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FIRST ANNUAL REPORT
OF THE
PROGRAM ON POLICIES FOR SCIENCE
AND TECHNOLOGY
IN DEVELOPING NATIONS

August 11, 1971 - August 10, 1972

Cornell University

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November 2, 1972

Title: , Program on Policies for Science and Technology
 in Developing Nations

Grantee: Office of Science and Technology
 Technical Assistance Bureau, A.I.D.

Director: E.T. Cranch, Associate Dean of Engineering
 Cornell University

I. General Background and Purpose of Grant:

A. Statistical Summary:

Period of Grant August 11, 1971 - August 10, 1976

Amount of Grant \$580,000

Expenditures for report year 1972 \$76,929.14

Accumulated \$76,929.14

Anticipated for next year \$130,000.00

B. Narrative Summary:

The major goal of the Program is to build capabilities at Cornell through teaching and research, focusing on the role of science and technology in developing nations. A parallel goal is to identify and evaluate alternative policies for science and technology that might be implemented at national and regional levels to promote social and economic development of less developed countries. The Program is intended to foster greater interaction between Cornell and individuals, institutions, and government agencies from at

least three linkage countries representing main geographical regions. Healthy interaction between relevant physical and social technologies can contribute to national betterment, thereby pointing to ways of minimizing the developing nation's dependency on other nations.

Representatives from the College of Engineering; the Program on Science, Technology, and Society; and the Center for International Studies are actively involved in the Program. The interdisciplinary team approach to planning and conducting the Program is reflected in the composition of the executive committee.

Franklin J. Ahimaz, Assistant Program Director (ex officio);

Raymond Bowers, Deputy Director, Program on Science,
Technology, and Society;

Edmund T. Cranch, Associate Dean, College of Engineering;
Program Director (ex officio);

Milton J. Esman, Director, Center for International Studies;

Gilbert Levine, Professor, Agricultural Engineering;

Franklin A. Long, Director, Program on Science, Technology,
and Society and Chairman of the Executive Committee,
Program on Policies for Science and Technology in
Developing Nations;

John W. Mellor, Professor, Agricultural Economics;

Vithala R. Rao, Assistant Professor, Business and Public
Administration;

Bryant Robey, Executive Director, Center for International Studies (ex officio);

Andrew Schultz, Jr., Dean of the College of Engineering; Professor, Industrial Engineering;

Karel Stregl, Senior Research Associate, Program on Policies for Science and Technology in Developing Nations; Program on Science, Technology and Society; and the Center for International Studies (ex officio);

William F. Whyte, Professor, Industrial and Labor Relations.

To launch the Program, a series of seminars and discussions with faculty groups were organized to publicize the Program and to identify a group of Cornell faculty and students interested in focusing their interests and expertise on the problems of developing nations. Each seminar explored a specific area judged appropriate for the development process. Interdisciplinary teams of staff members were encouraged to plan and offer courses on areas where science and technology could augment the development in discrete sectors. Three new courses have been funded by the Program and discussions to start four more are in progress. A research proposal was funded which had policy implications for developing nations.

The Program provided partial support for students with

science and engineering background to participate in the U.N. and A.I.D. Summer Internship programs. It granted seed money for Cornell professors to develop joint proposals with international institutions and to attend national and international conferences. Funds provided by the Program enabled a Cornell professor to participate in a summer program at the University of Sussex. Cornell professors met as a group or separately with counterparts from NAS, U.N. Office of Science and Technology, ACAST, UNIDO, UNITAR, UNCTAD, OECD, AID, OAS, HEW, and the International Division of New York State Education Department exploring possible interactions with other agencies on mutually complementary programs.

A memorandum of understanding has been worked out between Cornell and KAIS (Korea Advanced Institute of Science). A Cornell/KAIS workshop at Cornell is planned for November 1972. A Cornell/India workshop was planned for mid-1973 following meetings with a member of the Indian National Committee for Science and Technology.

A Cornell team visited Guatemala to explore whether or not it would be possible to consider Guatemala as a linkage country for the Program. A select group of Cornell professors met with representatives from the Office of Scientific Affairs, O.A.S., and the Office of Science and Technology, A.I.D., to identify likely South American linkage countries for the Program.

The Program has accumulated a fair collection of catalogs that list publications in the area of science, technology and development. It also subscribes to journals and periodicals that list papers, reports, and book reviews relating to science policy, technology assessment, adaptation, transfer and innovation, science and technology research institutes, etc.

C. Detailed Report:

I. On September 15, 1970, President Nixon disclosed plans for an International Development Institute "to bring the genius of U.S. science and technology to bear on the problems of development". Regardless of congressional action on organized arrangements, it is clearly the intent of the Administration that science and technology be emphasized in foreign assistance efforts. Unless there is a rapid increase in the pool of first-class technical people committed to work in this field over a substantial period of time, these plans may turn out to be hollow indeed. The type of talent needed is significantly different from the bulk of technical talent traditionally involved in developing nations.

In the near term, as a result of the 211(d) grant effort, Cornell would be in a better position to provide its faculty members an opportunity to focus their solid technical credentials to understanding and solving problems in develop-

ing nations. In the longer term, Cornell should be able to develop a steady flow of talent at the student and faculty level which can contribute to strengthen U.S. capabilities in focusing modern technology to bear on the problems of developing nations.

II. Objectives of the Grant

A. Objectives Restated

Cornell University plans to increase its competence and breadth of interest on problems of science, technology and public policy relevant to developing nations through a program of applied research, graduate training, and curricular and relevant literature development. The effort would be an interdisciplinary one, centered in engineering and the physical sciences but with strong ties to the social sciences and to such other applied sciences as agriculture, industrial and labor relations, and urban studies. The expectation is that this grant will produce a body of trained people, knowledgeable in the application of science and technology to societal problems and desirous of working with groups within developing nations on these efforts, and a body of new research-based knowledge relevant to this subject.

In a broad sense, the Cornell program will study the policies and practices which influence the development of indigenous science and technology in developing countries, and

the ways in which this as well as imported science and technology can, by appropriate adaptation, be applied to the social and economic development of these countries. Of particular interest will be development of a rational base for analysis of procedures for the establishment of science program priorities, including the analysis of the interplay between strategies for overall science and technology with sector and subsector science and technology development strategies, and with economic planning and total national investment decisions. It will be necessary in the studies to consider the derivation of policies and strategies to the specific needs and problems of the countries, as for example: industrialization, use of technical manpower, natural resource and land use evaluation, housing, water management, education of scientists and engineers, etc.

The Program will make in-depth research and case studies involving the joint participation of personnel from both Cornell and the developing nations. These partnership arrangements will be established with selected universities or governmental institutes within the developing nations which desire to cooperate in this fashion with Cornell University. Thus, a two-way flow of people will result in continuing intensive interrelations, fostering analyses of science and technology policy issues of general application to developing countries. The interaction will be further

enhanced by workshops for officials and specialists from the U.S., developing countries and development agencies.

In making in-depth research and case studies, Cornell's initial analytical and research emphasis will be to identify areas where the lack of information or analysis is a crucial limiting factor to establishment of rational policies by the less developed countries for their development of an indigenous scientific and technological capability, and/or for the effective importation and adaptation of such knowledge from the more developed countries.

The grant will provide for a "core faculty" and coordinating center around which expanding efforts will arise and attempts will be made to solicit support for and to maintain a common, coordinated approach to identifying alternative policies for science and technology and the methodology for incorporating such policies in the national economic plans of developing nations.

B. Review of the Objectives

Given the objectives, the following is a procedure that appears amenable to accomplishing the goals of the Program:

A sound and ambitious science and technology base in a developing country is necessary for the efficient assimilation, adaptation and application of technology. More

often than not the specialized training that an international student elects in the U.S. is incompatible with the needs or the situation in his homeland. To the extent that his training deals with scientific and technical principles there is little cause for concern. What is needed is a supplementary training to enable the student in science and technology to innovate and develop policies which would lead to adapting available technologies for optimum use in his native land. This approach will offer the student an opportunity to focus his training on the problems of his country. This emphasis might offer a means to stem the brain drain from developing nations.

To meet this need the Program has encouraged staff members from related fields to jointly plan and offer a set of interdisciplinary courses seeking separate answers to discrete development problems. For instance, four professors who had worked on different aspects of planning for housing in developing nations have developed an interdisciplinary course on Low-Cost Housing for LDCs. The team comprising an architect, an economist, a social scientist, and a structural engineer, is indicative of the type of interdisciplinary effort supported by the Program. To strengthen the value of the course to the students, the faculty team is encouraged to submit proposals to the Program for a summer effort that would involve faculty and/or students to conduct related case studies, preferably in one of the linkage countries of the

Program. It is observed that a joint case study in a developing country offers the interdisciplinary group of faculty and students a personal look at a current problem and an opportunity to find solutions by working with counterparts from the host country.

Through the set of interdisciplinary courses, seminars, workshops, active U.S. and foreign student and Cornell faculty participation and research, the Program plans to study the appropriate role of science and technology to accelerate the social and economic development of LDCs. This academic exercise at Cornell, combined with the field experience in the linkage countries, would enable the Program to clarify policy choices for science and technology in developing nations. A series of seminars by leaders in science and technology and development is being planned for the academic year 1972-73.

III. Accomplishments

A. General

The following is a partial listing of areas where science and technology has the capability to make substantial contributions to augment development:

- Development of science and technology organizations that provide appropriate input to national economic plans for development;

- Science and technology research (particularly applied) institutions;
- Choice of resource allocation between science and technology research and research and development in competing sectors;
- Research and development resources for government and industry users;
- Relevance and application of technology transfer;
- Natural resources (forest, marine, mineral, water) planning and land utilization;
- Science and engineering education;
- Food processing, agricultural research, and farm implements;
- Industrial development and management training;
- Housing, building materials, rural and urban development;
- Rational plans for transport and communication;
- Social and political implications of scientific and technological innovation.

To stimulate interest among Cornell professors and students and to publicize the Program, seminars and separate discussions were held with students, faculty groups and departments. Interested teams of professors were granted funds for an interdisciplinary effort to develop courses appropriate to the Program. Opportunities were provided for

faculty members and graduate students to explore possible research efforts in LDCs, to gather data needed for thesis/course development at Cornell, to attend meetings or conferences that focused on the development problems and the role of science and technology to solve the problems. Students with a background in science and technology were encouraged to broaden training at Cornell by participating in U.N. and A.I.D. Summer Internship programs studying developing country needs. Representatives of similar programs in the U.S. and abroad were invited to meetings with the Executive Committee of the 211(d) program and with interested Cornell faculty members to brief the Cornell group about other efforts and to exchange ideas.

Before proceeding with the general plan to expand acquisition of materials for a specialized library capability for Cornell, an initial effort was designed to collect catalogs and bibliographies of publications, reports and papers and to gain a place on the mailing list of U.S. and foreign publishers where subject matter was relevant to the Program's interests. Some reports, papers and books of immediate value in the planning of the Program were purchased.

A Cornell team visited Guatemala to explore whether or not it would be possible for the Program to establish linkages with private institutions or government agencies in Guatemala.

Details of the accomplishments are given below and the proportion of the year's expenditures for an area of activity is indicated as a percentage against each title.

III.

B. New Program and Courses Developed Under the Grant (24%)

a. Program on International Studies in Regional Planning.

To promote research on regional issues and to provide graduate training for people working on alternative policies in developing countries, a program on International Studies in Regional Planning has been established in the Department of Policy Planning and Regional Analysis with partial support from the Program on Policies for Science and Technology in Developing Nations.

The program is organized around three topics:

(1) the impact of national development (including economic, scientific, technological, and political change) on the urban-rural balance, on urban growth, regional disparity, and the national spatial structure;

(2) the practices and potentials for policy (economic, technological and social) formation at both national and local levels to deal with these issues; and

(3) the use of limits of rational modeling for planning science and technology policies in low-income

countries, particularly in light of the complexities of economic and social development and the foreign origin of such models.

An important component of the program is the set of seminars designed to help participants apply the new materials they study to development situations. One such seminar relates urban and regional issues to several national development approaches and reviews much of the literature in the field. A second focuses on the application of sophisticated planning techniques and includes visitors from development agencies and programs. A third seminar offers research into specific policies that the students may expect to confront on their return home.

The Cornell faculty members responsible for the program are:

William W. Goldsmith, Assistant Professor of City and Regional Planning, Director;

Barclay G. Jones, Professor of City and Regional Planning, Associate Director;

Sidney Saltzman, Professor of City and Regional Planning, Associate Director;

Darrel F. Williams, Assistant Professor of City and Regional Planning, Associate Director.

b. New Courses Initiated by the Program

(1) Course on "Low-Cost Housing Primarily
for Developing Nations"

The major objectives of this graduate-level course are to present for study and discussion, aspects of low-cost housing involving technology, architecture and physical planning, economics, and sociology. Students from these, and possible related fields, will meet for common lectures and discussion periods shared by a multidisciplinary team of faculty members. Coverage of the topics will be broad rather than deep so that all students can participate in an inter-related manner; so that engineers, architects, economists, and sociologists will understand many of each other's specialties and be able to communicate and work together. In addition to the general coverage and study, more rigorous and intensive study by each student in his specialty will be provided by individual assignment such as a term paper under the guidance of the appropriate faculty member.

Emphasis will be placed on application to developing, non-industrialized countries, although modern principles of general application will be included. The course will also be developed to meet the interests of students from developing countries who are interested in science and technology aspects in housing policies and related problems in their own and other developing nations.

Four Cornell faculty members will cooperate in a joint multidisciplinary effort, sharing equally the work involved in developing and offering the course:

Floyd O. Slate, chairman and coordinator for the course - Associate Professor, Structural Engineering;

Peter Cohen, Visiting Lecturer, Architecture;

Charles B. Daniels, Assistant Professor, Consumer Economics and Public Policy;

Henry W. Richardson, Assistant Professor, Architecture.

This course will be offered in Spring 1973.

(2) Course on "Science, Technology and Development"

The purposes of this course are to (1) identify and analyse the positive and negative contributions of modern science and technology to the social, economic and political development of low-income countries; (2) analyse and discuss the various channels and processes of cross-national technology transfer; (3) identify and appraise criteria for the appropriate choice of technology; and (4) review alternative strategies to strengthen national scientific and technological capabilities and apply them to problems of development.

Milton J. Esman, Director of the Center for International Studies and John S. Knight Professor of International

Studies, is in charge of the course. The course is being offered this semester (Fall 1972).

The following new courses/seminar are in the planning stage:

(3) Seminar on "Science, Technology and Development of Colombia"

The seminar is intended as a follow-up to Esman's course (on "Science, Technology and Development"). An opportunity to focus the broad knowledge gained from the course to the particular problems of a developing country (Colombia) would provide a valuable experience. Colombia was selected because (1) there are several professors at Cornell who have experience working in Colombia and (2) the foreign students from Colombia represent the largest group at Cornell from any Latin American country.

The faculty members and Colombian students participating in the plans for the seminar are:

Gordon Cummings, Professor, Rural Sociology;

Peter Cohen, Visiting Lecturer, Architecture;

Tom E. Davis, Director, Latin American Studies Program
and Professor, Economics;

H. David Thurston, Professor, Plant Pathology;

Milton J. Esman, Professor of Government and Director,
Center for International Studies;

Eduardo Niño-Moreno, graduate student in education;
Luis Aramburo, graduate student in engineering;
Fabio Polania, graduate student in education.

(4) "Natural Resources Planning for Developing Nations"

Developing countries need to enhance understanding of their respective natural resources - land, forests, energy, water, and minerals - and about industries, products, and services that are closely associated with them. They also need capabilities to translate that knowledge into programs of development. Resource policies are the guidelines for development, and resource planning translates policies into concrete terms for land, forests, water, energy, and minerals. They serve as the connecting links between science and technology on the one side and higher economic and social development on the other.

The major objective of the course is to provide the student with the substantive and methodological underpinnings that will enable him to make intelligent decisions to plan and implement natural resources programs in developing nations. A laboratory exercise has been included as a significant feature of the course on the belief that meaningful introduction to the processes and problems of planning requires confrontation with real-world situations and data. The course is being planned for Fall 1973. Participating in the develop-

ment of the course are:

Courtney Riordan, Assistant Professor, Policy Planning
and Regional Analysis;

Ta Liang, Professor, Environmental Engineering;

Howard E. Conklin, Professor, Agricultural Economics;

John Bird, Professor, Geological Sciences.

(5) "Water Resources as Applied to Developing Nations"

The main problems in the field of water resources are to bring availabilities and requirements into rational relationship through the application of science and technology. In some nations the need might be to increase and regulate the supply of water, in others the effort may call for rationalizing water demand and consumption or to handle excessive amounts of water. In every case however, rationalizing supply and demand of water seem to be at the crux of the problem. The following staff members have expressed interest in the course and are discussing offering the course in Fall '73:

Gilbert Levine, Professor, Agricultural Engineering;

James A. Liggett, Professor, Environmental Engineering;

Douglas A. Haith, Assistant Professor, Agricultural
Engineering;

Leonard B. Dworsky, Director, Water Resources and Marine
Sciences Center;

Vaughn Behn, Associate Professor, Environmental Engineering.

(6) "Strategies for Management Development
in Developing Nations."

This course will cover the process of economic development of a less developed nation and the consequent needs of management personnel in several sectors of the economy. The methods of assessing the need for trained management and the strategies open for a nation to fulfill these needs will be discussed. The topics will be looked at in the context of an overall policy of science and technology to be pursued by the country. Students may undertake a project involving both the assessment of management needs and designing suitable training programs for a country of their choice.

Discussion on the development of the course is being carried out by the following team of Cornell professors:

Vithala R. Rao, Assistant Professor, Business
and Public Administration;

William F. Whyte, Professor, Industrial and
Labor Relations;

Byron W. Saunders, Professor and Director,
Industrial Engineering and Operations Research;

Milton J. Esman, Director, Center for Inter-
national Studies; Professor of Government.

III.

C. Conferences, Meetings and Seminars (5.3%)

- Dr. Francisco Sagasti, Department of Scientific Affairs, O.A.S., presented a study on "Science and Technology Policy-making and Planning for Peru" to a select group of professors and graduate students at Cornell.
- Discussions on selecting linkage countries and/or linkage institutions in South America for the Program.
 - Henry Arnold, Deputy Director, OST, AID;
 - Jesse Perkinson, Director, Department of Scientific Affairs, O.A.S.;
 - Dan Margolies, OST, AID;
 - Members of the Executive Committee, PPSTDN;
 - Guests and Cornell professors.
- Meetings with the International Division, HEW, and AID, Washington, exploring possible linkage countries in Asia and Africa for the Program while attending the annual conference of ASME. F.J. Ahimaz and E.T. Cranch.
- Discussions on the Cornell-AID Program and briefings by AID bureau experts for Asia, Africa, and Latin America. E.T. Cranch and F.J. Ahimaz.

- Attended meeting in Washington on Information Sources and discussed Cornell-AID Program with National Academy of Sciences and Organization of American States. E.T. Cranch
- Attended meeting of the International Division of American Society of Engineering Education at Houston. F.J. Ahimaz
- Meeting at Cornell jointly sponsored with Cornell's China Program, to discuss agriculture development in Mainland China with Benedict Stavis, who had conducted research which included a field visit to China.
- Meeting with U.N. Office of Science and Technology to discuss mutual sponsorship of a workshop on least developed countries. E.T. Cranch
- Meetings in Washington seeking information on Guatemala from the Office of Science and Technology, the Latin American desk officer for Guatemala, the Guatemalan Ambassador to the U.S., and the National Academy of Sciences. F.J. Ahimaz, O. Forker, J. Saunders.

- Attendance at National Academy of Science conference on "Appropriate Technology for Developing Nations". F.J. Ahimaz.
- Attendance at working session at Georgetown University, Washington, D.C., in Language and Organizational Policies for Developing Nations and the annual meeting of International Studies Association in Dallas, Texas. Donald F. Sola
- Participation in the OAS workshop in Washington, D.C. on Scientific and Technological Policy Studies and to develop a memorandum of understanding between the Program and the O.A.S. E.T. Cranch and F.J. Ahimaz.
- Meetings at Cornell with Hahn Been Lee, Director, East-West Technology and Development Institute, East-West Center, Honolulu, Hawaii.
- Attendance at UN/ACAST workshop session in New York and to explore possible joint programs with UNITAR. G. Levine, J.F. Metz, M.J. Esman, E.T. Cranch.
- Attendance at AID conference in Washington on "Technology and Economics in Inter-

- onal Development". F.J. Ahimaz.
- Meetings at the Office of Science and Technology to negotiate contract for "Science Policy for a Small Developing Country (Costa Rica)". F.J. Ahimaz.
 - Cornell meeting at which Allen Jedlicka from Northwestern University presented a study on "Basic and Applied Research Institutes in Developing Countries".
 - Meetings with appropriate representatives in AID, OAS, the International Office of Geology, and the Costa Rican ambassador to the U.S., prior to a Cornell team visit to Costa Rica. T. Liang, J. Liggett, F.J. Ahimaz.
 - Meeting at Cornell when Dr. H.T. Franssen of the Fletcher School of Law and Diplomacy at Tufts University spoke on the potential for development of marine science capabilities in developing countries.
 - Visit by Dr. B.D. Tilak, Director, National Chemical Laboratory, Poona, India, and member of the National Committee on Science and Technology, and Dr. A. Ramachandran, Director, Indian Institute of Technology, exploring separately collaborative research

ventures in India. As a result of the meeting with Tilak it was tentatively agreed that a Cornell group would visit India to plan for an August 1973 workshop in India.

- Visit by J.F. McDivitt, Director UNESCO Field Science Office for Southeast Asia, Djakarta, and M. Chapdelaine from the Science Policy Division of UNESCO, Paris, to discuss a possible Cornell affiliation with UNESCO's effort in building Indonesian scientific and technological capabilities by working closely with the Indonesian Institute of Science (LIPI) developing policies to promote the application of science and technology.
- Seminar on "Cultural Problems Associated with Technology Transfer in Developing Countries", by Dr. Louis Dupree - American Universities Field Staff and Adjunct Professor of Anthropology at the University of Pennsylvania. The seminar was jointly sponsored by PPSTDN and the Department of Anthropology.
- Seminar on "The International Enterprise and Transfer of Technology: Evolving Forms

for Less Developed Countries", by Ashok Kapoor, Associate Professor of Marketing and International Business at the Graduate School of Business Administration at New York University.

The seminar was sponsored by Cornell University School of Business and Public Administration and PPSTDN.

- Seminar on "Issues that will Shape Our Mineral Future" by Dr. Elburt F. Osborn, Director, U.S. Bureau of Mines, Washington. Jointly sponsored by Cornell University Department of Geological Sciences and PPSTDN.
- Seminar on "Mineral Resources, Environmental Quality and the Limits of Growth" by Dr. Vincent C. McKelvey, Director, U.S. Geological Survey. Sponsored by the Department of Geological Sciences and PPSTDN.
- Seminar on "Foreign Technical Assistance in City Planning - Urban Transportation Planning in Santiago, Caracas and Bogota" by Dr. Ralph Gakenheimer, Department of City and Regional Planning, M.I.T.

Jointly sponsored by the Department
of Policy Planning and Regional
Analysis and PPSTDN.

III.

D. Research Grants and Student Support (6.1%)

1. "Energy Subsidy in Protein Production: Its Use as a Policy Planning Tool" by Dr. Malcolm Slessor. The research was done over a period of ten weeks in the summer of 1972 under a grant from the Program. The work had its origin in an effort to make^a technology assessment of different forms of protein manufacture. In the sense that through energy calculations, which of several alternatives seem appropriate, this goal has been achieved. However, early in the study it became clear that the methodology enabled one to look at even broader matters - the implications of a food-generating policy within a given country. It is this outcome which may prove the more useful of the results of the study. Further research is being planned. A report on the initial study may be obtained from the Program Director.

2. Philip Y. Paden, a graduate student in Civil and Environmental Engineering, was in Venezuela to study the flow of patients through a Venezuelan family planning clinic and to compare data and impressions with those from an on-going time and motion study being conducted jointly by the

Cornell Operations Research department and the International Population Program. The motivation for this interest was that many patients claim that their reason for abandoning family planning is that the waiting lines are too long at the clinic. This field experience provided the student with an opportunity to build his knowledge on the problems of implementing science and technology programs in a developing country.

3. The Program provided partial funds for Thomas J. Ragonetti, a graduate student in Policy Planning and Regional Analysis at Cornell, to complete a summer internship program at the Social Development Division of the United Nations. He worked with the Documentation and Information Services and prepared an extensive bibliography of case studies in regional planning. Later he prepared a case study of regional development in West Irian.

III.

E. International Travel (4.7%)

- An exploratory visit to Guatemala to explore whether or not it will be possible for Cornell to establish linkages with institutions or government agencies in Guatemala. E.T. Cranch, F.J. Ahimaz, O. Forker, J. Saunders.

- E.T. Cranch was invited to participate in the International Symposium on "Targets for Scientific and Technological Development for the Second UN Development Decade" in Vienna, Austria. He took the occasion to meet with officials at UNESCO, Paris, and UNCTAD, Geneva.
- F.A. Long had discussions with representatives at the University of Sussex, England, on possible interactions between the Sussex program and PPSTDN.
- R. Bowers participated in a summer workshop at the Institute of Development Studies, University of Sussex.
- While visiting Peru in connection with another program, William Whyte explored (under 211(d) funds) possibilities for institutional linkage potential in Peru.
- Clifford Orloff of the Section of Public Systems Planning and Analysis, was in Athens, Greece, conducting research applying techniques of systems analysis to public systems planning and management in the areas of transportation. The study also included the social, political and economic impact of transportation networks on the country. With partial funds provided by

PPSTDN, it was possible for Orloff to travel from Athens to Cairo to attend a conference on "Management Sciences, Computer Application and Industrial Development". He is now participating with a group of other professors planning a course at Cornell on transportation needs for developing countries.

III.

F. Documentation Center (1%)

The documents currently available in the general area of science, technology and development which have policy implications for developing nations are varied and exhaustive. To build a center by expanding acquisition of materials from this broad area may soon deplete funds (\$3800/year).

For the effective use of funds in support of the objectives of the grant, the initial effort has been to subscribe to many journals, periodicals, news bulletins, etc., in the U.S. and abroad where articles in the general areas of interest are normally published. Also the Program is on the mailing list of known publishing houses in the U.S. and abroad and the developing world that circulate abstracts of forthcoming reports or books, monographs, official publications, reports, etc., relevant to the Program. An effort

is underway to prepare and up-date a card system where all relevant publications will be grouped under subject matter, author's name and developing country basis. As and when new courses at Cornell or research in a linkage country become functional under the Program, we plan to utilize funds to collect all relevant material appropriate for each area of effort.

IV. Impact of Grant Supported Activities in Developing Institutional Capabilities

The initial effort was to generate interest among Cornell experts in specialized fields to direct their interest in an interdisciplinary mode to look at the problems of developing nations. This effort is beginning to yield results. The fact that six separate groups of faculty members are planning on offering courses focusing their expertise on developing nations' problems is an impressive start. Each course will be listed in the respective department catalogs of the staff members planning the courses. Through the professors, the departments at Cornell are indirectly participating in the Program.

The interest evinced by U.S. and foreign students is obvious from the individual discussions that the administrators have had with students. Also a large number of students are exploring possibilities in the Program for a

research effort in developing countries. The student might use this research for his or her thesis requirement. The student's faculty advisor is generally involved in these discussions.

The only "other fund" activity that might be considered as grant related is the \$50,000 AID contract on "Science Policy for a Small Developing Country". Guatemala was initially identified as the small developing country. Now this contract will be carried out in Costa Rica instead.

V. Utilization of Institutional Resources in Development

The Program will shortly identify a linkage country for the Program in Latin America. There is considerable interest among faculty members and students to participate in the development activities of the linkage country. In addition to the grant, Cornell was awarded an AID contract to explore science policy for a small developing country (Costa Rica). The Costa Rican students at Cornell have shown keen interest in the regional and human resource development activities in Costa Rica that might be carried out under the Program. The commonality of the objectives of the grant and the AID contract has augmented the possibilities for developmental activities under the Program in developing nations.

Outside this grant, several Cornell staff members have been involved in development activities under other programs. It is difficult to list all the names and their related developmental activities since no record of such activities is maintained at Cornell. It might be worthwhile to compile such data since it surely would be impressive. To give some indication of such effort, listed below are the developmental activities that the executive committee members of the Program have been involved in during the past year with programs outside of the grant.

Franklin J. Ahimaz, Assistant Program Director and Assistant Dean of Engineering, as principal investigator for the AID contract program, visited Costa Rica with a Cornell team to explore areas of studies of mutual interest where science and technology has a major role to play in the social and economic development of this small developing nation.

Raymond Bowers, Deputy Director of the Program on Science, Technology, and Society, spent five weeks during the summer of 1972 at the University of Sussex. During that time he was able to review in detail all of the individual projects on science policy being carried out at the Sussex Science Policy Research Unit and have extensive discussions with individual research workers involved in these projects. He had discussions with Drs. Freeman, Oldham,

and Cooper, the senior members of the Sussex group, on the general problems associated with running the Science Policy Research Unit and covered such matters as organization, involvement of other departments, strategies, and funding. He discussed with the Vice Chancellor of Sussex (Dr. Asa Briggs) and the Deputy Vice Chancellor (Dr. Roger Blin-Stoyle) the University perspectives and problems associated with running a science policy research unit. He gave a seminar on American development in this area to the staff of the Sussex Program, concentrating on the teaching and research programs we are developing at Cornell. He arranged a meeting between members of the Sussex staff and members of the Science Research Council to discuss possibilities of joint projects and exchange of perspectives with Cornell University.

Edmund T. Cranch, Director of the Program on Policies for Science and Technology in Developing Nations, participated in the December 1971 AID workshop on Science and Technology Priorities at Airlie House, Virginia. He attended an International Symposium on "Targets for Scientific and Technological Development for the Second United Nations Development Decade" held in Baden/Vienna during the last week in May 1972. The Austrian Institute of Research in Education and Development hosted the meeting which was supported by the Austrian government and UNESCO. Dr. Cranch

spent a week with the Science Policy unit of UNESCO, the OECD Center for Educational Research and Innovation, and the International Institute for Educational Planning, all located in Paris.

In October of 1971, Milton J. Esman, Director of the Center for International Studies and John S. Knight Professor of International Studies, delivered four lectures on development administration and institution building at the Inter-American School of Public Administration in Rio de Janeiro. During the month of January 1972, he served as a Ford Foundation consultant to the Center for Economic Development and Administration, Kathmandu, Nepal. Also during the year, he delivered several papers to conferences in the United States and continued teaching and his research on administration and development. Professor Esman's book, Administration and Development in Malaysia: Institution Building and Reform in a Plural Society, was published in February 1972 by Cornell University Press. His article on "Foreign Aid: Not by Bread Alone" was awarded the LaVerne Burchfield prize of the American Society for Public Administration for the best review article in the Public Administration Review. He collaborated with John Montgomery in an article, "Popular Participation in Development Assistance", which appeared in the November 1971 issue of the Journal of Comparative Administration.

Gilbert Levine, professor of Agricultural Engineering, visited the Philippines and Taiwan in January and February 1971 under the University of the Philippines/Cornell graduate education program and then spent ten days in India as a consultant for the Ford Foundation. He hosted the International Seminar on Irrigation Management, sponsored by the Agricultural Development Council which was attended by representatives of four countries and nine states. Mr. Levine also participated in teaching a course on "Peasants, Power and Productivity" for the Center for International Studies at Cornell, and is active in a NASA-funded research program which is co-sponsored by the International Rice Research Institute and the University of the Philippines, under the ERTS-A Program.

Franklin A. Long, Chairman of the Executive Committee of the Program on Policies for Science and Technology in Developing Nations and Director of the Cornell Program on Science, Technology, and Society, participated in an April workshop on Science, Technology and Development at Columbia, Maryland. In December 1971 he chaired a session at the AID workshop on Science and Technology Priorities at Airlie House, Virginia, and in April 1972, participated in the 1972 Review of NAS Activities in Washington, D.C. Professor Long visited Korea in January 1972 as a consultant for the National Academy of Sciences and then served as Chairman of

a Council on Foreign Relations discussion group on National Policies for Science and Technology, from October 1971 until March 1972. Professor Long also made a visit to the Sussex Science Policy Research Unit in England.

John W. Mellor, professor in Agricultural Economics, made two trips to Asia in 1971 to supervise work under an AID contract which he directs, entitled "The Impact of New Technology on Rural Employment and Income". In February and March 1971, he visited Thailand, East Pakistan and India to supervise projects and prepare the way for new projects. In November 1971 he again visited India to continue supervision and to consult with knowledgeable people on the overall project. In October he participated in the "International Conference on Nutrition, National Development and Planning" at M.I.T. In December he participated in a conference on "Agricultural Strategies for the 1970s: Design and Implementation" for the Food Research Institute of Stanford University. Professor Mellor was also a member of the executive committee of the International Voluntary Service.

Vithala R. Rao, professor in the graduate school of Business and Public Administration, conducted a three-day seminar on "Research in Marketing" in Mexico City, Mexico. The seminar was sponsored by the Institute of Scientific Administration and several faculty members from the University of Mexico and representatives from several local industries attended the seminar.

Bryant Robey, Executive Director of the Center for International Studies, has coordinated the preparation of a proposal to create a program of study at Cornell leading to a new degree, the Master of Professional Studies (International Development). The objective of the proposed new program is to provide an appropriate course of study and degree for individuals who have embarked upon careers in administration, planning and applied research in international development. Initially, students will be admitted with a concentration in one of the following areas:

(a) nutrition, (b) policy planning and regional analysis, (c) population, and (d) housing and rural development. It is anticipated that other policy-oriented concentrations such as science and technology, may be formulated as well.

William F. Whyte, professor in Industrial and Labor Relations, continued his work with Lawrence K. Williams on the analysis of Peruvian communities which he has been studying by survey and other methods from 1964 until the present. He has also been working on two books. The first, Kuyo Chico: Applied Anthropology in an Indian Community, on which he collaborated with Oscar Nunez del Prado, will be published by University of Chicago Press in Spring 1973; and The Transformation of Sacred Valley in collaboration with Lawrence K. Williams.

Karel Stregl, Senior Research Associate for the Program on Science, Technology, and Society; the Center for International Studies; and the Program on Policies for Science and Technology in Developing Nations, conducted comparative research on science and technology in the COMECON, OECD and developing countries. He developed a general method of recomputation of Soviet statistical aggregates into the aggregates of U.N. national accounts and formulated a first draft of a theoretical model of organization, system of planning, financing, and the ways of stimulation of science and technology-development for the industrially semi-developed nations. A presentation on the subject will be made in the PPSTDN seminar series. He also prepared a background paper entitled "Science, Technology and Science Education in the Republic of Korea". A review for the American Scientist was published in September and a copy of it is in Appendix A. He also delivered several lectures and seminars to various Cornell programs and other U.S. (Department of State) and foreign institutions.

VI. Next Year's Plan of Work

For the academic year 1972-73 a seminar series has been planned. Under this series, experts active in relating science and technology to the development process and the national plans for economic and social advancement

of developing nations, would be invited for informal meetings and discussions with interested students and staff members at Cornell.

Following the drafting of a memorandum of understanding between Cornell and the Korea Advanced Institute of Science, a Cornell/KAIS workshop at Cornell is planned for November 1972 exploring collaborative activities in curriculum planning, interdisciplinary research and discussions in assessment and selection of technology.

Soon, a Cornell team will visit Latin America to identify a linkage country for the Program. This activity will substantially increase the case study and research opportunities for Cornell staff and students. Under the Cornell/Costa Rican contract, Cornell staff and students may be involved in field efforts between semesters and during summer 1973. Since the objectives of the Cornell Costa Rican contract complement those of the 211(d) grant, it is likely that additional research and/or case study efforts in Costa Rica will be carried out under the 211(d) Program.

Firm proposals for starting new courses at Cornell that focus on developing nations are under preparation. Several groups of staff members will be active drawing up course outlines and reviewing case studies prior to offering the course. Field studies, possibly in the linkage countries, in support of the courses will be explored.

It is anticipated that the major thrust of the Program during next year will be to encourage Cornell staff members and students to submit case study and/or research proposals on topics relevant to the Program.

Table I

Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding*

Review Period Aug. 11, 1971 to August 10, 1972

(List all grant related activities)	211(d) Expenditures			Non 211(d) Funding Amount
	Period Under Review	Cumulative Total	Projected Next Year	
e.g. Research	\$18,000	\$18,000	\$31,920	Except for the \$50,000 AID contract "Science Policy for a Small Developing Country (Costa Rica)," no other outside funding complementing 211 (d) objectives was available.
Teaching	18,000	18,000	46,000	
Libraries	568	568	4,000	
Consultation	1,000	1,000	5,000	
Publication	--	--	2,000	
Other (administration, office expense, some travel)	39,432	39,432	41,000	
TOTAL	\$77,000	\$77,000	\$130,000	\$373,000

* These figures are your best estimates

ANNUAL FISCAL REPORT

8/11/71 - 8/31/72
Reporting Period

Name of Grantee Cornell University Grant No. AID/csd - 3158
Grantee's Project Officer John Semmler Phone No. (607) 256 5014

Category	Total Expenditures			Estimated Expenditures			
	Total Budget Amount	To date 8/11/71 8/31/72	This Period 8/11/71 8/31/72	Yr/2	Yr/3	Yr/4	Yr/5
	(1)	(2)	(3)		(4)		(5)
Salaries	353,000.00	59,328.43	59,328.43				
Stipends for Graduate Research Assistants	\$ 61,000.00	\$ 0	\$ 0				
Tuition and Fees for Graduate Research Assistants	53,000.00	0	0				
Travel and Allowances	77,000.00	7,934.75	7,934.75				
Equipment, Supplies & Materials	17,000.00	9,097.83	9,097.83				
Library Development	19,000.00	568.13	568.13				
Grand Total	\$ 520,000.00	\$ 76,929.14	\$ 76,929.14	130,000.00	130,000.00	130,000.00	130,071.00

Method of Billing Cash Basis
 Accrued expenditure Basis

The undersigned hereby certifies: (i) that payment of the sum claimed under the cited Grant is proper and due and that appropriate refund to A. I. D. will be made promptly upon request in the event of disallowance of costs not reimbursable under the terms of the Grant, and (ii) that information on the fiscal report is correct and such detailed supporting information as the cognizant A. I. D. Controller or the Grant Officer may reasonably require will be furnished by the Grantee to A. I. D. upon request.

By _____
Frank J. Feocco
Title Contract Accountant Date 10/20/72

(To be submitted in original and three)

scattering theory needed for an understanding of the basic phenomena and experimental data of neutron interactions. Topics that are both interesting and useful have been carefully selected. A few of the reactions considered in detail are neutron elastic scattering, (n,p) reactions, neutron capture, fission, and thermal neutron inelastic scattering. High energy neutron inelastic scattering and (n,p) reaction cross sections are calculated in Hauser-Feshbach theory. The optical model describes elastic scattering.

Introductory fundamental material which the student might need is developed from elementary principles. For example, the harmonic oscillator solution is developed and later used in thermal neutron scattering in solids. The theory of angular momentum and its coupling is discussed for reaction theory applications. When possible, the author explains why the particular reaction being discussed is of practical importance in the nuclear industry. Although the development of the material is uniformly excellent, I believe that the parts on neutron radiative capture, the fission reaction, and thermal neutron scattering coherence effects were especially well done.

The cost of the book is reasonable, and I would recommend its purchase by nuclear engineering students who are interested in neutron or reactor physics. Furthermore, nuclear engineering professors who teach quantum mechanics should consider including parts or possibly the entire contents of this book in their nuclear science sequence. The book could also be used by undergraduate physics and chemistry students who will not proceed to obtain an advanced degree and who are interested in employment in the nuclear field. Scientists and engineers who measure or evaluate nuclear data may also benefit from reading it. More books like it should be published.—*Norman C. Francis, Knolls Atomic Power Laboratory, Schenectady, New York*

GREEN, H. S., and R. B. Leipnik. *Sources of Plasma Physics*, Vol. 1. 630 pp. Groningen, Netherlands: Wolters-Noordhoff, 1970. \$35.

The title of this book does not indicate its real contents. It contains a substantial, exhaustively thorough theoretical treatment of topics in classical physics: statistical and fluid mechanics, kinetic theory of fluids, electromagnetism, and electrodynamics. The authors claim in the preface, no doubt correctly, that this book is the first synthesis of these different branches. Relation to MHD is considered, but systems of charged particles and plasmas are slated for a following volume. I have not had the opportunity to use the book as a text, but I feel there would be difficulty since rearrangement of a curriculum, rather than a single course, would probably be entailed.

Heaviside-Lorentz-Rosenfeld units are used, although unit conversion tables are provided in an appendix. Problems are interspersed through the text, not gathered together at the end of each chapter. No claim is made that recent plasma physics research is referred to, although at least one of the authors has published extensively. References are provided at the end of each chapter, but it is not always easy from reading the text to find which reference is alluded to, particularly in the appendices.

One could find minor sources of complaint: for example, the statement that waveguides are "simply elongated resonant cavities" (p. 317), and the staff of the Australian National University would probably be surprised to find that a 6×10^4 joule homopolar generator could be classed as a toy (p. 133). The sections on shock waves and waves in magnetized plasmas are quite brief. But these are matters of individual preference. The book contains a great deal of basic material, well set out and clearly presented. It is a worthwhile addition to one's library.—*Jack H. Noon, Physics, Florida Technological University*

HEMY, Geoffrey. *The Soviet Chemical Industry*. 382 pp. Barnes and Noble, 1971. \$21.

The Soviet Chemical Industry amply demonstrates Geoffrey Hemy's long and concerned work with official statistics and other Soviet sources and reveals his broad knowledge of the technological level, performance, organizational structure, dislocation, and the systems of planning, financing, and management of the Soviet chemical industry. The evidence of this constitutes the strong side of his work.

The book portrays the Soviet chemical industry as doing prevailingly well. This may or may not be the case, depending on the criteria with which the development and current state of the Soviet chemical industry are assessed. In Hemy's book, the criteria are Soviet eyes. This reliance on one set of criteria means that the impact of the author's information on the reader—and, of course, the conclusion the reader may draw—will differ according to the extent of his prior knowledge of the actual functioning of the Soviet socioeconomic system in general and the Soviet chemical industry in particular, in comparison with that of other industrially developed countries. Hemy provides no such standard of comparison, and it is this lack of comparative information that is the weak side of the book.

Perhaps the author believes in the division of labor and trusts that others will attempt to recompute the official Soviet data he has compiled into the statistical form of United Nations National Accounts, and that, using this basis, a long-term international comparison will be made.

Should this be successfully done, then the importance of Hemy's decade-long effort will be strongly enhanced, for his book will prove to be a fruitful source for much more valuable qualitative information than it contains itself.

Even so, Hemy's book deserves consideration for what it is, a "record of what the Russians say about their chemical industry."—*Karen Stregl, Ithaca, New York*

KIRKLAND, J. J., ed. *Modern Practice of Liquid Chromatography*. 454 pp. Wiley-Interscience, 1971. \$14.95.

This monograph is a good indication of the manner in which liquid chromatography is renewing its position as a very useful analytical separations technique. The editor has done a fine job in presenting the various aspects of liquid chromatography. The monograph is representative of the kinds of books still needed in the ever-expanding area of analytical separations. As stated in the book, "It is not just a review of individual research, but a critical examination of various aspects of modern (liquid) chromatography."

The book is divided into three parts. Part 1 (ca. 35 percent of the book) discusses the fundamentals of liquid chromatography. The first chapter presents a theoretical discussion of liquid chromatography with analogies to gas chromatography. Chapters 2 and 3 give a comprehensive and well-organized discussion of apparatus and detectors. Chapter 4, also well-organized, contains a critical evaluation of the role of the mobile phase in liquid chromatography.

Part 2 (ca. 40 percent of the book) covers the practice of liquid chromatography. This part contains five chapters, each of which has been written by a qualified researcher in the areas of liquid-liquid, liquid-solid, gel permeation, and ion exchange chromatography. These chapters are remarkably current in listing of references.

Part 3 (ca. 23 percent of the book) deals with the applications of liquid chromatography. The three chapters in this part, which are the result of many years of laboratory application work by representatives of instrument companies, discuss a wide range of areas and compound types. This part contains useful information for the scientist who is not familiar with liquid chromatographic techniques as well as for the experienced practitioner of chromatography.

The book is well written and easy to read. There are a few misspellings and faulty notations, but they should not limit the book's value. Examples would be equation 1.7 and the equation in Figure 1.1 or the asterisks for footnotes on page 10. One feature that does detract from the book is the print style. Since the same type was used for figures, tables, and