
Porosity tester	Porosity (paper)	Frank or equivalent
Stiffness tester	Stiffness (paper)	same
Expansion tester	Dimensional stability (paper)	same
Printability tester	Printability (paper)	same
Universal tester for wood board	Bending & tensible strength	same
Tensile strength machine/s	Complete range of measurement capabilities for paper, textile, leather, plastic materials, etc. (but not metals)	Please recommend
3 Flow cup, model 243	Viscosity & density (paints & varnishes)	Erichsen GmbH, Hemer-Sundwig/ westf.
3 Flow cup with controlled temp. jacket		same
2 Dip viscosity flow cup, model 321		same
2 Viscostat Rotothinner model 322		same
Complete set of pycnometer cups		same
2 Hegeman grindometer, type 232		same
2 Garmsen fineness of grind gauge (DRP) type 256	Fineness of grind (paints and varnishes)	same
Erichsen universal drying time recorder, model 338	Drying time (paints & varnishes)	same
2 Rossmann thickness gauge, model 296	Film thickness (paints & varnishes)	same
3 Dry film thickness gauge, model 233		same
Paint inspection gauge, model 455		same

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
3 Pfund cryptometer, model 237, I, II & III Four sets of test cards, 21, 22, 23, & 24	Hiding power (paints & varnishes)	Erichson GmbH, Hemer-Sundwig/ westf.
Universal cupping test machine model 204	Elasticity (paints & varnishes)	same
Stamping lacquer bead test model 227		same
Conical mandrel bending tester, model 312		same
Distensibility tester (Eikens) model 439		same
Multicross cutter for the grid cutting, model 295		same
Pendulum hardness tester, model 299	Scratch and hardness (paints and varnishes)	same
Hardness and adhesion instrument, model 413		same
Scratch-hardness instrument, model 239/II motor driven		same
Holst m cro indentation tester, model 462		same
3 Hardness test rod,, model 318		same
Abrasion resistance tester (DBGM) model 317	Abrasion (paints & varnishes)	same
Inflammability tester, model 262/II k	Inflammability (paints & varnishes)	same
Glossmeter type GG 2700	Gloss (paints & varnishes)	same
Corrosion testing apparatus, model 351	Corrosion and durability (paints & varnishes)	same
Schlitt humidotherm testing apparatus, model 330		same
Climatest accelerated test apparatus, model 438		same
Rubo abraco tester, model 460		same
Washability and scrubbing tester, model 255	Washability and scrubbing (paints & varnishes)	same
Roto-scrub tester, model 447		
Chalking rate tester, model 244	Chalking (paint & varnishes)	same
Gardner clarimeter ASTM D 1746	Clarity (paints & varnishes)	same
Gardner colour measurements colorimeter	Colours (different materials)	Please recommend

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Laby system, XYZ System		
Photoelectric Leukometer	Whitness (different materials)	Zeiss
6 Ball mills rotatary (laboratory) for 100, 250 & 500 grams paints (porcelain balls) and motor driven stand	Milling	Please recommend
2 Red-Devil mixer type 392		
Laboratory setup (stainless steel, 10-15 litres capacity kettle for cooking resins complete. (Carl Ganzler 516 Duren, Postfach 107).	Cooking of resins (paints & varnishes)	Erichsen GmbH
Spinner coater, model 334	Film applicators (paints & varnishes)	same
2 Complete sets of film applicators, models 288 and 360 (20 ug - 180 ug).		
Spiral type film applicators		
Sagging instrument, model 419	Sagging (paints & varnishes)	same
Pore test instrument using high voltages	Porosity, filling and cracks (paints & varnishes)	
Sedimentation balance	Sedimentation rate (paints & pigments)	Glasuret GmbH
Autoanalyser for salinity, pH, oxygen and nutritives (for sea water)	Determination of environmental conditions around marine paints	Erichsen GmbH
Injection moulding machine (labor)	Plastic forming of test pieces	
Extrusion moulding machine (labor)	Plastic forming of test pieces	
Capillary viscometer Zwick 104	Viscoelasticity of thermoplastics and determination of melt index	Zwick
Universal testing machine Zwick series 1400 or 1300	Tensile strength, compression & elongation	
Pendulum impact tester Zwick 5102 according to Charpy & Izod	Impact strength of plastics & composites	
Dimensional stability tester according to Vicat & Martens Zwick 4201 & 04	Dimensional stability of plastics	
Rockwell hardness tester Zwick 3106	Hardness (Rockwell)	
Two roller mixing machine (Lab. scale)	Rubber compounding	
Internal mixer (Lab. scale)		

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Hydraulic press with heating plates (up to 200° C ± 1°C)	Vulcanization of rubber sheeting and forming	
Tortion vulcameter, Zwick 4307	Rate of vulcanization of rubber mixes, start & completion of cross-linking, activating energy	
Plastometer. Zwick 4304 according to Mooney	Plasticity of raw and compounded rubber and scorch time	
According to Shore, A, C, and D Zwick 7201	Hardness for soft materials	
Zwick rubber fatigue testing machine 5301	Resistance of rubber against cracks	
A series of punch presses & dies Zwick 7100	Specimen cutting devices (rubber)	
Abrasion tester (Du Pont-Croydon)	Abrasion resisence of rubber & composites	
Apparatus for measuring wear, fade & coefficient of friction of composites	Coefficient of friction of abrasive materials, e.g. tire, brakes, & clutch materials	
Rotovisco Haake RV3, with X-Y recorder	Rheometry of pharmaceutical preparations (newtonian & non-newtonian): solutions, colloidal dispersions, suspensions, emulsions, ointments, creams, pastes, suppositories, etc.	Haake, Berlin
Balance-Rheometer		Contravas AG
Set of Ubbelohde viscometers with 2 heating/cooling jackets		
Set of Cannon Penske viscometers with 2 heating/cooling jackets		
Three roller mill, laboratory		
Coulter counter model B with Coulter channelyzer model P 128 with osciloscope display	Particle size analysis, Crystal Growth, Aggregation/deaggregation phenomena (powders, suspensions, emulsions, microcrystalline suspensions, ophthalmic ointments, aerosols)	
Millipore IIMC particle measurement computer system		
Ultrasonic disintegrator		
Cube mixer, laboratory		
Ball mill, laboratory		

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Sieve Vibrator with a set of sieves		
Orr surface area pore volume analyzer		
Tablet dissolution tester (USP XVIII) with synchronous motor (220V,50 Hz), gear plates, gold-plated basket, flask and cover	Physical constants for solid unit dosage forms (tablets, capsules, suppositories)	Hanson Research Corp., Northridge, Calif., U.S.A.
Consistometer	same	Haake, Berlin
Millipore membrane filter holder (90 mm) with stainless steel pressure vessel	Particulate contamination in injectables	Millipore, Neu Isenburg.
Sartorius absroption tester, complete	In vitro control of drug release	Sartorius
Automilk moisture tester with infrared heater	Testing of milk	
Abbe refractometer	Testing of milk	
Dipping refractometer	Testing of milk	
Milkotester	Testing of milk and dairy products for fat, total solids, proteins, lactose	Milkotester Co., U.S.A.
Leather thickness gauge, Ø of feeler 10 mm, measuring pressure 500 gm/cm, reading exact to 0.01 mm (IUP /.3), length of arm 60 mm, or nearest	Leather thickness	
Tensile strength machine for heavy leathers (DIN 53 328, IUP/.8, with uniform speed of separation of the jaws of 100 ± 20 mm./minute, complete with recorder, jaws, set of grips for clamping leather specimens and accessories	Tensile strength, stitch tear, buckle tear, etc.	Otto Wolpart, Frank, Zwick or similar
Repair and spare parts for apparatus for testing flexlife and finishing of upper leather, type Bally Flexometer, complete with accessories.	Flexlife and cracking of leather finish	
Repair and spare parts for apparatus for two-dimensional extension of light leather (IUP/.13), type Bally Tensometer, complete with accessories.	Two-dimensional extension of light leather	

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Repair and spare parts for apparatus for measuring the waterproofness of sole leather under dynamic conditions (IUP/11), type Baily permeometer, complete with accessories	Waterproofness of sole leather under dynamic conditions	
As above (IUP/10), with accessories including standard absorbent cloth (300 g/cm2)	same	
Leather cutting press knife, (hard steel edge, for tensile strength (DIN 533289)		
Same for stitch tearing 100x20 mm		
Same for buckle tearing 100x40 mm		
Rectangular leather cutting press knife 150x25 mm, with slot		
Same 50x25 mm, with slot (IUP/8)		
Same 200x30 mm		
Same 100x20 mm		
Same 100x40 mm		
Same 40x40 mm		
Circular leather cutting knife Ø 70 mm		
Same Ø 35 mm		
Motorised specimen cutting press for leather, fiberboard, plastic, etc. up to 9 mm thick		
Abrasion tester (DIN 53516), complete with accessories, type Zwick 6106 or similar	Abrasion tests for leather	
Instrument for measuring sweatfastness of leather, type perspirometer, AATCC, or Hydrotest-Geraet, Chemiocolor AG, CH-8602 Kilchkerg ZH (VESLIC, O 4260)	Sweatfastness of leather	
Rub fastness tester - VESLIC, complete with accessories (VESLIC, C 4500)	Rub fastness of leather	
Light fastness, blue scale (1-8) on wool fabric (VESLIC, C 4C10)	Light fastness of leather	Beuth-Vertriehs, GmbH, Berlin W15

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Stelometer	Strength (textiles)	
Ball's sorter	Cotton length	
Oven and basket type apparatus	Moisture content	
Abrasion resistence tester	Yarn abrasion	
Elemendrof tester	Tearing test	
Bursting tester	Bursting strength	
Abrasion & flexing tester	Fabric abrasion	Karl Frank GmbH
Instron apparatus	Tensile strength	USTER
Fatigue tester	Fatigue test for yarns & fabrics	
Rotameters	Air flow	
Xenotest fadometer	Light fastness of dyed goods	Ouartz lampen, GmbH
Lanimeter: Projection microscope and camera	Maturity & fiber identification	
Mechanical fiber blender	Fiber blending	
Tubular Furance. Type RR 4014 FN 33.334, Temp. 1800 (70 V, max. 40 Amp.), with 2 heating tubes and 2 thermocouples	For ceramics	Herneus
Tubular furnace, type REH 7/60 N-45610, temp. 1300 (220 V, 11.5 Ampl), with 4 beating tubes.	For ceramics	Ruhstrat
Tubular furnace, type K. 148 No. 3121, Temp. 1500 (32/ 11.5 AMp.), with 4 beating tubes	For ceramics	Johnson Matthey
Chambers furnace, with kanthal super element for HT 8, 30 Kanthal super element for HT 16, 40 Connection contact 2 Thermcouples.	For ceramics	Conrad Nober Elektrobau Lilienthal Brauien Johs-Riechermann
Dialatometer, Malkin type, with 5 heating tubes of the tubular furnace, 3 silica rods, 5 fused silica tubes, 2 micrometers.	For ceramics	J.Malkin Co., Stoke-on-Trent, Fngland.
Refractoriness testing apparatus, No. EV 16 A - 1960	For ceramics	Chem. Lab Tonindustrie, Berlin-Friedenau

First Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard	Manufacturer
Complete carbon gradual resistance furnance, type EVL 12, with 10 refractory rods, 100 carbon electrodes, 20 carbon rings, 500 refractory test holds, 10 Refractory ring Seger cones, and complete series from cone No. 16-42 (100 each).	For ceramics	Chem. Lab Ton-industrie, Berlin-Friedenau
R.U.L. Testing apparatus, No. 5702 No. with 10 refractory tubes, 100 refract. discs, 20 iron electrodes, 3 Pt-Th-18 thermocouples, 100 lower and upper carbon stamps, 200 carbon discs.	For ceramics	Chem. Lab Ton-industrie, Berlin-Friedenau

Annex 10-B

National Research Centre

Central Research Laboratory: Special Services

Second Priority Equipment

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard (price not available)	Manufacturer
Hot compressive machine	Hot compressive strength for ceramics	
Tensile strength tester	Tensile strength (ceramics)	
Microhardness tester	Hardness (ceramics)	
Tersion tester (1500°)	Tersion (hot) (ceramics)	
Multicell ageing oven (standard)	Ageing of rubber (deterioration rate)	
Compression stress relaxation apparatus	Compression set elastic recovery	
Yhe Flexure apparatus for determining Young's modulus of elastomers	Young's modulus	Wallace Test Equipment Co.
Bending & compression strengths	For plastics	Zwick 2201
Dynstat tester	Bendability & impact strength of small plastic specimens	Zwick 5106
Zwick testing machine No. 42.LO	Creep resistance and tenacity at constant temp. & stress	Zwick
Tortiometer, Tortiomatic	Shear modulus and domping of plastics	Zwick 5203
Zwick elasticity tester No. 5105	Impact elasticity of soft rubber and foams	Zwick
Zwick tensile tester (one of series 14GC)	Tensile strength, compression and elongation of rubber	Zwick
Tortional shear tester, Wallace XII	Shear testing (tortional and adhesion)	
Shawberry-Wallace, self-recording age tester	Stress relaxation testing (of rubber)	
Turbidimeter	Stability of Colloidal and "Supracolloidal" dispersions (Measurements of: zeta potential, turbidity, light scattering, surface activity)	Micromeritics Instrument Corp.
Electrophoretic mass transport analyzer Model 1202		A.R.L. Ltd.
Photogoniodiffusiometer, Fica 42000		A. Kraess, Hamburg
Du Nouy interfacial tensiometer		

Second Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard (price not available)	Manufacturer
Double beam recording spectrophotometer (visible and UV) with flow cell and temp. controlled cell housing	In vitro control of drug release	
Climatic chamber	Physical constants of solid unit dosage forms	
Lab. Beater Valley	Evaluation of different pulps	Frank
Wet strength tester	Wet strength (pulp and paper)	same
Standard Freeness tester for ground wood pulp	Freeness of ground pulps	same
Beating and Freeness tester	Freeness of pulp	same
Tear tester	Tear	
Bottom leather grain crack tester, complete with 8 mandrels (I.U.P/12), type SATRA, S 132	Grain crack testing	
Leather finish heat resistance, complete with accessories, type SATRA, SID 111	Heat resistance of finish	
Instrument for measuring fastness of leather dyeing to washing, type Launderometer of AATCC (VESLIC, C4230)	Fastness of leather dyeing to washing	
Leather densimeter, type SATRA SID 143, complete with mercury	Leather apparant density	
Tensile strength for light leathers, e.g., type OTTO Wolpert EZR 30 or similar, complete with accessories	Tear, buckle tear, etc.	
Instrument for measurement of water vapour permeability of leather after Rice-Mitton (I.U.P./15), complete with motor, 8 spare bottles and 10 mg silica gel, type Wallace	Water vapour permeability	
Instrument for measurement of water-proofness of gloving leather, complete with accessories (I.U.P./14), e.g., type Wallace	Water-proofness of gloving leather	

Second Priority Equipment (continued)

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard (price not available)	Manufacturer
Instrument for measuring tendency of upper leather material to crack or burst during testing (I.U.P./9), type SATRA Instant Lasometer SID 190, complete	Tendency of upper leather material to crack or burst	
Permeability tester	Permeability (cement)	Ton-industrie
Porosity tester	Porosity (cement)	same
Automatic setting time apparatus	Setting time (cement & gypsum)	same
Autoclave for soundness test	Soundness (cement)	same
Length comparater	Volume change	same

Annex 10-C

National Research Cent

Central Research Laboratory: Special Services

Third Priority Equipment

Apparatus/Instrument/ Accessory	Relevant Capability or Evaluation Standard price not available)	Manufacturer
Sand strength tester	Strength (sand)	
Automatic dilatometer	Linear thermal expansion (ceramics)	
Inecrastions in Pharmacological Preparations: dielectric constant, vapor pressure, calorimetry)	Precision calorimetry system Dielectric constant meter, with cells Vapor pressure osmometer with membrane osmometer attachment	
Tablet disintegration equipment tester	Physical constants for solid unit (capsules, suppositories)	
Tablet hardness tester		
Precision balance	Clinical constants for solid units	
Suppository disintegration tester		
Suppository hardness tester		
Differential thermal analysis system with thermogravimetric analyzer accessory	Thermal, transitions in drugs, polymorphism, etc.	
Laboratory sterilizer, vertical, electrical	Particulate Contamination in Injectables	
Ampoule testing apparatus with polarizing filters		
Dose analyzer	In vitro control of drug release	
Sizing tester	Sizing (paper and pulp)	
Burst tester	Burst factor (paper)	
Folding tester	Folding number (paper)	
Thickness tester (paper)	Thickness	
Precision strip cutter	Preparing paper t st specimens	
Surface water absorption apparatus	Surface water abs rption (on leather)	
Apparatus for determining leather sample age, temperature, behavior	Leather shrinkage temperature	
Machine for leather analysis, type SATRA (STM 145) complete with leather thickness meter	Leather analysis Leather property evaluation	
Automatic finish rub tester	Finish rub fastness (leather)	

Annex 11

Tentative Budget for Equipment Needed for the Project "More and Better Food"

It has been felt that so complex a project must be assigned to be implemented in stages. Accordingly, this project can be visualized as falling into three distinct phases:

Phase I

1. Preparation for the final formulation of the project.
2. Upgrading of laboratories in the NRC expected to be involved in the project (Food Technology and Nutrition Division, Agriculture Research Division, and Animal Resources Division).
3. Training of staff in order to update administrative and technical capabilities.
4. Establishing information and documentation facilities.

   This phase is expected to last 1 year.

Phase II

1. Establishment of pilot-plant facilities.
2. Preliminary investigations within the scope of the project.
3. Setting up various techniques and procedures involved in the project.

   This phase is expected to last 1 year (2nd year).

Phases III and IV

Both phases require a further thorough study as they will involve, in addition to NRC laboratories, various other research sectors in the country.

Phase I

1. Preparation for the final formulation of the project.

Apart from the general outline of the project discussed, it is felt that a final formulation is needed. It is assumed that this will require a period of 8 to 10 months of necessary consultations with American counterparts. This requires a tentative budget of $100,000.

2. Upgrading of the NRC laboratories expected to be involved in the project.

This requires a tentative budget of 1.75 million dollars. The following tables specify the equipment needed by these laboratories.

3. Training of staff to update technical and administrative capability.

This requires a tentative budget of 200 thousand dollars.

4. Establishing information and documentation facilities.

This requires a tentative budget of 200 thousand dollars including a Nova 3/10 data general minicomputer set or its equivalent.

Total budget would appear to be in the range of $2,000,000 for the first year.

Food Technology and Nutrition Division

(1) Food Technology and Dairy Laboratory

Number	Quantity	Item	Approximate price (in dollars)
1.	1	Reverse osmosis, Lab. type, with membranes and suitable pressure pump	2,000
2.	12	Chromatographic columns for gel filtration, ion exchange, and high pressure chromatography. Different sizes with standard accessories.	1,000
3.	200 m	Teflon tubings, inside diameter 1, 2, and 3 mm	100
4.	2	Peristaltic pump	1,200
5.	2	Fractional collector, for time, drop and volumetric capabilities	1,000
6.	1	Continuous flow UV absorpimeter at 280 nm	1,000
7.	1	Recorder with 50 chart rolls	1,500
8.	1	Microzone electrophoretic apparatus for protein separation on cellulose acetate complete with all accessories	1,700
9.	1	Deionizer, cap. 60L/h	500
10.	1	High voltage paper electrophoresis complete with accessories	1,500
11.	1	Preparative ultracentrifuge, up to 100,000 g different heads with 10-50 ml tubes	3,000
12.	1	Amino acid analyzer, 6-12 samples/day with integrator, and complete with packing material, ninhydrin, buffer salts and charts.	20,000
13.	2	Electric Balance, cap 200 g, 0.0001g	1,000
14.	1	pH meter, digital, expanded scale 0.01 unit, with different electrodes.	500
15.	2	U.V. visible spectrophotometer range 200-1,000 nm, Model DB digital.	8,000
16.	1	Technicon milk analyzer, for fat, protein, lactose determination	4,000

Food Technology and Nutrition Division (continued)

(1) Food Technology and Dairy Laboratory

Number	Quantity	Item	Approximate price (in dollars)
17.	1	Gas chromatographic apparatus, with flame ionization detector, temperature programming and different exchangable packed columns, provided with hydrogen gas generator and integrator.	8,000
18.	1	Laboratory fermentor, with variable adjustment for pH oxygen and temperature, capacity 1 L	3,000
19.	2	Electric drying oven	600
20.	2	Electric muffle furnace	1,000
21.	1	Fameless digestion apparatus	1,000
22.	1	Saccherometer	500
23.	1	Farinograph	2,000
24.	1	Alveograph	2,000
25.	1	Extensograph	2,000
26.	1	Spreader for TLC	1,000
27.	4	Calculators, scientific	1,000
28.	1	A-M total copy system	17,000
29.	4	Hamilton syringe, 10, 50 µl	100
30.	12	Micropipette 2 µl	50
31.	12	Micropipette 5 µl	50
32.	12	Micropipette 10 µl	50
33.	12	Micropipette 25 µl	50
34.	12	Micropipette 50 µl	50
35.	2	Hollow fiber dialyzer	100
36.		Laboratory Chemicals	10,000
37.	1	Freeze Drying Unit	6,000
38.	1	Immunoelectrophrase and Immunodiffusion unit	1,000
39.	1	Flying Denistometer (TLD 100)	-
40.	1	Cooling Centrifuge	3,000

Food Technology and Nutrition Division (continued)

(1) Food Technology and Dairy Laboratory

Number	Quantity	Item	Approximate price (in dollars)
41.	1	Wrist action shaker	1,000
42.	1	Dickens Mill	1,500
43.	1	Hammer Mill	1,500
44.	1	High speed blender explosion proof	700
45.	1	Tube shaking machine	800
46.	1	TLC apparatus	800
47.	1	Chromatoque	

Food Technology and Nutrition Division (continued)

(2) Nutrition Research Laboratory

Number	Quantity	Item	Approximate price (in dollars)
A. Laboratory Equipment			
1.	1	Refrigerated Centrifuge	6,000
2.	1	Liquid sentillation counter	19,000
3.	1	Gas-liquid chromatography	3,500
4.	1	Amino acid autoanalyzer	35,000
5.	1	Recording spectrophotometer	30,000
6.	1	Atomic absorption spectrophotometer	20,000
7.	1	Ultracentrifuge	20,000
8.	1	Fractional collector	2,000
9.	3	Laboratory centrifuges	2,000
10.	4	Table centrifuges	1,000
11.	2	Calorimeter	2,000
12.	3	Ultra thermostat	3,000
13.	2	Vacuum ovens	4,000
14.	1	Automatic recording titrator	2,500
15.	1	Shaking incubator	6,000
16.	1	Refrigerated incubator	1,000
17.	2	Incubators	2,000
18.	1	Drying oven	3,000
19.	1	Automatic bidistilling apparatus	1,200
20.	3	pH meters	1,200
21.	1	Thin layer chromatography	600
22.	2	Microkjedlahl 12	3,000
23.	4	Regulated thermostat	2,400
24.	3	Vacuum pump	1,500
25.	3	Hot plates	1,200
26.	1	Microzone electrophoretic unit with immuno accessories	7,000
27.	1	Warburg apparatus	6,000

Food Technology and Nutrition Division (continued)

(2) Nutrition Research Laboratory

Number	Quantity	Item	Approximate price (in dollars)
28.		Water deionizer	800
29.	3	Water bath	1,000
30.	1	Bomb calorimeter	1,000
31.	1	Flame photometer	2,500
32.	2	Old Portable Typewriter	200
33.	2	Typewriter, electric	1,000
34.	1	Copy machine	5,000
35.	1	Portable X-ray unit	3,000
36.	1	Calculating machine	1,000
37.	1	Recording fluorimeter	20,000
38.	1	Flame photometer	4,000
B. Animal House			
1.	1	Air compressor	1,000
2.	100	Cages, metabolic	6,000
3.	100	Cages	4,000
4.	24	Batteries - cages	24,000
5.	1	Deep Freeze	3,000
6.		Blenders	600
7.	2	Hammer mill	3,000
8.	1	Rotating washing machine	5,000
9.		Seives (4 sets)	1,000
10.	4	Air conditioning units	1,000
11.	1	Universal mill	3,000
12.		Food mixers: 50, 10, 5, 2, 1 kg	6,400
13.	1	Incinerator	10,000

Food Technology and Nutrition Division (continued)

(2) Nutrition Research Laboratory

Number	Quantity	Item	Approximate price (in dollars)
C. Nutrition Clinic			
1.	1	Anthropometric measurement set	1,000
2.	1	Metabolic ward	20,000
3.	1	E. E. G. apparatus - portable	5,000
4.	1	E. C. G. apparatus - portable	3,000
5.	1	First Aid set	1,000
D. Transport			
1.	2	Seven-passenger microbusses	20,000
2.	1	Economy car	4,000
3.	2	Mobile laboratory cars	50,000

Agricultural Research Division

Number	Quantity	Item	Approximate price (in dollars)
A. Machinery			
1.	4	Tractors, h.p. 65, w	
2.	4	Tractors, h.p. 65, with ploughs	16,000
3.	4	Sowers, with changeable devices	4,000
4.	2	Combined harvesters, moderate scale	4,000
B. Laboratory apparatus			
1.	3	Water baths, electrically heated, 8 holes	900
2.	1	Centrifuge, Max. speed 1000, replaceable heads	500
3.	1	Recording electrophoresis, horizontal	250
4.	1	Colorimeter, self contained, 400-700 mu	300
5.	1	Spectrophotometer, range 3600-10000Å	600
6.	10	Chromatography jars, 30x20x60 cm, Ascend 8 Descend	300
7.	1	Flame photometer, for any oil derived gases	200
8.	2	Micro grinding laboratory mill, different screens	300
9.	3	Drying oven, electr. heated, range 30-300°C	900
10.	1	Vacuum oven, range 20-150°C	200
11.	1	Muffle furnace, up to 1200°C, autom control	250
12.	1	Cooling incubator, range-5 till 80°C	400
13.	3	Refrigerator, capacity 1 m^3	1,200
14.	1	Freezer, capacity 1 m^3 range 5 till-10	300
15.	2	Binocular microscope, regul. objectives 8 oil emersion	700
16.	2	Stereo binocular microscope, magnification till 40	600
17.	1	Self indicating baranger-type balance, 30 kg, senst. 5 g	300
18.	1	Torsion balance, self indicating, cap. 5g, senst. 10 mg	150

Agricultural Research Division (continued)

Number	Quantity	Item	Approximate price (in dollars)
19.	2	Analytical balance, aperiodic, cap. 200 g, senst. 1 mg	600
20.	2	Tables for analytical balance, anti-vibration glassware	150
		Glassware	1,500
		Chemicals Jum annum	1,000

Fats and Oils Laboratory

Laboratory Equipment

Number	Quantity	Item	Approximate price (in dollars)
1.	1	Beckman-Spinco model E Analytical Ultracentrifuge	15,000
2.	1	E.C. Vertical Electrophoresis Equipment	5,000
3.	1	Automated Kjeldanl Auto Analyzer, Technicon Instruments Corp., Chauncey, N.Y.	2,000
4.	1	Laboratory Centrifuge (up to 9000 xg) with replacable heads	--
5.	1	Basket Centrifuge (or bowl for item 4)	--
6.	1	Beckman-Spinco Model 120 Amino Acid Analyzer	30,000
7.	1	Laboratory Air Classifier	6,000
8.	1	Beckman DU Spectrophotometer (or) Unicam SP-400 Spectrophotometer	8,000
9.	1	Perkin Elmer Infracord	8,000
10.	1	Serval Omnimixer	1,000
11.	1	Liquid-Solid Cyclone (50 mm) and (10 mm)	1,500
12.	1	Atomic Absorption Spectrophotometer	6,000
13.	1	Hydrogenation Autoclave	5,000
14.	1	Thin Layer Equipment (Desaga)	800
15.	1	Preparative Fraction Collector	2,000
16.	1	Laboratory Fractional Distillator	1,500
17.	1	Molecular Distillation Apparatus	2,500
18.	1	Abe Refractometer	2,000
19.	1	Electronic Polarimeter	2,000
20.	1	Viscometer,-recording Apparatus	2,000
21.	1	Ultra thermostat	2,000
22.	1	Moisture tester Automatic	1,200
23.	1	Mobile High vacuum unit	1,800
24.	1	Digital pH-meter	1,500
25.	1	Ultraturrax Stirrer	2,000

Fats and Oils Laboratory (continued)

Laboratory Equipment

Number	Quantity	Item	Approximate price (in dollars)
26.	1	Refrigerated centrifuge	5,000
27.	1	Vacuum oven	1,500
28.	1	Drying oven	1,500
29.	1	Water Deionizer (2 units)	1,000
30.	1	Spray Dryer	6,000
31.	1	Refrigerator 0.30 cu. ft.	1,000
32.	1	Deep freeze ca. 20 cu. ft.	1,000
33.	1	Alpine Kolloplex Flour Mill	3,000
34.	1	Laboratory tray dryer- (8-rack, 16 tray-producer: Proctor and Schwartz; Inc., Philadelphia, Pennsylvania)	2,000
35.	2	Stage Air Compressor Unit (50 hr.)	1,000
		(Animal House)	
1.	1	Batteries for Chick Starers (Two batteries, each battery 6 cages, each cage accommodates 10 chicks)	3,000
2.	1	Batteries for Hens (Accommodate 60)	2,000
3.	1	Batteries for rat feeding (Two batteries-accommodate 60 rats)	2,000
4.	1	Food Mixers - (5 - 20 kg)	1,500
		1 kg	100
5.	2	Air conditioning units	1,500

Animal Resources Division

Number	Quantity	Item	Approximate price (in dollars)
1.	-	Equipment for A.I. and Animal Health Centers	100.000
2.	2	Mobile laboratories and 3 Mobile Veterinary Clinics	100,000
3.	1	Modern slaughter house	300,000
4.	1	Dairy Plant (milking machine, cooling unit & Pasteurization unit)	100,000
5.	1	Dairy Farm (with food milking factory)	100,000

Annex 12

Volume I

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