

**THE A.I.D. RESEARCH PROGRAM**

1962 – 1971

**Project Objectives and Results**

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*Projects in Agriculture, Health, Nutrition, Population,  
Education, Institutional and Social Development, Industrial  
and Urban Development and Economics*

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Prepared by

Office of Research and University Relations

Bureau for Technical Assistance

**AGENCY FOR INTERNATIONAL DEVELOPMENT**

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## Foreword

The centrally funded research program of the Agency for International Development was initiated formally in 1962, although some proposals for research and work on internal research surveys had begun a year or so earlier. During the past nine years, a total of 142 research projects have been funded. Eighty-one have been completed and 61 are active, ongoing projects. New projects are being added as the program evolves.

This short volume provides information about the *purposes* of each project, a minimum description of the methodology employed, the countries in which the research was conducted, and a statement on the participation of personnel and institutions of other countries. Under the *results* category we have attempted to reflect important findings of the research and the known uses of the research product and efforts of research investigators to induce changes in policy and procedures in the developing countries and in A.I.D. programs and policies. It has not been possible to catalogue all of the uses served by the research.

The principal thrust of our research program has been toward applied or adaptive research. Scientific methods and research findings which are applicable in the U.S. and Western industrial nations cannot necessarily be applied directly to the problems of the developing countries. Adaptation of scientific theory and methods must be made to the differing environmental conditions around the world. Because of the different environments, the AID research program is emphasizing increasingly collaboration between U.S. scientists and institutions and the scientists and institutions of the developing world.

Frequently, operations of the research program have been located in a particular country or group of countries. However, location in a specific country or region does not mean that the findings are restricted to that area. The Agency has sought to select projects focussed on problems specific to the developing countries but with potential application beyond the borders of a given country or region of the world.

It is our hope that this report will provide information useful to AID personnel and others in making greater use of the AID research program.

We welcome, indeed, solicit your comments.

Dr. Erven J. Long  
Associate Assistant Administrator  
of the Bureau for Technical Assistance  
and Director of the Office of  
Research and University Relations

### **Acknowledgments**

The present research program of the Agency is the outgrowth of the efforts of a wide variety of people in and out of the Government. Credit must go to the many able professionals on A.I.D. staffs, to outstanding professionals in the universities, to research organizations and private industry, to specially constituted professional reviewers and panels, to other cooperating Federal Agencies, to the A.I.D. internal review committees, and, particularly to the external Research Advisory Committee, a committee of experts constituted principally from the universities and Federal Agencies, to evaluate and advise on changes in project proposals.

A draft of this report was initially prepared by Mr. Glenn McClelland, a consultant to TA/RUR, and by Drs. Stefan Krashevski and Birtjil Lloyd of TA/RUR. The initial drafts relied heavily upon research materials, including reports prepared for Agency use by professionals in A.I.D. and elsewhere and on special reports of A.I.D. contractors. The drafts were reviewed by A.I.D. Technical Offices and other professionals in the Agency. The redrafting and editing of the final copy was the responsibility of Mr. Glenn McClelland and Dr. Delbert Myren.

## SUMMARY OUTLINE

	<i>Completed Projects</i>	<i>Ongoing Projects</i>	<i>Total</i>
I. Agriculture and Fisheries	20	21	41
II. Health	6	9	15
III. Nutrition	7	8	15
IV. Population	3	15	18
V. Education and Human Resources	9	1	10
VI. Institutional and Social Development (Title IX)	16	1	17
VII. Industrial and Urban Development	7	0	7
VIII. Economic Studies	<u>13</u>	<u>6</u>	<u>19</u>
Totals	81 <sup>2</sup>	61 <sup>2</sup>	142 <sup>1</sup>

<sup>1</sup>Represents all projects for which contracting has been completed by March 1, 1971 (from 1962 on)

<sup>2</sup>Tabulation is based on expiration dates of contracts.

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## **CROP AND SEED IMPROVEMENT AND ANIMAL PROTEIN**

### **Development and Use of Improved Varieties of the Major Cereal Crops in Africa**

<i>Research Contractor</i>	<i>Agricultural Research Service, USDA</i>
<i>Principal Investigator</i>	<i>Dr. G. F. Sprague</i>
<i>A.I.D. Monitor</i>	<i>Bureau for Africa, Office of Eastern African Affairs</i>
<i>Duration of Project</i>	<i>June, 1963 to June, 1973</i>
<i>Contract Number</i>	<i>PASA (RA-(AT) 4-00)</i>

#### **Purpose**

Maize, sorghum, and millet are the major cereal crops in Africa. Economic progress requires a substantial increase in food production, which will only be possible with varietal improvement, disease and insect control, and development of adequate cultural and management practices in the cultivation of the major crops.

The broad objectives of this project are to: (1) cooperate with existing programs and initiate new breeding programs for the development of improved varieties or hybrids of sorghum, millet, and maize; (2) develop control measures for the principal diseases which affect these crops; (3) identify and determine the geographical distribution and severity of the principal insect pests; (4) determine soil management factors which will contribute toward maximum production of the three crops.

Two main research centers were established—at Ahmadu Bello University, Zaria, Nigeria, in West Africa,

and at the Government Experiment Station, Serere, Uganda, in East Africa. Satellite stations for maize were located at Ibadan, Nigeria, and Kitale, Kenya. In order to extend the research results to additional countries, the Africa Bureau has exercised responsibility for this project since July 1, 1969.

#### **Results**

High-yield maize varieties have been developed at Kitale and are now in wide use by farmers throughout the East African region. In West Africa, resistant lines of sorghum have been found for specific diseases and major insect pests. Samaru Hybrid No. 1, which has increased sorghum yields four-fold, has been released for commercial production. The maize-breeding program at Ibadan has produced composites and strains now under test in 10 countries. The opaque-2 gene, which improves the protein content of maize, is being incorporated into locally adapted varieties.

### **Improvement of Grain Legumes Production in the Near East, South Asia, East Africa and African Regions**

<i>Research Contractor</i>	<i>Agricultural Research Service, USDA</i>
<i>Principal Investigator</i>	<i>Dr. J. P. Meiners</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1963 to June, 1973</i>
<i>Contract Number</i>	<i>USDA - PASA RA (AJ) 3-00</i>

#### **Purpose**

Grain legumes are high protein food of many millions of people throughout the world. The yields of pulses are very low—a few hundred pounds per acre. However, yields of 5,000 pounds per acre are possible with improved species and cultural practices.

This research will (1) develop and test improved genetic material; (2) develop cultural and management practices; (3) introduce techniques for control of insects and diseases; (4) evaluate and propose other knowledge and techniques that will lead to increased production

and improved quality of pulses; and (5) train local researchers in modern techniques.

Two pulse research centers were established; one in India and another in Iran to conduct research and to train researchers in entomology, soil science and plant breeding.

#### **Results**

The research teams have completed a fourth season in Iran and a third season in India. Significant results include: (1) identification of varieties of

chick-peas that yield more than local varieties; (2) identification of chick-pea materials resistant to several of the major insect pests; (3) selection of varieties of mung beans that significantly surpass yields of local varieties; (4) development of improved cultural practices which have resulted in more than doubling the yields of local varieties; (5) assembling a collection of at least 10,000 varieties and selections from all parts of the

world for evaluation of yield potential, protein content, and insect and disease resistance. Centrally-funded A.I.D. support for the India-based part of the project ceased at the end of FY 1970. An "All India Pulse Improvement Project" will continue with support from the government of India and the A.I.D. country mission, A.I.D./W will continue to support limited project activities in Iran.

### **Inheritance and Improvement of Protein Quality and Content in Sorghum, Vulgare**

<i>Research Contractor</i>	<i>Purdue University</i>
<i>Principal Investigator</i>	<i>Dr. R. C. Pickett</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1966 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd 1175</i>

#### **Purpose**

Cheap, readily available sources of protein are needed to improve the diet of the people in the LDCs. Sorghum and related species have a wide range of protein for human consumption. Varieties of sorghum grown previously in Africa are low in protein but a screening of the world collection for desired high protein types will help select and permit inbreeding these with local varieties to upgrade the protein content.

The lines which show high quantity and quality of protein will be selected for study of genetic control, combining heterosis, and environmental interaction of amino acid composition, protein content and yield. The best varieties will be placed in block nurseries and tested at selected locations worldwide by cooperating plant breeders.

The main tasks of the project are to:

- (1) Identify the lines of sorghum which carry high quantities and qualities of protein;
- (2) Recombine these strains so as to improve further the amount and quality of protein in sorghum;
- (3) Determine the method of inheritance of protein quality and content;
- (4) Make all information and plant material available to all interested plant breeders.

The contract was amended in 1970 to add:

- (5) Evaluate the biological value of selected sorghum strains as determined by feeding tests.

#### **Results**

Approximately 3,000 lines of the World Collection have been screened for protein and lysine, day length

response, general yield performance and seed characteristics. A further germplasm source of 4,000 lines has been received from India. The contractor has also made many intercrosses of sorghum at Purdue University, Puerto Rico, Thailand, and other places. The contractor made a selection from the inbred derivatives to test the promising ones for yield, protein quality and the amino-acid composition.

Sorghum has been identified with protein content ranging from 7-25%. Lysine varies from 0.86 - 3.36% of the protein content. Investigation shows that yields, protein, and amino-acid content can be doubled by using the improved strains of sorghum. In these selected strains, the limiting amino acids such as lysine, threonine, tryptophan, methionine and cystine have been increased by 50-100%. The contractor has worked with 61 major cooperators in 53 countries and several others are asking for cooperative research of this kind.

The project supplements other research in this field. It also complements some of the projects in nutrition research. Information produced by the staff on this contract has been distributed to all interested AID Missions and to sorghum breeders throughout the world. The findings of the research should contribute to the improvement of diets in LDCs, although certain segments of people in Africa are hesitant to use the improved sorghum for human consumption because of lack of a taste they are accustomed to. This project will, however, go ahead with indexing, selection, breeding and testing until varieties have been produced which incorporate the desirable genetic characteristics of high yield, high protein and desirable amino acid balance.

**Research on Farm and Equipment Power Requirements for the Production of Rice and Associated Food Crops in the Far East and South East Asia**

*Research Contractor*      *International Rice Research Institute,  
Los Banos, Philippines*  
*Principal Investigator*    *Dr. A. U. Khan*  
*A.I.D. Monitor*            *TAB, Office of Agriculture & Fisheries*  
*Duration of Project*        *July, 1965 to June, 1972*  
*Contract Number*         *AID/csd 834 and AID/csd 2541*

**Purpose**

Basic to increased farm production and more intensive cropping is a reliable source of power, other than human and animal, at a cost that small farmers can afford. Animal and human power on rice farms in the Far East and other regions are generally inadequate for continuous and/or multiple cropping. The introduction of improved varieties also increases the machinery requirement for soil preparation, cultivation, harvesting, threshing, and drying.

The purpose of the research is to conduct applied research on the major paddy and farm mechanization problems and assist in the development of new and improved machinery, suitable for small farms in paddy rice and cultivation of other tropical crops in Asia; the goal is to develop simple machinery for cultivators within the manufacturing capability of the developing countries.

**Results**

Power equipment of various sizes and types is being developed and tested under field conditions. Cost and technical comparisons are established to obtain reliable estimates of economic efficiency. The economic comparisons include determination of size and shape of fields for maximum efficiency in cropping, soil and water management, and power use. Once equipment has been developed, tested, and found satisfactory, plans and specifications are made available to manufacturers.

A prototype thresher, simple in design and technically efficient, has been completed and is already being manufactured by three local firms in the Philippines. A table-type power thresher which can be conveniently carried by four persons has been built and tested. Prototypes of machines for harvesting, drying, seed cleaning, seed cultivating, and a stripped harvester have been constructed and are undergoing testing and adaptation. A push-type of rotary portable weeder produced by this project can weed one hectare in 20 hours—one-sixth the time required to weed the same area by hand.

**Improvement of Nutritional Quality of Wheat Through Increased Protein Content and Improved Amino-Acid Balance**

*Research Contractor*      *University of Nebraska*  
*Principal Investigator*    *Dr. P. J. Mattern*  
*A.I.D. Monitor*            *TAB, Office of Agriculture & Fisheries*  
*Duration*                    *June 1966 to June 1971*  
*Contract Number*         *AID/csd 1208*

**Purpose**

The project is analyzing the World Collection of Wheats to find superior protein and amino acid lines and incorporate them into over-all improved varieties adaptable to the food deficient developing countries.

Wheat types which are identified as nutritionally superior are used in breeding to produce a large number of hybrid populations which are tested and analyzed for improved protein and lysine and disseminated for seed increase and crop production. The research aim is to increase the yield of wheat as well as its nutritional quality.

The contractor is: (1) completing protein-lysine screening of the 15,000 items in the U.S. Department of Agriculture World Wheat Collection; (2) analyzing approximately 4,000 samples per year from environmental nurseries in the U.S. and the International Winter Wheat Nursery; (3) analyzing and segregating populations from crosses to identify high-protein, high-lysine segregates; (4) obtaining complete amino acid profiles on selected high-protein, high-lysine wheats from the international nurseries; (5) making additional crosses of high-protein and high-lysine wheats with commercially acceptable wheats from developing

countries and analyzing selected crosses for protein to identify new genetic sources of high protein; (6) making available promising high-protein, high-lysine lines to other agencies and developing countries.

#### Results

The project has been reviewed in the field and the reports are very favorable. International Wheat Performance Nurseries have been established in 26 countries to evaluate performance of 30 varieties and

new selections under different conditions with respect to yields and protein quality. New selections are being made in segregating progenies and promising hybrids, with initial field testing of winter types in Nebraska and of spring types in Mexico. All data relating to protein and amino acid composition of wheats analyzed by the contractor are put on punch cards and print-out sheets and made available to all cooperators in other countries, the International Maize and Wheat Improvement Center of the Rockefeller Foundation, and other interested organizations.

### Preparation of a Plan for Orientation of Research on Cassava

<i>Research Contractor</i>	<i>University of Georgia</i>
<i>Principal Investigator</i>	<i>Dr. C. Hendershott</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd 2497</i>

#### Purpose

Cassava is being consumed as a caloric source in sizable quantities by people of tropical countries. There exists a possibility of improving protein content of cassava through breeding better varieties or simple processing before preparation for consumption. Since presently there is no comprehensive review of literature on cassava in the English language, the University of Georgia will assemble world-wide literature on the subject to appraise cassava as a food and feed source and to evaluate existing knowledge in order to serve as a planning guide for basic and applied research which will lead toward the efficiency and usefulness of the crop.

Information will be compiled on: genetic characteristics, environmental adaptability, crop yields, cultural practices, chemical composition, comparative food value, insect and disease susceptibility and/or resistance to them, and harvesting and storage problems.

A part of literature search and evaluation will be conducted by the Taximetric Laboratory of the University of Colorado.

#### Results

A multidisciplinary cassava committee, consisting of eight members, has been formed to advise on project activity. The project leader requested publications from 57 different countries. The literature is being abstracted on index cards. About 122 articles have been reviewed and abstracted. Literature in foreign languages is being translated into English. Preliminary data has been prepared for discussion and follow-up.

The findings of the research will be distributed to all countries growing and consuming cassava to point out the additional research required and the potential of this crop as an improved food.

### Inheritance and Improvement of Protein Quality and Content in Sorghum and Maize

<i>Research Contractor</i>	<i>Purdue University</i>
<i>Principal Investigator</i>	<i>Dr. E. T. Mertz</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1975</i>
<i>Contract Number</i>	<i>AID/csd 2809</i>

#### Purpose

[This represents a combination of two projects—an extension of the Purdue contract on the improvement of sorghum and an added study extending the investigation to maize.]

Some 50% of human protein needs are supplied currently by cereal grains. Maize supplies are an important portion. With adequate, systematic, cooperative research, this crop could play an increasingly important role in solving the world's human and animal nutritional problems.

Maize research to improve production and nutrient quality is underway in the U.S., at CIMMYT, and in many parts of the world. To avoid duplication and to assure direction of the research to the most important problems, the proposed investigations will be coordinated with on-going research programs. A planning conference with CIMMYT, USDA, AID, private seed companies and Purdue will be held and liaison with these groups will be maintained throughout the life of the project.

Several new endosperm gene mutants that have been isolated and other genes and promising germplasm that may be discovered in world maize collections will be quantitatively and qualitatively evaluated for amino acid, protein, oil, milling properties and agronomic potential. New genes will be alleletested to known genes, and their linkage relationships determined. Studies of

genetic mechanisms and estimates of types of gene action involved in the more promising germplasm (varieties, races, etc.) will be carried out.

A central biochemical unit at Purdue will be established. Post doctorates will travel as necessary to coordinate and to offer instruction in analytical procedures for maize protein in major analytical laboratories participating in the studies. In cooperation with CIMMYT, CIAT and other institutions in the South American Andean Region, data will be collected simultaneously on net radiant heat and air temperatures under field conditions at three different altitudes. Cali (about 1,000 meters above sea level) Medellin (1500 m) and Bogota (2700 m) are the most probable sites. This information, along with other data, will provide a basis for estimating the adaptation of hybrids, composites and varieties to fit innumerable local situations all over the world.

#### **Survey and Analysis of the Problems of Cattle Feeding Systems and Nutrition in the Wet/Dry Tropics**

<i>Research Contractor</i>	<i>University of Florida</i>
<i>Principal Investigator</i>	<i>Dr. Hugh Popenoe</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>April, 1969 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd 2498</i>

#### **Purpose**

Because of the inefficient levels of nutrition and the low nutritive value of feeds and forages, animal production in the wet/dry tropics has been chronically low. To discover and outline essential procedures to improve cattle feeding, the contractor will; (1) assemble and analyze existing data on the nutritional value of feeds, fodders and useable agricultural by-products, (2) assemble data into a uniform, easily retrievable computerized system, (3) develop procedures and guide cattle feeding trials, and (4) develop feeding systems using indigenous feeds.

#### **Results**

Preliminary investigations into the problem of animal feeding indicate that protein and mineral content of feed are almost universally low in wet/dry tropics;

that forage products are inferior; that legume should be added to feed; and that the available feed and forage are used inefficiently, creating even greater food deficiency in animal production.

Tables of Feed Composition are being prepared using data from Colombia, Venezuela, Costa Rica and Guatemala. These charts will be distributed to LDCs, especially those that cooperated in this investigation to serve as guides to improve animal nutrition either by preparing proper ratios from available feed or by improving forage production and management and for the purpose of conducting needed feeding trials. The contractor, in cooperation with Latin American Scientists, will develop cattle feeding trials which will then be economically analysed as to their economic value in animal production.

The data will have wide application.

## Technical and Economic Factors Associated with Establishment of a Seed Industry in the LDCs

<i>Research Contractor</i>	<i>Mississippi State University</i>
<i>Principal Investigator</i>	<i>Dr. James C. Deloche</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1966 to December, 1968</i>
<i>Contract Number</i>	<i>AID/csd-1203</i>

### **Purpose**

The task of feeding LDC populations is the greatest challenge facing A.I.D. One of the bottlenecks in the increase in agricultural production is the lack of good crop seeds for the farmers of LDCs. Improved seeds, which are responding positively to high rates of fertilization, water supply and modern cultural practices are basic to increased agricultural production.

To assist A.I.D. Missions in alleviating the worldwide problem of seed production, processing, harvesting and storage, AID/W contracted with Mississippi State University to investigate present conditions and to proposed programs for seed industries in the LDCs. The contractor was also to determine the

conditions essential to the development of the private sector and to suggest new laws or necessary changes in existing laws, rules and regulations. He was to outline methods of operation needed for the establishment of seed industries.

The contractor was to prepare a handbook to be used to improve seed production.

### **Results**

Literature pertaining to the subject has been reviewed. Review of seed industry conditions has been made. Selected countries have been visited for in-depth studies. The second draft of the handbook was received in December, 1970 and is being prepared in final form for publication by June 30, 1971.

## SOILS AND FERTILIZERS

### Soil Fertility Requirements for Efficient Production of Food Crops on the Extensive Deep, Well-Drained but Relatively Infertile Acid Soils of the Humid Tropics

<i>Research Contractor</i>	<i>Cornell University, Department of Agronomy</i>
<i>Principal Investigator</i>	<i>Dr. M. Drosdoff</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1974</i>
<i>Contract Number</i>	<i>AID/csd 2490</i>

### **Purpose**

It has been estimated that there are more than two billion acres of uncultivated acid soils in the tropics which have high potential productivity. These soils are deep and well-drained and have good physical characteristics, but are relatively infertile for a variety of reasons. Most frequently they are low in nitrogen and phosphorous, are highly acid, may contain toxic amounts of aluminum, have a low base exchange capacity, and may have one or more micronutrient deficiencies. There is good evidence that they could be made highly productive at relatively little expense.

The object of the research is to determine limiting factors in soil fertility and devise management practices to utilize thousands of square miles of potentially productive savana lands in the humid tropics. Specific objectives are to devise and evaluate cropping patterns; to evaluate the critical nutrient status of the soils; to determine favorable soil-root relationships; to point out

training requirements of local researchers; and to prepare programs of soil management for optimum crop production.

Based in Puerto Rico, the project is designed to have application over extensive areas in Latin America, Africa, and Asia. Complementary studies will be carried out in other tropical countries from the Puerto Rico base. Cornell University is collaborating with the University of Puerto Rico, U.S. Department of Agriculture, and other agencies in carrying out the project.

### **Results**

The work has been initiated in Puerto Rico and is being closely coordinated with other A.I.D. sponsored soil projects. The literature has been reviewed as a basis for charting studies. Field trials on nitrogen requirements for various crops are in progress in Puerto Rico.

### Tailoring of Fertilizers for Rice

<i>Research Contractor</i>	<i>Tennessee Valley Authority</i>
<i>Principal Investigator</i>	<i>Dr. D. McCune</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>July, 1968 to June, 1972</i>
<i>Contract Number</i>	<i>PASA RA(QA) 5-69</i>

#### Purpose

The need exists for fertilizers that are tailored specifically for rice, in order to enhance the efficiency of fertilizer use and improve the yield of rice per unit of applied fertilizer. Recent observations show that sulfur-containing coatings remain effective in paddy cultures in controlling the release rate of applied urea. This suggests fertilizer use efficiency in rice production.

TVA is conducting on a worldwide scale tests of improved coatings, inhibitors, and products that will control the release and availability of applied nutrients for plant growth. Activities are concentrated on thorough testing for use in rice production in the less-developed countries. The work is being carried out at selected rice research centers (including the International Rice Research Institute in Philippines) and will be extended to other areas as results indicate.

#### Results

The tests show that sulfur-coated urea, when used on paddy grown with good water control, is a satisfactory source of nitrogen but is not superior to regular urea or ammonium sulfate. TVA has evaluated rock phosphates on the basis of their citric acid available phosphate, and structure. When representative series of these rock phosphates were used on acid paddy soils, the response of rice was closely correlated with the predicted availabilities. Thus, on acid soils certain types of rock phosphate may be satisfactory sources of phosphates for rice. Residual effects or carryover to subsequent crops is under study. Studies on sulfur-coated urea and/or rock phosphates have been initiated in the Philippines, India, Thailand, Ceylon, and Colombia. Trials will also be made in California and Louisiana.

### Determination of Research Needs of Soils of the Tropics

<i>Research Contractor</i>	<i>National Academy of Sciences</i>
<i>Principal Investigator</i>	<i>Dr. Joice Torio</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>May, 1969 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd 2505</i>

#### Purpose

There are more than four billion acres of potentially arable land in the world not under cultivation, about half of which is in the humid tropics. In addition, there are vast cultivated tropical areas where crop production is only a fraction of what should be feasible. Potentially arable lands in the tropics are uncultivated for a number of reasons, such as unfavorable geographic location, lack of markets and lack of knowledge of improved soil and crop management practices. In many of these undeveloped or poorly developed areas, soil infertility is a fundamental problem; however, ready responses to nitrogen, phosphate, and potassium have been noted. In other instances, the soil acidity is a factor limiting production. Deficiencies in other major essential mineral elements (magnesium, calcium, and sulfur) also have been identified. Minor element deficiencies (zinc, molybdenum, copper, etc.) may also be important. There are many other significant practical problems relating to the management of soils in the tropics which require additional knowledge for their solution.

A.I.D. wished to utilize the expertise of the National Academy of Sciences Agricultural Board in organizing and carrying out a definitive study of high priority research needs relating to the soils of the tropics and their management. Specific research recommendations will be formulated.

The Agricultural Board of the National Academy of Sciences has selected a task force of 12 qualified soil scientists familiar with problems of the soils of the tropics. Research consultants are gathering from all available sources the most pertinent data available on soils of the tropics. When the consultants have completed their research, the task force will meet with them to discuss the findings and outline the final reports. A final conference will review the reports and prepare recommendations.

#### Results

Work is in progress. Results are not yet available from the National Academy of Sciences.

## Agronomic-Economic Research on Tropical Soils

*Research Contractor* North Carolina State University  
*Principal Investigator* Dr. A. McCants  
*A.I.D. Monitor* TAB, Office of Agriculture & Fisheries  
*Duration of Project* June, 1970 to June, 1975  
*Contract Number* AID/csd 2806

### Purpose

The purpose of this project is to develop a methodology for an economically sound system of fertilizer recommendations derived from soil analysis and crop response data, and to obtain basic soil fertility information and other data to better explain the response of crops to fertilizer applications and thus improve management practices. This research consists of economic and agronomic (soils) evaluations. Both aspects will be conducted concurrently.

The economic research aspect will involve:

(1) The compilation of data for use in economic evaluation studies, including available sets of plot and field trials (soil test and yield) using standard correlation and data summary forms developed jointly with the Soil Fertility Evaluation and Improvement Program. Special consideration will be given to data from those sites and ecological zones selected for detailed soil investigations and from other tropical soil projects (either completed or in progress).

(2) These sets of data will be used to evaluate various analytical modes for identifying those soils with high probability of response to applied fertilizer.

(3) The best analytical systems will be used for biological-agronomic evaluations.

(4) The most promising models will be incorporated into other economic studies of maximization of rate of return, minimization of unit costs, and estimation of effective fertilizer demand.

The agronomic aspect will involve:

(1) Determination by horizons of selected profiles of key soils at benchmark sites in selected ecological zones those chemical properties deemed most important for liming, fertilization and management. All investigations will be conducted in cooperation with regional centers, host countries, local research institutions and other A.I.D. sponsored projects (especially the Cornell-Puerto Rico Tropical Soils Research Project).

(2) Determining soil mineralogy by horizons of selected profiles of the key soils, with emphasis on minerals of the clay and silt fractions and special attention to those species of greatest significance in fertilization and management of well-drained acid soils of the tropics.

(3) Determination of soil physical properties important to fertilization and management of those key soils at benchmark sites, first conducting a survey of additional data needed in cooperation with regional centers, host countries, and local research institutions.

(4) Obtaining basic soil fertility and soil chemistry information and conducting adaptive soil fertility research at the selected sites characterized under (1), (2), and (3) above. Research on specific nutrient elements will receive priority because of their importance in food production in Latin America.

## Analysis of Data on the Nutrient Status of Soils in Latin America

*Research Contractor* North Carolina State University  
*Principal Investigator* Dr. T. W. Fitts  
*A.I.D. Monitor* TAB, Office of Agriculture & Fisheries  
*Duration of Project* June, 1963 to June, 1970  
*Contract Number* AID/csd 287

### Purpose

Annual fertilizer consumption in Latin America is expected to reach 5.4 million tons by 1980—almost six times the 1960 total. To manufacture these increased quantities will require a capital investment of more than \$5 billion, while annual expenditures for fertilizers will run over \$4.5 billion. It is vital to the economy of the

countries involved that this money be invested in ways that will give the greatest return. Therefore, information must be gathered to ascertain geographic needs for kinds and amounts of fertilizers so that an efficient production and distribution system can be set up and farmers guided in making correct choices.

In cooperation with local institutions in selected countries, the contractor is concerned with: (1) improving soil testing techniques and increasing laboratory capacities; (2) establishing or strengthening soil sampling and soil test reporting methods; (3) improving soil fertility research capability, and (4) developing data on crop responses to fertilizers for various soil groups and climatic zones.

A soil testing program was initiated, coupled with greenhouse and field studies, to correlate crop response. This required the development and use of standardized tests and improving the laboratory capability to handle large numbers of samples. The resulting data is being summarized and plotted on maps.

#### **Results**

Currently all of the 14 cooperating countries have at least one modern laboratory equipped with multiple-unit apparatus capable of analyzing more than 100 samples per day. Brazil has 20 such laboratories. Soil fertility evaluation information is now used regularly in country fertilizer programs in Peru, Guatemala, Honduras, Nicaragua, Costa Rica, Brazil, and Bolivia, among others. Technical bulletins and other reports are issued in English, Spanish, and Portuguese. The project was completed in FY 1970. Its technical assistance aspects are being continued under a regional project sponsored and financed by the Latin America Bureau.

### **History and Current Status of Arid Lands Research in the United States**

<i>Research Contractor</i>	<i>American Association for the Advancement of Science</i>
<i>Principal Investigator</i>	<i>Dr. Carl Hodge</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>June, 1962 to April, 1964</i>
<i>Contract Number</i>	<i>025199</i>

#### **Purpose**

Many countries of the arid and semi-arid climatic zone have large areas of land which are potentially productive but are not farmed because of lack of irrigation water or have soils which are affected by salts making them non-productive. U. S. research institutions have been concerned with similar lands in this country and have succeeded in putting them into agricultural production.

The primary purpose of this project was to compile a research oriented report on the history and current status of research in arid lands, and to evaluate present trends and needs for future research.

#### **Results**

The purpose of this project was to gather and evaluate the U. S. experience in arid zone research. It was guided by a working committee and a project director. Outstanding research workers in this field prepared critical papers reviewing the specific aspects of arid land research in the U.S. These papers were published as a handbook entitled, "Aridity and Man" which was widely distributed for use by research workers in evaluating present trends in their countries and in preparing programs for needed future research. This publication is of continuing value to many LDCs faced with the problems of utilization of arid lands for agricultural production.

## **WATER MANAGEMENT**

### **Water Management Research in Arid and Sub-Humid Lands of the LDCs**

<i>Research Contractor</i>	<i>Utah State University Colorado State University</i>
<i>Principal Investigator</i>	<i>Dr. B. Palmer (Utah) Dr. M. Albertson (Colorado)</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1968 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd 2167 (Utah State) AID/csd 2162 (Colorado State)</i>

#### **Purpose**

Improvement of water management practices is essential to obtain maximum returns from limited water resources and such inputs as improved seeds and

increased use of fertilizers and pesticides. The objective of this project is to increase food production in the arid and sub-humid lands of Latin American and Pakistan through the improvement of water management

practices. Utah State is working in Latin America and Colorado State is working in Pakistan.

The research under the Utah State contract is aimed at on-farm water management problems in the semi-arid lands of Latin America, but it will be applicable in principle to similar conditions in other regions. Research studies include: (1) development of data on the most efficient means of supplementing soil moisture by limited amounts of irrigation water; (2) development of data that can be used for the on-farm design and construction of inexpensive conveyance, delivery, and drainage systems; (3) development of management systems to minimize salinity hazards in irrigation waters of different qualities on soils of varying physical and chemical characteristics. The research is being closely coordinated with A.I.D.-sponsored projects on soils, fertilizers, and water with TVA, North Carolina State University, Cornell University, and Colorado State University.

#### **Results**

A team from Utah State made on-site investigations of water management research needs in El Salvador, Honduras, Colombia, Peru, Chile, and Brazil. Studies are underway in the areas of water rights; the role of improved irrigation and drainage in the economics of farm production; interactions between crops, fertilizers, and soil moisture; salinity controls, and water requirements of crops by areas.

#### **Purpose**

Colorado State is focussing on the arid and sub-humid lands of the Near East-South Asia region through the improvement of water management practices. Research under this contract is centered on Pakistan, but the findings will be applicable to similar conditions in other countries in the Near East-South Asia region. A research team spent several weeks in Pakistan.

#### **Results**

As a result of the team visit to Pakistan, a group of on-campus studies was initiated. These include: (1) skimming of fresh water from aquifers in which fresh water is underlain by saline; (2) economic analyses to achieve an efficient allocation of water in Pakistan; (3) evaluation of mineral-water iron equilibria that relate to water management practices; (4) optimization of the conveyance, delivery, and application of water to the farm. Research is being initiated in cooperation with local institutions. In addition to its on-campus studies, CSU will post two scientists in Pakistan. One man, an agricultural engineer, has already been posted in Lahore and field experiments were initiated in cooperation with the Ayub Agricultural Experiment Station and West Pakistan Agricultural University.

## **PEST/DISEASE CONTROL**

### **Control of Weeds in Less Developed Countries**

<i>Research Contractor</i>	<i>Oregon State University</i>
<i>Principal Investigator</i>	<i>Dr. Wm. R. Furtick</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1966 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd 1442</i>

#### **Purpose**

There is a need for simple, inexpensive, and effective methods of controlling weeds that can be used by farmers in the less developed countries. Some new crop varieties, such as the short-statured, high-yielding wheat and rice, require the strictest possible weed control in order to fully realize their productive potential. Furthermore, dense weed growths serve as focal points for important plant diseases, insect pests, and plant parasite nematodes. Weeds also compete with crops for available water, soil nutrients and sunlight.

The research is designed to: (1) identify the nature of the weed problems of the LDCs for each major ecological zone; (2) test known methods of weed control for their effectiveness; (3) develop improved or new

control methods and improved adaptations of existing weed control methods; (4) train local technicians in weed control research and demonstration techniques, and (5) increase the weed control research capability of local institutions.

#### **Results**

The contractor has (a) searched relevant literature to catalogue and analyze the major problems of weed control in Latin America; (b) made field studies in Latin America to identify weed problems by species, extent, distribution, existing control measures, problems of control, and economic importance and (c) evaluated through on-site inspection, research institutions in

designated countries to determine adequacy of facilities and research capability.

Research indicates that new materials can cut the current costs of effective weed control by as much as 50 percent. A weed research manual has been written and is in press. Copies of the draft ms were distributed to A.I.D. missions. Major emphasis to date has been in Colombia, Ecuador, and El Salvador. Work has begun in

Panama, Honduras, Guatemala, Nicaragua, and Costa Rica.

A number of manuals and reports on weed problems and use of herbicides have been produced. Publications on weeds have been produced for many Latin American countries, and special reports have been prepared on research and problems encountered in project work in Hawaii, Turkey, and other places.

#### **Research on the Sterility Method of Tsetse Fly Control (Africa)**

<i>Research Contractor</i>	<i>Agricultural Research Service, USDA</i>
<i>Principal Investigator</i>	<i>Dr. Claude Schmidt</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>February, 1963 to July, 1974</i>
<i>Contract Number</i>	<i>AID PASA: RA (AJ) 1-00</i>

#### **Purpose**

It is estimated that over 4.2 million square miles of potentially productive land of the African Continent is under-utilized and under-developed because of the infestation with tsetse fly, which transmits diseases to humans and animals. Twenty-three varieties of tsetse fly are known to be spreading the parasites which produce sleeping sickness in humans and the so-called nagana in animals. Only fowl are immune to this disease. Even though effective drugs are available against nagana (trypanosomes) in animals and, for one strain, of the blood parasites in humans, the eradication of tsetse fly is the only economic way to control trypanosomiasis.

The goal of this research is to develop an economically feasible method of control or eradication of the fly by sterilizing male flies and releasing them at an appropriate time to successfully compete with the natural male fly to mate with the female, which, consequently, will be incapable of producing offspring. Through repeated release of sterilized males, control of the fly is possible.

#### **Results**

The research contractor tested several sterilization methods, and, after evaluation of results, decided on using chemosterilants as the most economical and promising method. The organic compounds tepo and matepa appear to be the best sterilants. The male flies are sterilized on contact with the materials. About 10 milligrams per 1 sq. ft. of surface will sterilize the flies

for a month or longer. Sterilization of pupae is also possible. These encouraging results offer the possibility of controlling one of the most dangerous disease spreading insects.

Because large numbers of male flies are required in the research and in control of the insect, the rearing of flies in captivity had to be developed. The flies are reared in large cages placed in the natural habitat of the insect. The contractor developed a new membrane feeding technique to supply blood meals for the pupae stage of the tsetse fly.

Small scale field trials proved that density of and timing of release of sterilized male flies is an important factor of population control. Density and timing factors have been incorporated into improved tests conducted on two square miles of isolated area which showed successful elimination of the tsetse fly.

The researchers also explored the development and use of attractants to lure native insects to chemosterilants placed in the field, thus eliminating the need of mass rearing in captivity for sterilization purposes.

The research will be directed toward determining a practical and efficient field control technique which will include sterilization, quite probably together with other methods fully integrated and producing an adequate control program. The Government of Tanzania has requested AID's consideration for establishing a cooperative effort to develop methods for large scale rearing of sterile male flies and control measures.

## Research on Hemoprotozoal Diseases of Food-Producing Livestock in the LDCs

<i>Research Contractor</i>	<i>Texas A &amp; M University</i>
<i>Principal Investigator</i>	<i>Dr. Fred Maurer</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration</i>	<i>June, 1968 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd 1947</i>

### Purpose

Estimates show that animal losses from hemoprotozoal diseases amount to 50% in some areas of Latin America. This research aims to determine the causes of diseases and to develop preventive and immunization methods.

The contractor will (a) establish laboratories to develop immunization and other preventive measures; (b) evaluate ecological factors seeking to interrupt the perpetuation of vectors; (c) assess possible interactions of certain hemoprotozoal organisms in relation to pathogeny and immunity; and (d) train host country participants in research methodology and organization.

### Results

Preliminary survey data indicate that altitude and climate play a decisive role in the incidence of the diseases. Only below 5000 feet were Anaplasmosis and chronic infection with Trypanosoma found. The red water disease (babesiosis) was common at lower elevations.

Below 600 feet elevation in areas of moderate rainfall, infection with Anaplasma and Babesia were so rapid that any successful prophylaxis must be administered within the first few months of animal life. A new drug, Glaxazone (dithiosemicarbazone) was found superior to terramycin both in treating acute cases of Anaplasma and Babesia.

Close working relations have been established with the Tropical Center of Agricultural Research (CIAT), at Palmira, Colombia. The Colombian government has made available a large tract of land for experiments, near the CIAT center. The promising research methods on protozoal organisms under way in Texas have been introduced in Colombia. Studies on the incidence of hemoprotozoal diseases in varying ecological zones have been completed. Treatment studies with chemotherapeutic agents have now been completed, so that clean cattle can be moved into vector-infested areas for immunity experiments. Experimental studies comparing the efficacy of vaccines are under way.

## Control of Vertebrate Pests

<i>Research Contractor</i>	<i>Fish and Wildlife Service</i>
	<i>Department of Interior</i>
<i>Principal Investigator</i>	<i>Dr. Nelson B. Kverno</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Contract</i>	<i>April, 1967 to April, 1972</i>
<i>Contract Number</i>	<i>PASA RA(ID) 1-67</i>

### Purpose

Rodents, vampire bats, and noxious birds take a heavy toll of food supplies in the less-developed countries, and effective methods of controlling such damage have not been developed. Attempts to increase agricultural productivity without adequate protection of the products will be nullified by proportional increases in pest populations. The objective of the research is to provide control methods that are safe, effective, economical, and adaptable to the social and economic conditions of the LDCs.

### Results

Laboratory investigations of existing chemical control agents are being conducted, including toxicological studies and evaluation of chemical repellents. Research includes designing and adapting

electronic equipment such as radio-telemetry systems and automatic data-recording devices, and exploring the applications of radar, infrared, and other monitoring instruments. Existing theories and basic assumptions about pest population and control are being re-examined and new concepts developed.

General research is conducted at the BSFW's Wildlife Research Center at Denver, Colorado. In addition, there are research stations in the field for each of the project's three components: at Los Banos, Philippines, for rat control; at Palo Alto, Mexico, for bat control; and at Palmira, Colombia, for bird control. Three annual reports recently were distributed to the USAID Missions--one on Vampire Bats; one on the Rodent Research Center; and one on the Denver Wildlife Research Center.

**Laboratory and Field Testing of a Newly Developed Foot-and-Mouth Disease Vaccine for Potency, Viability and Immunity Duration**

<i>Research Contractor</i>	<i>National Academy of Sciences</i>
<i>Principal Investigator</i>	<i>Dr. J. J. Callis</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>May, 1969 to May, 1970</i>
<i>Contract Number</i>	<i>AID-csd 2273</i>

**Purpose**

The main function of this project was to participate in field-testing of a newly developed vaccine which might have a potential for controlling, and possibly even eliminating completely, foot-and-mouth disease. The contractor was to determine the relative potencies, viabilities, immunity to and duration of the tested vaccine. The results of serological tests and direct virus challenge were to be evaluated. Also, the value of the vaccine for FMD control in cattle, sheep and swine was to be assessed.

**Results**

The investigator participated in the various aspects of cooperative research on foot-and-mouth disease in Brazil and Argentina. As a result of this study, the National Academy of Sciences issued publication No.

1343 entitled "Studies on Foot and Mouth Disease", which received wide distribution within the LDCs. The study demonstrated that meat from cattle vaccinated several times against FMD and later exposed to the virus could contain virus and thus transmit it further.

The research produced information on killing virus by cooking meat. This information has been used in exporting and importing countries as a standard to be followed. Based on the activity of this research, done cooperatively with the Pan American FMD Center in Rio, the Center prepared recommendations for the vaccination of sheep against FMD.

Cooperative research is still underway on improved foot and mouth disease vaccine for cattle.

This project was completed as scheduled. Information generated by this project is available for use by research workers in Latin American countries.

## FISHERIES

**Development of Conservation Processes for Fish By-Products**

<i>Research Contractor</i>	<i>Agrarian University of Peru</i>
<i>Principal Investigator</i>	<i>Dr. Eduardo Loayza</i>
<i>A.I.D. Contact</i>	<i>TAB, Office of Nutrition</i>
<i>Project Duration</i>	<i>April, 1968 to April, 1971</i>
<i>Contract Number</i>	<i>AID/csd 1904</i>

**Purpose**

Adaptive research will focus on developing better preservation techniques to increase the supplies of the protein-rich sea food resources. Emphasis will be placed on: (1) the development and application of improved processes of drying, salting and smoking of Peruvian fish; (2) proper use of wood smoke to stabilize the residual oil in anchoveta meal; and (3) liquefaction of anchoveta by microbial fermentation and subsequent treatment to yield a stable product.

**Results**

The contractor concentrated his efforts on new processes of drying, salting and smoking of Peruvian fish and on the process of preservation of anchoveta. Fish

preservation can be improved considerably by salting and quick partial drying to attain 30% moisture content. Gutting and bleeding of fresh fish prior to salting and drying will result in a more desirable, tastier fish product.

Research in liquefaction of anchovy by microbes is in progress. Bacteria have been selected, laboratory growth medium formulated and optimal growth condition for the liquefying organism established. The technique for liquefaction has been perfected. The results obtained in laboratory investigations are encouraging. They show that the best liquefaction and tastiest product is obtained by adding 20% molasses and 200 ml of lactobacillus plantarum to coarsely ground anchovy. Fish is ground to pass 20 mm grinder-openings.

# LAND TENURE

## Land Tenure and Reform in Puerto Rico

<i>Research Contractor</i>	<i>Economic Research Service, USDA</i>
<i>Principal Investigator</i>	<i>Dr. Howard L. Hill</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>January, 1962 to June, 1964</i>
<i>Contract Number</i>	<i>USDA - PASA 12-17-0017-41</i>

### Purpose

This research project was concerned with evaluating the concepts and techniques developed in land tenure studies and focus on the experience gained and analyze the effects of the land tenure reform law in Puerto Rico on the productivity of agriculture and on economic development in the country.

The "Organic Law of 1899" specified that corporate land holdings are to be limited to 500 acres. This provision was made effective with the introduction of the "Land Law" of 1941. A Puerto Rican land authority was established to manage lands acquired under the system of Proportional Profit Farms which distributed profits to farm workers according to union wages and also distributed some of the land to the farmers to be managed as family farms.

The research focussed on and identified land tenure problems by: (1) analyzing the effects of land

tenure reform on agricultural productivity; (2) the level of income of rural population; and (3) patterns of land use. It evaluated the program in respect to its relevance to current and future land policy.

### Results

The researchers directed their attention to the study of the effects of the land reform law in Puerto Rico which might serve as a basic guide for land reforms elsewhere.

The evaluation of the Puerto Rican experience in land reform showed the following significant features: (1) agrarian reform was necessary, but it did not create a condition sufficient for the industrialization program in Puerto Rico; (2) proportional profit farms seemed to have a depressing effect on the sugar industry; (3) the *agregado* resettlement program seemed to perpetuate rural poverty, and (4) compensation for expropriated lands provided a stimulant to diversified development.

## Research and Training in Land Tenure and Reform in Latin America

<i>Research Contractor</i>	<i>University of Wisconsin</i>
<i>Principal Investigator</i>	<i>Dr. Peter Dörner</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>May, 1962 to June, 1969</i>
<i>Contract Number</i>	<i>AID/repas-3</i>

### Purpose

In Latin America about 80% of the farm land is owned by about 10% of the landholders. Maldistribution of land, labor, credit, technical information services and other resources severely hinders agricultural development.

In September 1961 the University of Wisconsin submitted to A.I.D. a document proposing to establish an interdisciplinary research and training program on agrarian structure, land ownership and tenure in Latin America. This document set forth fifteen major objectives of such a study and training program. Among these objectives were the following: (1) build a comprehensive body of knowledge about land ownership, land tenure and agrarian structure in Latin

America; (2) document significant agrarian reform activities in L. A. countries; (3) develop as specific case studies land development and new land settlement projects with particular reference to their impact on related economic development and on the agrarian structure; (4) undertake continuing analysis of objective methods and results of land redistribution and sub-division programs and their impact on production and agrarian structure in each country; (5) identify political forces having principal concern with agrarian reform programs and, to the extent possible, political change attributable to agrarian reform; (6) evaluate the administrative machinery for planning and administering reform; (7) evaluate the problems and conditions of social change incident to modifications of agrarian

structure; (8) analyze demographic and legal factors as causative and resultant factors; (9) assess programs of taxation, credit, health, education and local organizations in respect to agrarian reform relationship; (10) formulate possible modifications and improvements in the agrarian reform programs of specific countries as technical assistance in cooperation with officials of the host country; (11) assemble the research results from the several L.A. countries in a center for continuing use and study by students of all countries; and (12) develop in each country a national research facility with a group of trained national research technicians.

Under the initial proposal, at least three research centers were to be established, one in Madison, one in Santiago, Chile and one in Porto Alegre, Brazil. To these three were added Bogota, Colombia and Costa Rica.

As the research developed emphasis was placed on the following areas: (a) Farms (tenure, size, crops, inputs, productivity, income) in subsistence and larger farm areas; (b) farm labor (conditions of employment, wages, income); (c) cooperative or profit sharing plans; (d) availability and use of government services to farmers; (e) communication of technical information; (f) population growth and migration; (g) local government; (h) land taxes; (i) legal basis and use of water rights; (j) financing of agrarian reform; (k) land titles and registration; and (l) land tenure or agrarian reform legislation and administration.

## Results

Research was conducted in eleven Latin American countries in cooperation with local universities, research institutes or government agencies. The Land Tenure Center at Madison prepared more than 125 research reports and papers. The subject matter dealt with in these papers ranges over a wide spectrum of land reform topics. The papers and reports deal with data on land ownership, significant agrarian reform activities in LA countries, case studies on land development and new land settlement, land distribution, political forces influencing land reform or being influenced by it, administrative machinery for planning and administering land reform, social change, demographic and legal factors, taxation and credit in agriculture, and a variety of related topics. There have been several rather comprehensive case studies on land reform programs and accomplishments in specific countries. Two such reports are "Chile's Experiments in Agrarian Reform" by William C. Thiesenhusen and a "Case Study of A Venezuelan Agrarian Reform Settlement" by the same author, along with others.

Research in the fields named above has served to create an important capability in the Land Tenure Center for teaching, further research and consulting

services to AID and the Latin American countries as well as to other world areas. When AID received authority to use the so-called 211(d) grant to support the building of such capabilities, the activities of the Land Tenure Center were financed under this authority. Under the research contract, the LTC had provided training and research experience for some 300 students, half of whom were from Latin American or other developing countries.

The LTC library contains approximately 20,000 items. It is distinguished for its large and well organized non-book materials—government documents, reports, manuscripts, research articles, reprints, etc. related to overseas agricultural development. Secondary research and reviews are prepared by staff and graduate students and continuously add to the scope and depth of analysis available regarding principal topics in various aspects of land tenure and reform.

Specific accomplishments and uses of the research and the research staff include the following:

(a) In Bolivia special studies were conducted on speeding up the legal and administrative procedures for clearing land titles. The Bolivian government organized mobile units to clear land titles; more land titles were cleared up in a short time than had occurred during any preceding five year period;

(b) Two studies in Chile influenced the government to make certain modifications in the Frei sponsored land reform legislation;

(c) L.T.C. research on water law has received attention in the formulation of new legislation in Colombia and Chile;

(d) Individuals from the Land Tenure Center have participated in a wide variety of consulting and evaluation assignments in several LA countries upon request of LA Governments or AID missions or both. In many LA countries the product of LTC research was drawn upon extensively in drawing up new land tenure policies and procedures.

(e) Graduates of the LTC from LA countries who return to their countries undoubtedly will have influence in the long run on attitudes and policies developed in the LA societies.

(f) The AID Administrator's Spring Review in 1970 brought together land reform specialists from all over the country. The Land Tenure Center contributed to this review in an important way. LTC is looked upon as a major source of information and advice on land tenure and reform matters. It has marked capacity to supply such information and advice and is a focal point for additional research and policy advice, much of which will be needed in the future if the overall objective of agricultural development is to be realized in the LDCs.

## FACTOR ANALYSIS – PLANNING

### Rural Development Analysis: Agricultural Sector Planning Models

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contact Number*

*Michigan State University*  
*Dr. Glenn Johnson*  
*TAB, Office of Agriculture & Fisheries*  
*June, 1967 to April, 1971*  
*AID/csd 1557*

#### **Purpose**

It is believed that systematic and judicious application of economic knowledge to the development process can be improved considerably by introducing simulation models into development planning. This project is employing systems analysis--the simulation model technique--to ascertain the performance of a set of factors or manipulations on the economy, with special reference to the agricultural sector.

The simulation results will, it is believed, provide answers to: (1) what alternative policies, programs or projects are essential for development and (2) what set of policy variables appear to be most feasible. The project will also point out how to avoid undesirable economic situations, assist in designing development plans, and indicate the effects of introducing new technologies into development planning.

#### **Results**

The computerized systems approach to economic planning and development has been set up, tested, examined and applied to the development of the Nigerian economy, with components for livestock, annual crops, perennial crops, population, the non-farm sector and the transportation system with emphasis on the rural economy.

The simulation model will evaluate the impact on farm income of: increasing the marketing price to farmers, and increasing research and extension efforts along with studying other alternatives. A population growth model is in final stages of computerization.

The model is being extensively tested to improve its usefulness.

As this model building phase comes to a satisfactory conclusion, it is intended that the model will be operationalized with colleagues in Nigeria, Brazil, Colombia, the Philippines or other location.

### The Impact of New Agricultural Technology on Rural Employment and Income

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*Cornell University*  
*Dr. John W. Mellor*  
*TAB, Office of Agriculture & Fisheries*  
*June, 1970 to June, 1973*  
*AID/csd 2805*

#### **Purpose**

The first objective of this project is to determine and quantify the principal means by which new agricultural technologies affect employment opportunities and the incomes of rural people. The second objective is to derive from the analysis policy recommendations which will accelerate technological change and production growth in agriculture.

The research will delineate the set of forces which determine the distribution of employment and income effects from new agriculture technologies and measure the relative importance of these influences on various situations. From this and related studies of direct and indirect influences will come the knowledge of what policies to introduce to strengthen those forces of growth which provide expanded employment and

broader distribution of income and how to remove or weaken those forces which impede the desirable policy objectives.

Particular attention will be given to the application of new technologies and policies on small farms. Access to credit, water, fertilizer and knowledge, as well as the underlying characteristics of these small cultivators will be explored. Knowledge of the special needs of small farmers can provide policies which narrow income gaps and accelerate growth rates for agricultural production by 25% or more. If greater participation in technological change is to be achieved by small holdings, we must have a better understanding of technological change, employment opportunity and income distribution in agriculture.

Findings from this research will be coordinated with those of the recently completed Cornell projects on the role of agricultural prices in economic development

and other allied studies relating to rural income and employment.

### **Factor Analysis for Accelerating Agricultural Productivity in LDCs**

*Research Contactor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*International Marketing Institute*  
*Dr. Simon Williams*  
*TAB, Office of Agriculture & Fisheries*  
*October, 1966 to December, 1969*  
*AID csd 1467*

#### **Purpose**

The project was concerned with working out practical ways of attracting private investment capital from domestic and foreign sources into rural "agribusiness" enterprises throughout the developing areas of the world.

In carrying out the objectives, the research contractor was to: (1) provide guidelines for developing the private enterprise sector within a country; (2) make suggestions on how to transfer ownership of all such enterprises to the farmers; (3) prepare outlines to show how to roll out the original investment capital in a reasonably short time and at an acceptable level of profit so that more and more risk capital becomes available; and (4) to train local people on the job for the task of operating and managing the profit-making resources created in their interest.

#### **Results**

Through the efforts of this research project the Mexican rural development corporation, the FOMENTADORA Rural S.A. de C.V., has been established with six share holders consisting of: Ingenieros Civiles Asociados, S.A., with 66.6%; Bank of America-Mexico with 10.4%; Dr. Redvers Opie, with 10.4%; Massey - Ferguson de Mexico, Ames-Timsa, S.A.,

and Anderson-Clayton de Mexico, each with 4.2%. The number of share holders will be expanded further. Important support from the private sector was obtained in 1970 when the Mexican Development Foundation extended guarantees for a private bank line of credit sufficient to cover all short term loans to be made to the farmers in 1970.

Partly out of the inspiration of this research there emerged the Latin American Agribusiness Corporation (LAAD) which is now operating and actively seeking to extend the role of U.S. private enterprises in rural development in Latin America.

Using methods of analysis developed by this project, feasibility studies are being made by a Mexican rural development institution on (1) the feed lot program; (2) a fruit orchard; (3) a range improvement beef cattle project, and (4) a project to improve the operations of a group of small scale dairy operators. Programs are also being considered to conduct feasibility studies of agriculture concerned with shrimps, oysters, and finfish, and, to hasten the introduction of high lysine corn for human and animal nutrition.

The research contract has had a dynamic, growing impact. The reports have been widely distributed and are used in several countries.

### **Analysis of Factors Associated with Differences and Changes in Agricultural Production in the LDCs**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*Economic Research Service, USDA*  
*Dr. P. P. Christensen*  
*TAB, Office of Agriculture & Fisheries*  
*February, 1963 to June, 1970*  
*AID PASA-RA-2-00*

#### **Purpose**

Reliable guidelines are needed for increasing agricultural productivity in the less-developed countries, based on analyses of data to: (1) determine differences among countries in rates of progress in improving

agriculture; (2) identify those factors most commonly associated with higher rates of increase in output and productivity; (3) develop alternative approaches to agricultural development of less-developed countries through economic and technical assistance, and (4)

analyze the processes by which less-developed countries make the transition from low to higher levels of agricultural output and productivity.

#### **Results**

A 26 country study has been done and published as "Changes in Agriculture in 26 Developing Nations" by the U.S. Department of Agriculture, of which 11,500 copies have been distributed. Eleven universities are using the material and translations have been made to French and Spanish.

The results of intensive studies in eight selected countries were published as "Economic Progress of

Agriculture in Developing Nations 1950 – 1968" by USDA. This study has also produced 46 technical reports. Taiwan used the reports to restructure changes to further increased agricultural productivity.

The findings of the case studies in India and Tunisia influenced decisions on agricultural development policies.

The first phase study was used as primary source material for a joint Task Force of USDA, AID, and the White House which led to the revised PL 480 Legislation and AID policy focus on agriculture.

### **Diffusion of Innovations in Rural Societies**

<i>Research Contractor</i>	<i>Michigan State University</i>
<i>Principal Investigator</i>	<i>Dr. Everett Rogers</i>
<i>A.I.D. Monitors</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>December, 1964 to December 1968</i>
<i>Contract Number</i>	<i>AID-CSD 735</i>

#### **Purpose**

The diffusion of new ideas such as new farming practices in traditional cultures has not always been effective. If agricultural production is to keep pace with population growth, much more rapid diffusion and adoption of farm technology must occur. This study was initiated to investigate the communication and adoption of agricultural innovations by the farmers of LDCs living under a wide range of social and economic conditions. The reasons why some programs of change are relatively successful and others are not, was to be determined. Knowledge of the successful channels of communication or communication techniques were thought to provide useful guidelines for change.

The project had the following objectives: (1) to obtain a clearer understanding of the process of adaptation of improved farm practices; (2) to determine the relationship between increased agricultural production and farmers' desires for change; and (3) to determine the relative effectiveness of various communication channels and techniques in stimulating the adoption of improved practices. The research was conducted in Brazil, India and Nigeria.

#### **Results**

The investigation has been completed and a final summary of the findings is being reviewed. Michigan State University has established a central library facility

on the diffusion of innovations. About 1200 publications have been collected. Requests for literature from foreign countries amount to 480 per year. A Manual on communication for use by agricultural extension workers has been prepared at the request of the Government of Brazil which is planning to expand its activities in diffusion of information to farmers.

The contractor set up a computer data analysis including the simulation of innovation diffusion at the Michigan State University campus.

Seven research fellows were trained at MSU. Over 70 publications resulted from this research. These were widely distributed and are reported to be used by various LDCs and other countries in their training in the field of communication.

General direct and indirect uses of the research have been recorded:

(a) In Lima, Peru, an official of the OAS Interamerican Institute of Agricultural Sciences has put certain of the findings into his program.

(b) In Eastern Nigeria, five ministries with which the investigators worked established a system of radio farm forums, which was later expanded into 165 forums.

(c) In India, the staff trained about 400 government officials at the National Institute for Community Development.

(d) In Brazil, ACAR has emphasized the use of mass media channels by local ACAR agents to diffuse farm innovations to villagers.

# AGRICULTURAL FINANCING, PRICING MARKETING, CREDIT AND PRODUCTIVITY

## Analysis of Capital Formation and Technological Innovation at the Farm Level in LDC's

<i>Research Contractor</i>	<i>Ohio State University (Research Foundation)</i>
<i>Principal Investigator</i>	<i>Dr. D. Boyne</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>June, 1969 to June, 1974</i>
<i>Project Number</i>	<i>AID/csd 2501</i>

### Purpose

Some LDC's commit relatively large amounts of capital to the agricultural development of their countries. Knowledge of capital formation and utilization and its relation to development has not been adequately acquired and analyzed. Commitment of capital without sufficient knowledge of the expected results or impact hampers an orderly agricultural planning process. Thus, the main focus of this research is to analyze: (1) how the capital is formed and utilized at the farm level; (2) how technological innovation will affect capital formation; and (3) what will happen to capital formation when government introduces certain selected policies and programs. The interrelation between capital formation, technological change and growth of agricultural output also will be studied.

### Results

This is a new research program. A series of "on farm level" studies have been started in Brazil to determine first the resources, income allocation, internal and external forces and how they affect agricultural production and income growth and distribution. Brazil is well suited for this phase of research because it has a scale of farms ranging from very poor, small income farmers to very large, rich farm enterprises. As a part of this study, a working analytical method for measuring capital formation and technological inputs will be developed.

This project has been using university graduate students in agriculture in Brazil to identify rural problems, who are using the data collected to write their Ph.D dissertations. The Central Bank of Brazil is using the methodological assistance of Ohio State to guide a program of providing rural credit to farmers. The IBRD is providing loans to farmers. The project will assist IBRD in determining the practicability and profitability of increasing credit to small farmers.

## Analysis of Capital Formation and Utilization in LDC's

<i>Research Contractor</i>	<i>Ohio State University</i>
<i>Principal Investigator</i>	<i>Dr. David Boyne and Dr. Normal Rask</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>June, 1968 to September, 1969</i>
<i>Contract Number</i>	<i>AID/csd 1937</i>

### Purpose

The use of agricultural credit as a tool to accelerate farm production has not been satisfactory in most of the LDCs. It has been established that credit can speed farm production only if the country's economy as a whole is functioning smoothly and adequate resources are available to develop those economic, social, political, and institutional factors which, if neglected, could impede development in the agricultural sector.

The purpose of the research was to analyze the principles of agricultural capital formation and

utilization in four selected LDCs (Brazil, Colombia, Ecuador, and Peru). The goal of the studies was to indicate where credit has been utilized most advantageously, by size of farm, type of farm enterprise, and management level, so that policy-makers may be guided in allocating credit to the most effective and efficient uses.

The contractor's researches were primarily concerned with: (1) input-output relationships, i.e., production functions determining the productivity of capital; (2) identification of factors and production

practices that change the rate of returns to capital; (3) identification of the factors limiting the use of credit, such as inputs, storage, markets, roads, as well as credit and other incentives.

#### **Results**

A final report was submitted which summarized the findings and conclusions. The value of the data is dependent upon the use to which it is put by

policy-makers. The material is being exploited further in a related project by the same contractor.

In his final report the contractor presented (1) a study of income, investment and saving patterns; (2) an analysis of resource productiveness; (3) a study of the impact of selective price and credit policies on the use of new inputs and mechanization; and (4) a study of the management performance and productivity of capital resources under different levels of management on hog farms.

### **Role of Agricultural Prices in Economic Development**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Project Duration*  
*Contract Number*

*Cornell University*  
*Dr. J. W. Mellor*  
*TAB, Office of Agriculture & Fisheries*  
*June, 1966 to June, 1970*  
*AID/csd 1438*

#### **Purpose**

The direction of farming systems is profoundly affected by price structure or changes in prices of agricultural products. Changes in price policy by governments of LDCs will have direct effects on consumer prices or indirect influence through costs on income and capital formation.

This study determined the relationship of prices and rates of development, especially as they are affected by improved agricultural technology and materials which would provide an understanding of the role, function and operation of agricultural prices in the context of agricultural development.

To properly evaluate the role of agricultural prices in economic development five interrelated sub-project investigations were completed: (1) the role of prices in intersectoral capital and income transfer; (2) the effect of price relationships on agricultural production and marketing; (3) the effect of relative prices on enterprise selection; (4) the management of pricing systems and buffer stocks and; (5) the relation of non-agricultural policies on price and capital transfer mechanisms within agriculture.

#### **Results**

The study concentrated on India, Thailand and Taiwan to more accurately evaluate the role of prices. A study was conducted in India which pinpointed the domestic terms of trade in agricultural commodities. An intersectoral capital transfer analysis model was evaluated for agricultural enterprises in Taiwan. The effect of prices on production was studied in India where the basis for evaluation was the situation in respect to aggregate demand for fertilizer. The factors affecting urban food prices were evaluated using milk marketing conditions in India, and rice marketing in Thailand. The effects in infrastructures, (improvement of transport - etc.) as a factor in agricultural development were studied in India. The influence of price policy on intersectoral development relationships was studied to derive information on the effect of price policy on changes in development and income.

The integrated data developed for India were used by that government in helping to establish its price support program for agriculture. Assistance provided the AID Mission in Nepal has contributed to the rapid acceptance of the importance of agricultural inputs, agricultural prices, storage and marketing in developing the agricultural sector.

## **Analysis of Demand Prospects for Agricultural Exports of LDCs**

<i>Research Contractor</i>	<i>Economic Research Service, USDA</i>
<i>Principal Investigator</i>	<i>Dr. K. L. Bachman</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>January, 1966 to June, 1970</i>
<i>Contract Number</i>	<i>PASA AD-RA-2-66</i>

### **Purpose**

LDCs are placing progressively more efforts into promotion of exports and import product substitution. A firm understanding of the demand structure for agricultural products is necessary in order to develop agricultural development policies. This research contract was intended to design and evaluate techniques essential for ascertaining prospects for future commodities demand. The project was to provide (1) a historical analysis; (2) an analysis of policy and demand prospects over the next 15 years; (3) an analysis of policy implications relative to agricultural projects and technical support in the LDCs. In the investigation of the historical phase, in-depth analyses were to be made to determine: (a) the volume, price, and value of agricultural commodities exported by each LDC; (b) import funds of the importing countries; and (c) changes in plans for international trade in agricultural commodities from the LDCs to other countries. A world trade and demand model for making projections up to year 1980 of the demand for exports of important agricultural products was to be formulated.

### **Results**

The research on the historical phase of this project resulted in the publication of 5 reports in which 26 commodities were evaluated according to the outline presented above under project purpose.

The reports entitled "World Trade in Selected Commodities, 1951 - 1965" have been widely distributed and are being used by many LDCs and other countries. Under the demand analysis phase of this work the investigator formulated a demand model to make projections of demand for exports of selected agricultural commodities up to 1980. The model helps to determine: (1) equilibrium quantities and price in some future period; (2) trade flow between regions; and (3) export earnings under alternative supply and demand situations in 1980. The economic model automatically stores historical data. Recently, the model has been computer programmed for commodity projections of export demand.

## **Study of Farm Marketing Facilities and Practices in Tropical Africa**

<i>Research Contractor</i>	<i>Stanford Research Institute</i>
<i>Principal Investigator</i>	<i>Dr. W. O. Jones</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>May, 1965 to June 1969</i>
<i>Contract Number</i>	<i>AID/csd 801</i>

### **Purpose**

Marketing systems play a decisive role in agricultural development. This study identifies methods for increasing marketing efficiency as an aid to economic growth in tropical Africa. The study identifies ways by which agricultural products in Kenya, Nigeria, and Sierra Leone could be marketed more effectively.

### **Results**

The study analyzed food marketing systems in Kenya, Sierra Leone, and Nigeria. The main conclusion was that generally food marketing systems have performed efficiently. None of the markets, however, had been subjected to the results of high rates of agricultural growth.

The market chain consists of many small units (from assembler to retailer) which function competitively and are relatively free from price

collusion. There is a minimum supply of credit and minimum facilities for storage and processing. The existence of government marketing boards and cooperatives with their regulations and attempts at market control have not been successful in improving market efficiency. Despite these insufficiencies, the farmers have successfully met local needs and have also supplied a large export market in cocoa, tea, coffee, rubber, palm oil, and tobacco.

The overall report on the study entitled, "Marketing of Staple Food Crops in Tropical Africa: Overall Analysis and Report" summarizes the findings. The research indicated genuine need to improve farmers' production incentives in a number of respects. This and other research underscores the fact that farmers in LDCs are responsive to adequate production incentives. The Study makes 14 recommendations for market improvement.

**Study Conference on Means to Increase Agricultural  
Productivity in Underdeveloped Countries**

<i>Research Contractor</i>	<i>Massachusetts Institute of Technology</i>
<i>Principal Investigator</i>	<i>Dr. Max Millikan</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>May, 1964 to February, 1965</i>
<i>Contract Number</i>	<i>AID/csd 452</i>

**Purpose**

Intensive study conferences have been used successfully to solve complex interdisciplinary problems. Systems problems such as those of increasing agricultural productivity when multiple factors are involved can be solved through study conferences. The conference (1) considered the alternative solutions related to the problem of increase of agricultural productivity; (2) outlined research showing how to overcome major obstacles and (3) dealt with some of the problems by recommending specific measures to be taken.

**Results**

The conference consisted of 40 full-time participants and several part-time consultants representing U.S. and foreign scholars who dealt with the problem of increasing agricultural productivity as affected by social, life, and physical sciences.

The conference report on the subjects studied was entitled "Policies for Promoting Agricultural Development." It was distributed to many USAID Missions (Circ A-299), OECD, AID/W and other agencies. The report was subsequently published as a book entitled "No Easy Harvest" by Little, Brown and Co., Boston, Massachusetts.

**Mapping of Research Requirements for  
The Food-for-Peace Program**

<i>Research Contractor</i>	<i>Michigan State University</i>
<i>Principal Investigator</i>	<i>Dr. Lawrence Witt</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>June, 1964 to December, 1965</i>
<i>Contract Number</i>	<i>AID/csd-677</i>

**Purpose**

Food for Peace influences a wide range of complex activities in the LDCs. A.I.D. initiated a project to prepare a comprehensive and systematic mapping and planning for research to determine priorities, comprehensive planning, and effective administration of new multidisciplinary and other research into specific Food for Peace problem areas.

**Results**

Within this assignment the contractor (1) identified, described and categorized the objectives of Food for Peace; (2) produced new knowledge to help achieve the objectives; (3) assessed alternate strategies; (4) measured the relative effectiveness of the several categories of commodity assistance; (5) examined the present research program; (6) pinpointed research needs; (7) prepared a sufficiently detailed report indicating research needed to be undertaken and by whom; and (8) consulted and advised A.I.D. on research planning and administration.

The investigation identified and discussed 28 major Food-for-Peace issues and described the important features of some 84 research projects. Each project was discussed as to research rationale, research completed, or in progress, research objectives, suggested research personnel and priorities of research. The research undertaken was cross referenced. A separate paper contains suggested cost figures for each project.

A research "map", consisting of 3 volumes, was prepared in a carefully structured analytical, planning document. This document resulted from the activities of multidisciplinary groups comprising some 17 Michigan State University consultants and representatives of the White House, A.I.D., USDA, Food for Peace and State staffs.

Limited distribution of the research results has been made within A.I.D., State, USDA, etc. Limited use has been made of the map by A.I.D., State and USDA staffs during the planning for the new Food-for-Freedom legislation.

**Appraisal of the Administration of Technical Assistance  
Programs with Special Reference to Agriculture**

<i>Research Contractor</i>	<i>Syracuse University</i>
<i>Principal Investigator</i>	<i>Dr. John Lindeman</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1963 to June, 1966</i>
<i>Contract Number</i>	<i>AID/csd 289</i>

**Purpose**

The primary objective of this project was to conduct research to improve the administration of technical assistance, especially in the field of agriculture. Both strengths and weaknesses were studied in order to recommend possible improvements. This study evaluated the methods of projects and program planning personnel, management, project review, the coordination of work among donor agencies, and the administration of technical assistance by recipient governments.

**Results**

The project staff prepared 26 reports on various aspects of their research in 35 countries. The research findings concentrated on three key issues: (1) the function of the field Missions, (2) personnel, and (3) programming.

The conclusions of the researchers was that: (a) the USAID should be the operating branch of the Agency's technical assistance; (b) headquarters should be

filled increasingly by personnel with overseas experience, (c) the relation between headquarters and field staffs should be much closer; (d) A.I.D. should develop a set of global objectives against which the programming of country activities could be measured; (this programming should meet the budget cycle and Congressional presentation and it should reach agreement with recipient governments on activities of common interest); (e) that program evaluation should be a function of headquarters—project evaluation a function of the A.I.D. Mission. Program coordination among various aid givers should be the task of the host government. The phase-out of projects should be gradual to assure that the LDC government is in a position to continue the work. The projects should be concentrated on areas ensuring significant results; (scattered projects are less useful.) When third country resources are superior to U.S. resources, they should be used.

These reports have been used for "inhouse" guidance.

**Analysis of Programs for the Development of  
Agricultural Credit Institutions and Services**

<i>Research Contractor</i>	<i>Ohio State University</i>
<i>Principal Investigator</i>	<i>Dr. Mervin G. Smith</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>June, 1964 to December, 1967</i>
<i>Contract Number</i>	<i>AID/csd 463</i>

**Purpose**

The establishment and functioning of institutions and systems of agricultural credit are vital to an effective agricultural development program. This research project provided guidelines for the establishment and successful functioning of such institutions. Specifically, the contractor undertook to: (1) develop guidelines for the establishment and operation of permanent and effective institutions and systems of agricultural credit; (2) develop guidelines for technical and economic assistance programs; (3) provide research experience and training in agricultural credit; and (4) provide current, objective, operational research findings to A.I.D.

**Results**

The research contractor summarized and analyzed all available data, reports, and studies of agricultural

credit in the LDCs. This phase of the study was conducted on the home campus. Following this, a preliminary research framework was developed and intensive country case studies were organized in Brazil, Colombia, Ecuador and Peru. The research results showed that infrastructural deficiencies in markets, transportation and communications were directly and indirectly limiting the effective operation of agricultural credit institutions. Components influencing the performance of agricultural credit institutions were: level of managerial ability; adequacy of non-farm input resources; local market facilities; and availability of credit.

In respect to agricultural credit institutions the contractor found that: (1) most LDCs need to improve the institutions; (2) the performance of the marketing system will affect the amount of agricultural credit that

can be used; (3) credit can increase the returns to labor and land; (4) short and intermediate farm credits can be beneficial to agricultural production; (5) agricultural credit is not the only method of injecting capital into agriculture; (direct growth of improved seeds, fertilizers, and other supplies are more effective than credit in generating increased agricultural production); (6) agricultural credit institutions should not be expected to provide adequate credit to all farmers; and (7) the social structure can restrict the effective use of credit.

Some forty reports on specific segments of the project have been published. Some of these have been widely distributed.

Specific results and uses of the research project include the following:

(a) Ecuadorean Government officials used the findings to determine policies on government education and financial support to farmers and credit institutions.

(b) The comprehensive analysis of the Ecuadorean National Development Bank was of great value to the A.I.D. Mission and AID/W in consideration of a major development loan to Ecuador.

(c) The project evaluated the fertilizer loan program in Brazil. This was useful to AID and to Brazil.

(d) Because of increased capability in this field, Ohio State was able to provide special training in agricultural credit to 100 foreign participants from 1965 to 1970.

### Comparative Study of Food Marketing Systems in Latin American Countries in Early Stages of Economic Development

<i>Research Contractor</i>	<i>Michigan State University</i>
<i>Principal Investigator</i>	<i>Dr. Charles C. Slates</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>April, 1965 to September, 1968</i>
<i>Contract Number</i>	<i>AID/csd 786</i>

#### **Purpose**

Traditional assembly, marketing and distribution methods existing in Latin American countries contribute to high food costs. This study was to identify means for improving food marketing systems by providing background information and analyses for planning marketing improvements. A comparative study was made of food marketing systems in several countries. The study objectives were: (1) to analyze changes in the food marketing system of the San Juan, Puerto Rico area over a 15 year period; (2) to analyze the cost effectiveness of food marketing in an urban center in Latin America; (3) to identify priority marketing problems and to determine ways of making improvements; (4) to develop research methodologies useful in appraising marketing problems in other Latin American countries and possibly other areas of the world; and (5) to draw inferences and formulate hypotheses concerning the role of food marketing in countries in the early stages of economic development.

#### **Results**

Michigan State conducted studies of marketing in Puerto Rico, Bolivia and Brazil. The San Juan and Puerto Rico research report was published in 1966 in Puerto Rico. The report presents an evaluation of the 1950 marketing study by Harvard and Puerto Rico Universities on the Puerto Rican markets and the findings. It presents results on the surveys of consumers, retailers, wholesalers, processors, and

assemblers, and provides data on food marketing changes since 1950. The report also contains recommendations given to the Government of Puerto Rico for improvement of agricultural marketing in Puerto Rico.

A study entitled, "Market Processes in the Recife Area of Northeast Brazil" was produced by Michigan State in collaboration with SUDENE, the Northeast Brazil Economic Development Agency. This study makes four major policy recommendations:

1. Modify industrial development programs so that a portion of investment funds are directed toward marketing systems for manufactured products, especially agricultural inputs and low-priced consumer goods.
2. Stimulate and reinforce the modernization of the Recife food marketing system through a program providing credit and technical assistance to food retailers with emphasis on increasing size of operations and rationalizing the related wholesaling functions.
3. Improve performance in rural assembly markets by expanding and strengthening the existing government price stabilization programs for staple food crops, developing a market information system linking interior trading centers with Recife, and improving village-to-market convergence center roads.
4. Give high priority to a program of accelerated agricultural research for the testing of new crop varieties, fertilizers, etc., along with a

program to provide technical information to farmers and credit for input purchases.

Another excellent study entitled "Market Processes in La Paz, Bolivia" was produced by Michigan State. Chapter 10, pages 225 to 242, deals with

conclusions and recommendation for improving the marketing system there.

In connection with this project, Michigan State participated with A.I.D. in the review of a large loan proposal for Northeast Brazil. Related to the studies was the development of a large scale marketing organization.

### **Analysis of Data on Development - Related Attitudes and Behavior of a National Sample of the Turkish Peasantry**

<i>Research Contractor</i>	<i>Massachusetts Institute of Technology (Center for International Studies)</i>
<i>Principal Investigator</i>	<i>Dr. Frederick W. Frey</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Duration of Project</i>	<i>June, 1965 to September, 1968</i>
<i>Contract Number</i>	<i>AID/csd 811</i>

#### **Purpose**

This study was to demonstrate, using a pilot study area in Turkey, the feasibility of obtaining information about the effect of attitudes on country agricultural developments. In 1962 the Government of Turkey and USAID/Ankara sponsored an attitudinal survey of 8,000 peasants in 460 villages. Data were collected on eight attitudinal measures: (1) communications; (2) personal background; (3) development behavior; (4) relevant psychological traits; (5) social values; (6) beliefs about social structure; (7) political awareness; and (8) intensity of religious beliefs.

#### **Results**

Seven reports on the correlation of attitude and development measures were prepared. By title items were:

- (1) No. 1 - "General Description and Evaluation", Frederick W. Frey and Herbert H. Hyman, MIT, 1967. (50 pp).

- (2) No. 2 - "Index Construction and Validation", Allan R. Kessler, Joan E. Rothschild and Frederick W. Frey - MIT, 1967. (155 pp.)
- (3) No. 3 - "The Mass Media and Rural Development in Turkey" - Fredrick W. Frey, MIT, January 28, 1966. (202 pp.)
- (4) No. 4 - "Regional Variations in Rural Turkey" Frederick W. Frey, MIT, December 1, 1966. (67 pp.)
- (5) No. 5 - "Age as a Factor in Turkey's Rural Development", Noralou Roas and Frederick W. Frey, MIT, Oct. 19, 1967. (14 pp.)
- (6) No. 6 - "Land Ownership and Peasant Orientations in Rural Turkey", Frederick W. Frey with Ayse Sertel, MIT, 1967 (30 pp.)
- (7) No. 7 - "The Propensity to Innovate Among Turkish Peasants", Leslie Roos and Frederick W. Frey, MIT, Oct. 19, 1967 (16 pp.)

## **A.I.D. - UNIVERSITY PROGRAMS IN AGRICULTURAL PRODUCTION**

### **Analytical Study of AID/University Programs in Agricultural Education**

<i>Research Contractor</i>	<i>Purdue University (Research Foundation)</i>
<i>Principal Investigator</i>	<i>Dr. Ira L. Baldwin</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Agriculture &amp; Fisheries</i>
<i>Project Duration</i>	<i>February, 1965 to June, 1969</i>
<i>Contract Number</i>	<i>AID/csd 754 &amp; 840</i>

#### **Purpose**

During the past 15 years, AID has assisted in the development of more than 50 foreign universities and research institutions in more than 30 countries through contracts with some 50 U.S. universities.

The overall purpose of this project was to evaluate and strengthen policy, program and operating decisions concerning rural development assistance provided through AID contracts with U.S. universities by providing AID with information on: (1) experience

based principles of the major factors which led to project success; (2) criteria of progress in institutional development; (3) assessment of accomplishments to date, and (4) indications of the type of development assistance for which U.S. universities could be advantageously employed.

The study was concerned with an evaluation of: (a) the effects of AID-university contracts and projects upon host country institutions, taking into consideration kinds, paths and rates of change and how the change becomes self-generating as an outgrowth of the past; (b) factors affecting the type of agricultural education and research institutions best suited to a country; (c) factors influencing the effectiveness of the university in finding technical assistance; and (d) the effect of U.S. institutions resulting from university participation in the technical assistance program.

The principal research contractor enlisted the participation of investigators from eight U.S. universities which were to sub-contract to investigate specific parts of this research proposal. The universities involved were:

Ohio State, Illinois, Indiana, Minnesota, Missouri, North Carolina State, Purdue, Utah State and Wisconsin.

#### **Results**

Thirty-one reports covering the various aspects of this investigation were published and distributed to various institutions and AID missions. The research contractor received several requests for short-term consultants to assist host universities in streamlining their organization, functions and operating procedures. Summaries of the reports encompassing all phases of university assistance to institution building and administration provided material for policy planning and for workshops on institution building and new university projects. The reports were used as basic material for developing the new Institutional Development Agreement which was printed recently by AID under the title: "Guide Manual for the Institutional Development Agreement - A New Operational Framework for AID and the Universities."



## II. HEALTH

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## COMMUNICABLE DISEASE

### Malaria Eradication Research (in Support of World-wide Program)

<i>Research Contractor</i>	<i>Center for Disease Control U. S. Public Health Service, HEW</i>
<i>Principal Investigator</i>	<i>Dr. George W. Pearce</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>January, 1962 to June, 1972</i>
<i>Contract Number</i>	<i>PASA RA (HA-7-00)</i>

#### Purpose

For many years the U. S. Government has been working with WHO, PAHO, UNICEF and others in an attempt to eradicate malaria or limit its incidence in many malarious areas of the world. The Technical Development Laboratories (TDL) of the Center for Disease Control of PHS has provided technical backstopping and research support to A.I.D. and predecessor agencies since 1953 in the malaria control and eradication programs. U. S. assistance toward the eradication objective was declared by Congress to be U. S. policy in the Mutual Security Act of 1957.

Early in overseas anti-malaria campaigns, it became evident that such investigations as are now being conducted by TDL would be essential to success. Serious problems were encountered with formulation and physical deterioration of DDT and other insecticides. As the programs developed, there were increasing demands for work on application equipment, biological research on malaria mosquito vectors, new methodology for attacking vector populations where outdoor transmission is prevalent, and practical studies of a variety of other problems encountered in field administration of the programs.

The several PASA agreements with PHS over the years have outlined particular work which TDL would do, depending upon the particular problems encountered in intervening periods. TDL has undertaken (a) improvement of insecticide formulations and quality, (b) development of more efficient methods and devices for

packaging and application of insecticidal materials, (c) exploration of nonconventional pesticidal compounds and biological agents, and (d) collaboration with international organizations in field evaluation and training in methods of malaria mosquito control.

#### Results

TDL has accomplished the following to date, contributing to technical effectiveness and reduction of cost and wastage:

(a) developed new test methods and specifications used in the surveillance of purchased and stored DDT powders;

(b) discovered and eliminated the causes of instability in storage of water-dispersible DDT powders;

(c) demonstrated that malathion is a suitable substitute where resistance to DDT and other chlorinated compounds is encountered;

(d) developed new test procedures and specifications for spraying equipment, resulting in stronger, more efficient sprayers and erosion resistant sprayer nozzles;

(e) redesigned and standardized DDT packaging for more efficient handling and improved durability at less cost;

(f) screened numerous insecticidal compounds and established new routes toward alternative materials and methods for malaria mosquito control.

### Malaria Immunity and Vaccination

<i>Research Contractor</i>	<i>University of Illinois</i>
<i>Principal Investigator</i>	<i>Dr. Paul H. Silverman</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1966 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd-1432</i>

#### Purpose

The work proposed under this project had the object of developing a vaccine for use in the prevention and treatment of human malaria. The initial approach

has been to investigate the production and application of antigens of mammalian malaria, using a form of rodent malaria parasites, rodent hosts and anophelinemosquito vectors as an experimental system. Studies have been

conducted to evaluate the comparative immunogenicity of antigens derived from forms of the malaria parasite found in mosquitoes and in mammals. New techniques have been tested in the preparation and use of mosquito tissue extracts for production of mosquito antibodies, in mammalian blood, as a means of interference to the development of the Malaria parasite in the mosquito.

#### Results

A recent progress report indicates the following accomplishments:

(1) The emergence of malaria strain variations and their possible exploitation in production of a live vaccine have been discovered.

(2) Successful work has been done on the control of a microsporidian parasite of malaria mosquitoes in experimental insectary colonies. There are indications of its potential as a biological agent for mosquito control.

(3) Anti-mosquito vaccination with mosquito tissue antigens has been attained in rabbits.

(4) A highly responsive model system for the study of artificial induction of protection against malarial infection has been achieved.

(5) New methodologies for the purification of plasmodial materials have been developed and work has been done on the isolation of new plasmodial antigens for immunological studies.

(6) Vaccination against malaria has been demonstrated in rodents with antigens prepared from malaria parasite forms found in the mosquito and in mammalian blood. Successful progress has been sufficient for work to begin with primate malaria, transferring experimental techniques from rodents to monkeys.

(7) Culture of tissues from malaria mosquitoes has been started as a possible basis for production of mosquito tissue antigens and growing of malaria parasites to produce malaria antigens.

### Serologic Diagnosis of Malaria

*Research Contractor*

*Principal Investigator*  
*A.I.D. Montor*

*Duration of Project*

*Contract Number*

*Center for Disease Control*

*U. S. Public Health Service, HEW*

*Dr. Irving G. Kagan*

*TAB, Office of Health*

*April, 1967 to December, 1972*

*PASA RA (HA) 5-68*

#### Purpose

The worldwide malaria eradication program has eliminated malaria or stopped malaria transmission in areas occupied by well over half of the affected 1.8 billion population. The successful outcome of this huge program depends on the utmost efficiency in delimiting malarious areas, identifying problems of malaria redistribution, and safeguarding the gains in areas cleared of malaria. Serologic diagnosis can contribute importantly to rapid, accurate detection of the disease.

Positive detection of malaria has depended on microscopic blood examination, which is time consuming because of training and supervisory requirements. In serologic techniques, the blood sample is tested by chemical and physical reactions which are readily produced and easily observed. The purpose of the project is to refine and standardize the testing procedures to enhance their specificity and applicability.

#### Results

The laboratory has concentrated its efforts on the evaluation and standardization of two techniques: (a) indirect hemagglutination test for the detection of malaria antibody for epidemiological studies and (b) indirect fluorescent antibody test for diagnosis and serologic determination of malaria species.

The initial goals have been achieved in that the IHA test has been shown to be a reproducible, sensitive and specific technique for the diagnosis of malaria. The IFA technique, employing an antigen preparation in a thick smear (as distinguished from the usual thin smear of infected blood), has proven 95% sensitive.

Numerous collaborators in governments and agencies participating in the worldwide malaria eradication program have been enlisted to assist in collection of blood samples and evaluation of the practical application of the new techniques to field requirements.

## Central America Malaria Research Station

<i>Research Contractor</i>	<i>Center for Disease Control</i>
	<i>U. S. Public Health Service, DHEW</i>
<i>Principal Investigator</i>	<i>Dr. Geoffrey M. Jeffery</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>March, 1967 to June, 1972</i>
<i>Contract Number</i>	<i>PASA RA(HA) 2-67</i>

### Purpose

The Central America Malaria Research Station is A.I.D.'s response to the reservations concerning the adequacy of malaria eradication attack measures expressed in recommendations of a Joint PAHO, PHS, SNEM Evaluation Group Report in 1966. The main activity of CAMRS is to discover causes of failures in the program in specific locations of the region and to develop practical methods for overcoming them.

Technical approaches are through bio-ecological studies, application of new insecticides, larviciding techniques, aerial spraying, water management, biological control, drug treatment, epidemiological investigations, health education, or combinations of the above. The Government of El Salvador provides rent-free buildings, and this government and others in Central and South America cooperate in field work. The USAID missions assist in administrative requirements. Activities are coordinated with WHO and PAHO research programs.

### Results

The facilities of the station are now well established in cooperation with the Government of El Salvador. A recent progress report presents the following summary of the development of the project activities.

The program of the station has been directed toward (1) seeking basic information on malaria-carrying

mosquitoes and malaria parasites to provide rationale for the selection of control measures, (2) reevaluation of past antimalaria methodology (such as larviciding, drainage and water management), and (3) development of new weapons (such as new insecticidal materials and methods, biological agents and other alternate control approaches). Particular attention has been given to a combined approach in which multiple disciplines are used to evaluate the problems and multiple measures are used in logical combination or succession to achieve the desired ends of control or eradication. Included in all of these studies has been the evaluation of human population attitudes toward the measures used, the influence of these responses to program effectiveness, and educational techniques which might improve acceptance and cooperation.

Studies on the ecology of the malaria mosquitoes have begun to reveal patterns which will be significant in designing vector control programs. The characterization of Central American strains of malaria parasites as to relapse patterns, pathogenicity and normal responses to various drugs is similarly yielding results of importance to the future planning of malaria treatment programs. The station is pursuing a wide range of investigations of available and potential antimalaria methods to meet the multifaceted special problem requirements represented in the region.

## Investigation of Engineering Aspects of Schistosomiasis Control

<i>Research Contractor</i>	<i>University of North Carolina</i>
<i>Principal Investigator</i>	<i>Dr. D. A. Okun</i>
<i>Project Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1969 to May, 1971</i>
<i>Contract Number</i>	<i>AID/csd-2487</i>

### Purpose

The University of North Carolina is preparing an annotated bibliography and a "state of the art" paper on engineering aspects of schistosomiasis and its control. Among the subjects to be treated will be; (1) effect on the causative agents of water and sewage treatment; (2) control measures for use in water supply systems; (3)

mechanisms of transmission between man and snail; (4) control of host snails in their natural environment; (5) and study of situations where the host invades facilities provided for human use.

### Results

A final report is now being prepared.

### Thailand Malaria Operational Research Unit

<i>Research Contractor</i>	<i>Center for Disease Control U. S. Public Health Service, DHEW</i>
<i>Principal Investigator</i>	<i>Dr. William Chin</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>July, 1969 to June, 1974</i>
<i>Contract Number</i>	<i>PASA (HA) 1-70</i>

#### Purpose

This project is to establish an operational research unit in Southeast Asia, (a) to define the causes of persistent transmission of malaria in special problem areas receiving total spray coverage; (b) to develop new or improved eradication techniques in these areas; (c) to evaluate the extent and significance of malaria parasite resistance to anti-malarial drugs; and (d) to perform field trials of alternate drug treatments.

Thailand was selected as the base for the research unit because it has a uniquely favorable combination of representative problem foci, available cooperation of a well-advanced program, and workable field conditions. The Royal Thai Government provides office and laboratory facilities at Bangkok headquarters and up-country field stations, assistance in local staffing, and cooperation in field work. The USAID Mission assists in administrative requirements.

#### Results

Progress reports received from the project indicate that the laboratory and field station facilities are now established in cooperation with the Royal Thai Government. Work is proceeding on such identified special technical problems as outdoor malaria transmission, possible changes in habits of known malaria-carrying mosquitoes, increasing refusal of house-spraying by occupants, chloroquine-resistant strains of malaria parasites, and movements of the rural population as a cause of malaria persistence and redistribution. The project has confirmed that *Anopheles balabacensis* is the primary vector of malaria in problem areas and that chloroquine resistance is enabling a buildup of large reservoirs of infection. Solutions to these two main problems constitute the current major focus of the project.

### Malaria Insecticide Research

<i>Research Contractor</i>	<i>Center for Disease Control U. S. Public Health Service, HEW</i>
<i>Principal Investigator</i>	<i>Dr. George W. Pearce</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>May, 1962 to June, 1964</i>
<i>Contract Number</i>	<i>PASA 5903-7</i>

#### Purpose

The Center for Disease Control conducted field tests of a fumigant residual insecticide, DDVP, in Upper Volta, in Haiti, and in its laboratories at Savannah, Georgia. These tests indicated that the residual fumigant technique for malaria eradication, using DDVP as a toxic agent, offered considerable promise as an alternative in situations where mosquitos had developed resistance to DDT.

This project specified that CDC would continue work on the development of a new spontaneous DDVP vaporizer. This device was field tested in Haiti in occupied dwellings constructed of typical native materials, to permit observation of the effectiveness of the residual vapor. The CDC also evaluated chemical and other control methods against the vectors of malaria.

#### Results

More than 30 widely circulated technical reports were prepared in connection with this project, covering a wide range of findings and observations on chemical and control methods and on procedures for ensuring better results through spraying techniques. Work by CDC has been continued in other projects later financed by A.I.D.

The findings of this project showed the effectiveness of the fumigant against the malaria vector species in Haiti within dwellings or enclosed buildings. However, malaria transmission was not interrupted where outdoor biting habits occurred.

## HEALTH PLANNING

### Inter-American Investigation of Mortality in Infancy and Childhood

<i>Research Contractor</i>	<i>Pan American Health Organization</i>
<i>Principal Investigator</i>	<i>Dr. Ruth Puffer</i>
<i>Project Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1966 to March, 1972</i>
<i>Contract Number</i>	<i>AID/csd 1431</i>

#### Purpose

PAHO organized and is collaborating with workers of 13 areas in eight countries of Latin America in a joint effort to determine more accurately the causes of death in children under five years old. Results are being analyzed to exhibit recurring associations of malnutrition and infectious diseases, and social, environmental, and economic factors present at the time of death and which might have influenced its occurrence.

The project is involving the entire health and vital statistics structures of the communities in a closely coordinated effort which brings together leaders for regional discussions of progress and problems, and project wide meetings. It is expected that these exchanges will have lasting influence in upgrading the quality of substantive and institutional accomplishments and performance of medical, health, and civil personnel and bring to the people involved a new sense of participation in their relationship with the involved governmental structures.

#### Results

The following results are reported:

- (1) Early discovery of the excessive mortality due to measles in Recife, and La Paz, Brazil lead to massive vaccination of all children eight

months to three years, and similar national programs are planned or underway in several countries of the region.

- (2) The understanding of the role of nutritional deficiencies in death and of their interrelationships with other causes of mortality gives strong support for executing nutrition programs within the context of comprehensive health programs.
- (3) The levels of pediatric pathology have visibly improved both quantitatively and qualitatively in all of the projects.
- (4) Quality and handling of clinical records as well as in reporting births and deaths, particularly of small premature infants, are greatly improved.
- (5) The methodology being used in the investigation and the results are used for teaching and training of medical students, residents and students of public health, while the probability sample design is being used in community research projects in such areas as nutrition, demography studies, evaluation of medical care, etc. Improvement in the quality and handling of clinical records as well as in reporting births, especially those of small infants, is taking place due to close relationship between institutional and project activities.

### FEASIBILITY STUDY OF THE RELATIONSHIP OF HEALTH INVESTMENT AND SOCIAL AND ECONOMIC DEVELOPMENT

<i>Research Contractor</i>	<i>Harvard University</i>
<i>Principal Investigator</i>	<i>Dr. Robert H. Hamlin</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1963 to March, 1969</i>
<i>Contract Number</i>	<i>AID/csd-297 (PASA RA-11-00)</i>

#### Purpose

The purpose of this project was to explore the feasibility of measuring the effects of investment in health services on economic and social development in LDCs. A conceptual model was developed which relates health investments to social and economic development. This model served as a basis for field work in Tunisia. By

household interview, quantitative data on the relationship of health attitudes and behavior to social mobility, educational aspirations and economic activity was developed. It was also proposed to explore the feasibility of macroeconomic studies on the effects of health investment through intensive analysis of the

health sector as an integral part of the national development plan in selected countries.

Harvard University developed an exploratory multi-disciplinary study under the auspices of four divisions of Harvard: the School of Public Health, the Center for Middle Eastern Studies, the Center for Studies in Education and Development and the Department of Social Relations. The inquiry focused on the measurement of health and education conditions and their relations to economic and social development in Tunisia.

## Results

A progress report entitled "Harvard Studies on Measurement of Social and Economic Development in Tunisia", covering the period from June 1963 to March 31, 1969, discusses methodology and findings in the following areas:

Section A - Socio-Economic Implications of Mass Education in Tunisia - David C. Kinsey

Section B - A Profile of a Slum Community - G. W. Goethals and E. J. Rolde

Section C - A Study of Health, Growth and Social Behavior of Children: Basic Investigation for Economic Development and Productivity - Harben J. Bontourline - Young

Section D - Economic Analyses of Education and Finance Inputs in Rural Tunisia - John L. Simmons

## FUNCTIONAL ANALYSIS OF HEALTH CENTER ACTIVITIES IN DEVELOPING COUNTRIES

<i>Research Contractor</i>	<i>Johns Hopkins University</i>
<i>Principal Investigator</i>	<i>Dr. Carl E. Taylor</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1965 to June, 1970</i>
<i>Contract Number</i>	<i>AID/csd-832</i>

### Purpose

Many LDC governments have placed substantial investments in nationwide programs for the establishment of health centers to deliver preventive and curative services in both rural and urban areas. During the past twenty years, AID has assisted health center programs in several ways; (a) by providing local currency for the construction of facilities; (b) by training LDC health personnel; and (c) by providing medical equipment and supplies.

The purpose of this project was to develop and field test a systems analysis method for designing the organization, staffing and administration of health services for LDC communities. The specific objectives of this project were to measure health needs, to measure health resources, to define desirable and practical

alternatives for the reorganization of health centers, along with other allied objectives.

Research was divided into two phases to be conducted concurrently in India and Turkey. Phase one intended to develop a research framework; phase two was to apply the framework to the study areas in the two countries.

### Results

A report, entitled "Feasibility Report" was prepared by Johns Hopkins in three parts. Part I is entitled "summaries;" Part II is a Detailed India Report; and Part III is a detailed Turkey Report. Part I described the methodology employed. Parts II and III describe the procedures and findings in India and Turkey. There appears to be no overall summary of findings.

## SANITARY ENGINEERING

### Development of a Water Pump for Developing Countries

<i>Research Contractor</i>	<i>Battelle Memorial Institute</i>
<i>Principal Investigator</i>	<i>Dr. W. Frink</i>
<i>Project Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1966 to June, 1970</i>
<i>Contract Number</i>	<i>AID/csd 1434 &amp; 2174</i>

### Purpose

The contractor is developing a hand-operated water pump to meet the following requirements:

- (1) low production cost,
- (2) long life under severe conditions,

- (3) easy to maintain with simple tools and unskilled labor,
- (4) suitable for shallow or deep well installation with only minor changes,
- (5) capable of being manufactured in developing countries with a minimum of capital investment,
- (6) easily operated by everyone, including women and children, and
- (7) built-in features which will discourage pilfering and vandalism.

**Results**

A shallow well pump whose cylinder could be separated and assembled for use below the level of water being pumped was designed and constructed following field visits to the Philippines, Thailand, East Pakistan, India, and Jordan where many of the specific problems in use and maintenance were observed. Tests made on this model revealed other weaknesses of components and design which were corrected; and systematic field testing program was recommended in order to discover under controlled conditions and disciplined observation other

weaknesses that may not have been reported. Engineering tests on a limited number of modified commercially available pumps in both shallow-well and deep-life configurations were focussed on behaviour of designs and materials of plunger cups, valves, and pump cylinders. These tests provided information for the production model that was to be multiplied for large scale field testing.

A proposed layout for a machine shop and foundry using 15 personnel to produce an estimated 20 pumps per day based on use of minimum jigs and fixtures and operations using single point tools was also submitted. Proposed large scale field testing involving UNICEF, PAHO, WHO, and the AID Missions was not undertaken and must await contractual adjustments.

Phase III of the project is concerned with helping manufacturers in LDCs produce satisfactory pumps. In response to a joint AID- Battelle press release sent to 195 agencies representing local, domestic and foreign publications, Battelle has received 65 requests for more information. Requests have been received from India, Papua, Singapore, Mozambique, Guatemala, Costa Rica, Nepal, Nigeria, Laos and England as well as from organizations represented in the United States.

**Development of Methodology for the Determination  
of Design Capacities of Small Water Supplies**

<i>Research Contractor</i>	<i>University of North Carolina</i>
<i>Principal Investigator</i>	<i>Dr. D. A. Okun</i>
<i>Project Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1971</i>
<i>Contract Number</i>	<i>AID/jesd-2494</i>

**Purpose**

In order to provide valid criteria for the efficient design of economic small water supplies for developing countries, the University of North Carolina is collaborating with San Carlos University of Guatemala. They will determine the amount of water consumed by households in small communities as a function of environmental, social, and economic variables, and attempt to forecast water demand as a function of time.

Criteria will be developed for the selection of economical design periods (years before major extensions are required), based on value of money, life of project components, present cost vs. future cost and other factors. The combination of these factors may then allow the use of standard techniques for both the original and expanded facilities.

**Results**

No results have been reported as yet.

## FOOD UTILIZATION

### MEASUREMENT OF NUTRIENT LOSS FROM THE INTESTINAL TRACT DUE TO MALABSORPTION

<i>Research Contractor</i>	<i>U.S. Public Health Service, HEW</i>
<i>Principal Investigator</i>	<i>Dr. J. M. May</i>
<i>Project Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1971</i>
<i>Contract Number</i>	<i>PASA RA (HA) 9-69</i>

#### Purpose

This project attempts to test the hypothesis that inefficient absorption from the intestinal tract is a significant source of nutrient loss and could be a serious burden on the food supply. There seems to be some ground for the belief but quantitative measurements are lacking.

Nutrient losses from the intestinal tract will be measured in subjects from several geographical regions at three nutrition research institutions: University of Pennsylvania-Pahlevi University in Shiraz, Iran; Ludhiana Christian Medical Board, USA, Inc., Ludhiana, Punjab, India; and University of Rochester and Puerto Rico. Absorption and energy balance studies will be done on apparently normal individuals determined not to be suffering from interfering diseases, and who come from environments characteristic of the selected regions. Results will be recorded in terms of percentage loss of

oral input. Its significance in terms of the gross burden upon the food demands of developing countries will be estimated.

#### Results

Final choices of project locations have been made and work is near completion in one and about 70% completed in the other two. Pilot testing revealed the protein free diet, an essential prerequisite to the egg protein test, to be unacceptable to the study's populations. Accordingly, the final protocol calls for evaluation of absorption of a food normally eaten in each area. Fourteen of 69 persons examined in Puerto Rico have had high fecal nitrogen values and 20 have had abnormal absorption of xylose. Fat absorption has been normal in all persons. Preliminary results from Ludhiana reveal an astonishingly high prevalence of xylose malabsorption, (16 of 17 persons).

## HEALTH MANPOWER

### STUDY OF METHODS FOR IMPROVING THE TRAINING AND USE OF MIDDLE-LEVEL HEALTH MANPOWER

<i>Research Contractor</i>	<i>Medical College of Virginia</i>
<i>Principal Investigator</i>	<i>Dr. Edwin F. Rosinski</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>August, 1963 to December, 1966</i>
<i>Contract Number</i>	<i>AID/csd-312</i>

#### Purpose

This study was one of a coordinated group of studies focussing on health manpower carried out with AID support. The Rockefeller Foundation, the Association of American Medical Colleges and the Johns Hopkins University School of Public Health had carried out related studies. The objective of the study was to develop techniques for improving and accelerating the training and use of medical manpower below the level of M.D., (assistant medical officers and other auxiliary medical technicians) in LDCs.

#### Results

The investigators conducted intensive studies of assistant medical officers in seven countries: The Fijis,

Papua, Tanzania, Kenya, Ethiopia, Ceylon and Iran where intensive experience had been gained in the training and use of such personnel. Senegal and the Congo were also studied to ascertain factors there contributing to the discontinuance of the use of assistant medical officers.

The principal products of these studies are contained in a volume entitled, "The Assistant Medical Officer," by Edwin F. Rosinski and Frederick J. Spencer, published by the University of North Carolina Press, 1965 (195 pp) and a "Further study of the Assistant Medical Officer, His Training and Duties with Recommendations on Implementing Similar Programs"--by the same authors plus Howard K. Holland and Robert Jessee, xeroxed, by the Medical College of

Virginia, May 1967. Copies of these studies were widely distributed to AID missions and elsewhere.

The Oxford University Press requested publication rights from the University of North Carolina and has published the report for European and African nations. Guatemala is developing a program of training physician

assistants and is using the report as its model. The report serves as a basis for WHO's activities on the use and training of physician assistants in almost all of the LDCs. The U.S., Britain and France have shown great interest in this report and, in the US, HEW, The Veterans Administration and the White House have shown interest in the idea of physician assistants.

### RESEARCH IN HEALTH MANPOWER PLANNING FOR SELECTED LDCs

<i>Research Contractor</i>	<i>Johns Hopkins University</i>
<i>Principal Investigator</i>	<i>Dr. Timothy D. Baker</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Health</i>
<i>Duration of Project</i>	<i>June, 1962 to June, 1968</i>
<i>Contract Number</i>	<i>ICA-1883-1</i>

#### **Purpose**

This project involved a series of grants from ICA and AID to create a facility for providing the Agency with studies and recommendations on health manpower and training problems in selected LDCs. The School of Hygiene and Public Health of Johns Hopkins was the primary recipient of the grants. The grants also financed public health training and consulting services, in addition to work on specific research projects in the field of health manpower.

In its proposal of March 19, 1962, Johns Hopkins set forth its initial objectives in connection with the proposed grant. "The project will develop a series of methods for countries at varying levels of economic development to examine their problems in health manpower, and to enable them to follow a rational course of planning to answer these problems. It is our intention to work with approximately five countries at different levels of economic development in various

parts of the world to determine which techniques are successful in attacking the problem."

#### **Results**

Four voluminous reports have emanated from this project:

(1) "Turkish Health Manpower Study", xeroxed, February 1967 (545 pp.)

(2) "Health Manpower Planning: The Peru Case Study" by Thomas L. Hall, M.D., June 1967 (408 pp.)

(3) "Medical Manpower: A Study of Demographic and Economic Impacts" (Taiwan Study) by Timothy D. Baker, M.D. and Mark Perlman, Ph.D. undated (323 pp.).

(4) "Health Manpower Planning in Developing Nations", by J.H. Div. of International Health, Drs. Timothy Baker, Donald Ferguson, Thomas Hall, Alfred Haynes and Carl Taylor (238 pp.).



### III. NUTRITION

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# CLINICAL STUDIES OF HUMAN NUTRITION

## CLINICAL EVALUATION OF NEW PROTEIN SOURCES FOR THE PREVENTION OF MALNUTRITION

<i>Research Contractor</i>	<i>British-American Hospital Lima, Peru</i>
<i>Principal Investigator</i>	<i>Dr. George C. Graham</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1966 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd-1433</i>

### **Purpose**

To establish and test a protocol for determining relative biological value (protein quality) of new foodstuffs prepared from non-traditional protein sources (cotton seed, soybeans, peanuts and fish) now being developed for feeding infants and children in protein deficient countries. Biochemical analyses of food and animal testing are useful screening techniques. However, before entering into any large scale feeding studies, the proposed foods must be evaluated in humans.

The tests are being carried out in the British American Hospital on infants who have been rehabilitated from severe malnutrition (marasmus and kwashiorkor). The protein quality of the new foodstuffs is being compared in feeding experiments against the established quality of cow's milk. The products are then given as the only source of protein for periods of between 4 and 12 months. The products are being evaluated as the only source of protein for infants under six months.

From the results obtained it will be possible to evaluate the relative priority of the specific tests in determining protein quality under various conditions. The principal investigator and his staff will also be able to gain important information on the relation of nutrition to mental development in infants and children. The Lima Hospital is well equipped for this work and is being backstopped by the Baltimore City Hospital and the Johns Hopkins School of Medicine.

### **Results**

These studies have shown that products such as soy flour and soy protein isolates, cottonseed protein and fish protein concentrates, as well as various balanced combinations of these materials with cereals can be comparable in effectiveness to milk itself in the rehabilitation of children recovering from protein-calorie malnutrition.

Equally important is the demonstration that various clinical, biochemical and physiological parameters for judging nutritional adequacy such as nitrogen balance, serum protein analysis, blood acids, etc., are useful in evaluating protein quality of unconventional foods.

These studies have also produced a series of excellent publications in the clinical and pediatric literature that have helped develop and popularize new protein resources to meet nutritional needs.

Approximately 30 products have been evaluated. Some of these can be summarized as follows:

In studies at 8.0 percent or higher protein calories, nitrogen absorption and retention were indistinguishable from those obtained with milk. If protein calories were lowered by decreasing the amounts of FPC there was prompt development of anorexia, nausea, etc. The circumstances under which these manifestations developed ruled out toxicity as their cause; the results remain unexplained.

A detailed evaluation of a corn-soy-milk blend (CSM) has been published. The product has a good biological value but is somewhat inferior to corn-soy-methionine mixture such as Fortifex, a commercial mixture of 50% defatted soy flour, 49% cornmeal, 1% calcium carbonate and 0.2% of D. L. methionine. Pro-Sobee, a soy milk produced by Mead Johnson & Co., to which methionine has been added, is very successful but there is little hope that it can be produced at low cost. Cotton seed flour of certain types, processed to bind the gossypol, can be the sole source of dietary protein for rapidly growing infants for many weeks.

The principal investigator urges that methionine supplementation of CSM be considered seriously. Peruvita, a vegetable protein mixture, developed in Peru, and put out by Nestle was unsuccessful.

Results of the studies have been made available to UNICEF and have been of assistance in formulating emergency feeding programs in Biafra and in making recommendations to other LDCs. Results have also been made available to the General Foods Corporation, which with British-American Hospital assistance, has developed a corn-soy-wheat noodle which is being introduced in Brazil and the southern U.S. Mead Johnson Company, Beach Nut (Inc.), the Miles Laboratories and Hoffman LaRoche have been stimulated to further research in the development of inexpensive sources of protein.

**Extending Protein Concentrates for : Child Feeding  
by Addition of Inexpensive, Simple Nitrogen Sources**

<i>Research Contractor</i>	<i>Massachusetts Institute of Technology and INCAP</i>
<i>Principal Investigator</i>	<i>Dr. Nevin S. Scrimshaw</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>May, 1966 to December, 1970</i>
<i>Contract Number</i>	<i>AID/csd-1441</i>

**Purpose**

The concept that the protein value of a food such as cow's milk, meta or soya protein with E/TN ratios (essential amino acid/total nitrogen) of 3.20, 2.79 and 2.66, respectively, can be extended by dilution with simple and inexpensive nitrogen sources is being tested. The study is to test the validity of this concept for pre-school children who are healthy as well as those suffering from infections and other stresses. Preliminary tests on older groups have suggested that the concept would hold for children in the 6-9 year old range.

In the first phase, requiring 18 months, the extent to which dried milk can be safely extended for healthy, pre-school children of various ages by dilution with glycine and diammonium citrate was to be determined at the MIT Clinical Center. In the second phase, reconstituted dried skim milk containing amounts of glycine and diammonium citrate indicated to be satisfactory by the MIT studies will be given to children with Kwashiorkor at the Institute of Nutrition for Central American and Panama (INCAP) metabolic ward. The third phase will involve testing the practical application of the findings of the first two phases.

**Results**

Nitrogen balance studies with 21 young adults at MIT, fed a diet in which 90% of the total dietary protein was supplied by dried non-fat skim milk (oatmeal supplied the remainder of the protein) indicated that at least 20% of the nitrogen in milk could be replaced from non-specific nitrogen sources without affecting nitrogen retention or dilution at the 25% (replacement level) with

an isonitrogenous mixture of non-essential amino acid. Composition of whole dried non-fat skim milk protein had little deleterious effect.

Based on these studies, 20% dilution of milk protein was employed in studies at MIT with seven retarded, but otherwise healthy children aged 4-9 years. The 20% dilution with non-specific nitrogen (glycine and diammonium citrate), did not alter the efficiency of nitrogen utilization.

A 10% dilution was used in nitrogen balance studies on four children from 2-6 years of age, who had been studied during the early phase of recovery from severe protein-calorie malnutrition, at INCAP. In these tests no differences were detected in nitrogen retention between children fed undiluted and 10% diluted milk.

Some similar experiments were conducted on both weanling and young adult rats. It was found that rats were more sensitive to milk protein than children or young men, hypothetically because there were differences between these two species in their requirements for sulfur amino acids.

Preliminary studies on the effects of dilution and non-dilution are being conducted on poor Central American populations whose diets are principally corn and black beans. The addition of either the undiluted or diluted milk had little effect on both nitrogen absorption and nitrogen retention.

The study with young adults "Partial Dietary Replacement of Milk Protein by Non-Specific Nitrogen in Young Men", Scrimshaw, Young, Hiang, Thanangleul and Cholakos, was published in the *Journal of Nutrition* 98, 9, (1969).

**Lysine Enrichment of Wheat Flour**

<i>Research Contractor</i>	<i>British-American Hospital Lima, Peru</i>
<i>Principal Investigator</i>	<i>Dr. George Graham</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Project Duration</i>	<i>June, 1967 to March, 1971</i>
<i>Contract Number</i>	<i>AID/csd-1805</i>

**Purpose**

This project will seek to establish the amount of lysine to be added to wheat flours to make them effective sources of protein in the diets of infants and

pre-school children. Selected amounts of lysine will be added to wheat flour at various protein levels, using high protein wheat flour as the major source of protein. The study will determine under sensitive clinical supervision

if wheat proteins with lysine added, and without additional protein supplementation, can be used to furnish the protein requirements of very young children, including some who have been rehabilitated from a previous serious condition of malnutrition of the marasmic-kwashiorkor type.

Investigations will ascertain those levels of lysine addition necessary to produce the best attainable protein nutritive value at two protein levels, i.e., the high one (21%) and also at normal flour protein level (10.5%), but which will not create a deficiency in the next limiting amino acid. The study follows a logical step-by-step sequence using a sound reference point, the amino-acid composition of human milk, from which to calculate the levels at which lysine is to be added to flour as a dietary supplement.

#### Results

(a) *From the October 14, 1969 Progress Report.*

"Within a relatively narrow range of dietary protein calories, 6.4 to 8.0% of the total, neither the

source of milk protein (cow's milk) nor its level had a significant effect on fasting plasma total free amino acids, on the ratio of essential to total amino acids of convalescent malnourished infants."

(b) *From the June 1970 Progress Report.*

"White wheat flour enriched with lysine was the only source of protein in the diet of six convalescent malnourished infants for 3 to 6 months. At 8% protein calories the equivalents of 0.1, 0.2 and 0.4% lysine enrichment were equally effective in supporting normal linear growth, weight gain, nitrogen retention, serum proteins, plasma amino acids and liver morphology." (At least 0.2% enrichment of wheat is recommended, where wheat is the sole diet).

The research has demonstrated that lysine increased by approximately 60% the protein value of ordinary white wheat flour. India, the Philippines and other countries have mounted action programs by adding lysine. The Food and Nutrition Board and Protein Advisory Group of The United Nations is seriously considering action along these lines.

### The Relation of Dietary Caloric Intake to Protein Utilization

<i>Research Contractor</i>	<i>Massachusetts Institute of Technology</i>
<i>Principal Investigator</i>	<i>Dr. N. S. Scrimshaw and Dr. U. R. Young</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2808</i>

#### Purpose

To provide quantitative data on the relationship between caloric intake and protein utilization in man on which to base rational and efficient protein supplementary feeding programs. The specific questions to be answered are (a) how useful is it to improve dietary protein quality and/or quantity when calories are definitely inadequate and; (b) can the utilization of protein-rich snack such as dried skim milk given during the mid-morning be improved by supplying simultaneously dietary calories when the total diet is inadequate in calories. Answers will be obtained by direct metabolic studies in human subjects.

Part one will study the effect of nitrogen utilization of adding lysine to a low protein diet when ingested calories are low. Part two will study the

quantitative relationship between restricted calorie intake and the utilization of dietary protein. Part three will study the effect on nitrogen utilization of giving protein supplement at different times of the day when calorie intake is limited.

#### Results

The initial investigation of the quantitative relationship between the supplemental effect of lysine addition to a low protein wheat gluten diet has been studied in healthy young adult male subjects fed on adequate or inadequate dietary caloric intakes. This study involved the participation of eight subjects during a three-month study. The feeding phase of the study has been completed and the data are now being summarized and evaluated.

**Study of the Influence of Early Nutrition on Cognitive Development in the Young Child in Peru**

<i>Research Contractor</i>	<i>Cornell University</i>
<i>Principal Investigator</i>	<i>Dr. Richard H. Barnes</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>November, 1966 to November, 1967</i>
<i>Contract Number</i>	<i>AID/CSD 1209</i>

**Purpose**

This project was a limited feasibility study, designed to test under field conditions available methodology relative to measuring the influence of early nutrition on the young child. The children population samples were to be supplied by the British - American Hospital in Lima, Peru (urban samples).

The major objective was to determine: (a) whether appropriate psychological testing methods could be devised for pre-verbal as well as verbal children which are not unduly influenced by cultural or other variables

unrelated to the effects of malnutrition on development; and (b) whether it is possible to select experimental and control groups in Peru which are dissimilar only in nutritional history.

**Results**

This was one of the few feasibility studies that AID has financed. Following rather extended study in Peru, the principal investigator concluded that because of population mobility it was not practicable to undertake further study.

**Evaluation of High-Protein Supplements in Child-Feeding Programs in the Philippines**

<i>Research Contractor</i>	<i>National Institutes of Health</i>
<i>Principal Investigation</i>	<i>Dr. R. W. Engle and Dr. Arnold E. Schaefer</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1965 to June, 1968</i>
<i>Contract Number</i>	<i>PASA RA-1-65</i>

**Purpose**

The project was designed to provide valuable information for preparing soy and coconut products in the Philippines. It was to develop information to enable the use of supplements from local resources that would be acceptable to children. The studies would also provide basic data on nutritional values needed to plan balanced U.S. food assistance programs.

In 1965 a contract was negotiated by NIH with the Virginia Polytechnic Institute for research studies on evaluation of high protein supplements in child feeding operations in the Philippines and Turkey. The Turkey project was subsequently dropped.

**Results**

In the first experimental group of children studied Dr. Engle discovered that little or no improvement had occurred through the ingestion of high protein supplements. He concluded that the average diet of the children was so low in calories that the added protein was burned up to supply energy. He repeated the experiment, but provided supplemental food (calories) from a good vegetable protein source, averaging about 300 additional calories per day for each child. Under the repeated experiment he found that there was a significant improvement in size and stature of the children.

## Study of Liver Disease and Nutrition in Uganda

<i>Research Contractor</i>	<i>Harvard University</i>
<i>Principal Investigator</i>	<i>Drs. Charles S. Davidson, Dr. Morton E. Alpert and Dr. Jacques</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>September, 1966 to June, 1968</i>
<i>Project Number</i>	<i>AID/csd 1435</i>

### • Purpose

Cirrhosis and tumors of the liver are of frequent occurrence in Uganda and other developing countries in Africa. Tribal and geographic differences in the prevalence of these conditions suggest that these variations may be associated with different dietary patterns. It has been established that certain fungi and plants growing on common foods produce substances that are toxic to the liver. One such substance, aflatoxin, has been isolated from groundnuts (peanuts) and moldy grain samples in Uganda.

The study was to determine the role of environmental factors, particularly dietary hepatotoxins, in causing cirrhosis of the liver and/or hepatomas in Uganda. The study was concerned with four phases of investigation:

(1) Patients, known sufferers of hepatoma, were to be selected and information was to be obtained regarding residential history, previous jaundice and nutritional history, including type and amount of alcohol, moldy grains and groundnuts. Liver biopsies, urine assays for aflatoxin and analysis of food materials for mycotoxin were to be performed.

(2) The prevalence and kind of liver disease in four to six geographic or tribal areas where predominant foods are peanuts, plantain, grains or milk and blood were to be studied. Liver biopsy specimens were to be obtained from patients not known to have liver disease.

(3) An environmentally homogenous group of males in a prison or school in which groundnuts form a major part of the diet were to be selected for study in comparison with a control group, matched for age, sex and tribe but ingesting no groundnuts or other likely source of aflatoxin.

(4) The prevalence of hepatoma and food content of aflatoxin in various geographic areas of Uganda were

to be compared. Foods, grains, groundnuts, alcoholic beverages, cows' milk were to be collected from various areas and hepatotoxicity evaluated by a bio-assay compared to the hepatoma rates in each area to see if a correlation exists.

### Results

The following specific studies have been completed or are nearing completion:

(1) A prospective study of liver disease in a large general hospital in Uganda defined the clinical syndrome of primary liver carcinoma in East Africa and documented some clinical and pathological features peculiar to the area.

(2) A detailed prospective survey of 46 hepatoma patients, their families, and appropriate hospital and non-hospital controls, revealed no significant differences in the micro-ecology, occupational or residential histories, dietary or alcoholic intake.

(3) A prospective study of the diagnostic accuracy of hepatoma on purely clinical grounds in Uganda, revealed an accuracy of 85% correct diagnoses, utilizing a few simple clinical criteria.

(a report, dated March 27, 1969 indicated that the three above studies would be published shortly)

(4) Study, published in the *Lancet* 1, 1265, 1968 entitled "Hepatoma in Uganda: A Study in Geographic Pathology."

(5) Study, "Hepatoma and Aflatoxin in Uganda," published in *Gastroenterology*, 54:149, 1968.

(6) "Alpha - Feto-protein in the Diagnosis of Primary Liver Cancer," *New England Journal of Medicine* 278:984, 1968.

(7) The importance of Mycotoxins in the etiology of human liver carcinomas was reviewed in an editorial. *American Journal of Medicine*.

## FOOD PROCESSING STUDIES

### Effects of Extrusion Processing Variables on the Nutritional Quality of Inexpensive High-Protein Food Mixtures

<i>Research Contractor</i>	<i>University of California - Davis University of Chile, Santiago</i>
<i>Principal Investigator</i>	<i>Dr. C. Chichester</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1967 to June, 1971</i>
<i>Contract Number</i>	<i>AID/csd-1587</i>

#### Purpose

To study the effects of varying pressure, temperature and time via extruder processing upon the nutritional quality and acceptability of low-cost protein foods. (An extruder is a heat-jacketed screw press in which food ingredients can be mixed, cooked, and forced through a heated die). The project was developed to complement an on-going University of California project in Chile (in fact, the two projects were combined in 1969) in which vegetable--fish protein mixtures are being investigated for use in the feeding of pre-school children, infants and lactating women (sponsored by USPHS). The low cost foods in the A.I.D. project were to include mixtures prepared from sunflower seed, rape seed, corn, wheat, fish protein concentrate, fresh raw fish and non-fat dried milk.

This project also includes training of Chilean nationals at the Department of Food Science and Technology, University of California, in the techniques of analysis, processing, acceptability testing and nutritional evaluation. Production facilities were to be set up in the Institute of Food Science and Technology at the University of Chile.

#### Results

The nutritional, toxicological and acceptability studies have progressed faster, at least initially, than the technological aspects. In part, this was attributable to a student strike at the University of Chile which hampered technological progress. Rather than delay studies, food mixtures were prepared initially by drymixing rather than by extrusion. A mixture of sunflower meal, fish protein concentrate and non-fat dried milk (designated as "Lecke Alim") was selected as a food mixture to be studied in detail.

Initial problems were eventually resolved and the Wenger extruder provided by A.I.D. is functioning

admirably. (e.g., about 500 pounds of the Lecke Alim formulation can be prepared per hour). Optimum extrusion processing conditions have been worked out for a series of single food components and mixtures, including Lecke Alim, corn, milk, sunflower meal, whole fish, wheat, sunflower seed meal and fish protein concentrate, etc. Physical and palatability characteristics of products are in all instances better than those of dry-mixed products. In addition, extrusion results in a major reduction of viable microorganisms in the processed as compared to the dry-mixed product.

The Lecke Alim product is being evaluated as a milk substitute. Field studies are being conducted, and the Lecke Alim formulation has been found acceptable. It is hoped that this product will prove acceptable on a long-term basis. Preliminary results indicate that, compared to dry-milk powder, a higher proportion of Lecke Alim reaches the pre-school child.

Sunflower and rapeseed meal studies have resulted in the development of interesting processes for their utilization. Sunflower meal protein has an amino acid profile, low in lysine but high in sulfur containing amino acids. Mixtures of sunflower protein and FPC (as in Lecke Alim) have excellent biological value. A procedure has been developed by which the 12% fiber present in the sunflower press-cake meal is easily reduced to 2%, making it useful for child feeding.

Rapeseed protein has an excellent amino acid profile. Because of toxic factors the biological value is poor. A 2-stage water extraction procedure that produces a highly nutritive non-toxic rapeseed meal has been developed. It is hoped that this product can be used for animal feed, releasing in turn sunflower meal for human consumption.

As a result, in part of this A.I.D. contract, nutrition research and programs for applying the research results to real life situations is an accepted government policy.

## Development of Soy-Based Foods of High Nutritive Value for use in the Philippines

<i>Research Contractor</i>	<i>Cornell University</i>
<i>Principal Investigators</i>	<i>Dr. David B. Hand</i> <i>Dr. Keith Steinkraus</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1967 to December, 1970</i>
<i>Contract Number</i>	<i>AID/csd-1815</i>

### Purpose

Advances in soybean technology offer opportunities for the introduction of a variety of inexpensive foods that are already known to be acceptable for human uses. Studies will be undertaken to define processes for manufacturing soy-based foods such as soy milk, soy curd, fermented soybeans, and pre-cooked dehydrated soybeans, which are of a scale and simplicity relevant to the socio-economic needs of relatively small population centers in countries such as the Philippines. Effects of processing on yield, flavor, texture, nutritive value and storage life were to be investigated. Major emphasis was to be placed on soy milk.

A pilot plant line was to be established at the College of Agriculture of the University of Philippines in order to study the adaptation of the results obtained in the Cornell Laboratory to local Philippine conditions.

### Results

#### (a) Soy Milk

(1) For urban areas an acceptable product and a valuable process that can be demonstrated to potential commercial processors has been developed.

The product is a sterilized soy milk packaged in hermetically sealed containers.

(2) For villages no process is yet available to meet the needs of the village, which is the development of a simple procedure to produce soy milk to be sold at very low cost. This is still a number one priority of the project.

#### (b) Soybean curd:

The Cornell group at Los Banos can demonstrate how to make a less "beany" tasting curd since the blander soy milk is the starting product.

#### (c) Tempeh:

A large stock of powdered dry Tempeh (utilizing soybeans—especially suitable to village use) has been built up that can be distributed as a starting culture for Tempeh production.

(d) A pilot plant, for producing soy milk and for teaching purposes, has been installed at Los Banos.

(e) At Gereva, a process for improving the flavor of soy milk has been discovered. A wet grinding process to improve flavor has been developed, studies on digestibility and nutritive value of various soy products have been completed and extensive flavor studies have been conducted.

## Improving the Nutritive Value of Cereal-Based Foods

<i>Research Contractor</i>	<i>Kansas State University</i>
<i>Principal Investigator</i>	<i>Dr. William J. Hoover</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1967 to June, 1972</i>
<i>Contract Number</i>	<i>AID/csd-1856</i>

### Purpose

This research is intended to improve the nutritional value of wheat based food by supplementation and process modification without decreasing the food acceptability to the consuming people in three food deficit areas of the world. The project will investigate the processing and preparative techniques involved in making chappaties (India) rote (Pakistan) and cous-cous (North Africa), to determine and measure quality criteria, and to develop quality parameters. Formulas will be developed that increase the nutritional levels while maintaining acceptability.

Current knowledge has assessed both caloric and protein deficiencies in India, Pakistan and North Africa in sufficient depth to recognize the inadequacies of the diet, the significance of breads in the diet, and the role of improving protein resources. In most milling or processing operations as carried out today, the most nutritious part of the grain is diverted to animal feed or non-food use. Knowledge of process modification in the U. S. can be used to convert these by-product streams into acceptable and nutritionally available food forms. The participation of LDC nationals will be enlisted in the project.

## Results

A thorough survey has been made of grain products and legumes available in Morocco and Pakistan. The Indian phase of the project has not been implemented. Based on this survey, similar legumes were procured in the USA for study. In addition, the native methods used to process grains ranging from village techniques to continuous processing systems were ascertained. Contacts were also established for collaborative field testing in West Pakistan and Morocco.

Animal studies have been conducted to evaluate the nutritional merits of indigenous legumes. Diets based on wheat flour and containing 10-13% protein to which all necessary vitamins and minerals were added have been studied. Procedures for the manufacture of flour from a wide variety of legumes have been developed.

Data obtained to date include the following: (1) defatted chick pea flour containing 23% protein was developed with a PER of 2.96, as compared to 2.68 for casein controls and (2) pigeon peas with 0.67 were

developed. Work on pigeon peas has been dropped. PERs for mixtures containing 20% for broad bean flour were comparable to casein controls.

Processing procedures for the manufacture of atta supplemented with soy flour, chick pea flour or broad-bean flour at various levels of supplementation have been developed. Standard procedures for the preparation of chapatis, parathas and nan using these supplemental attas have also been developed.

All products are evaluated for nutritional value and acceptability.

A major breakthrough may have resulted from this contract. By the use of specific emulsives, such as sucrose ester, various breads and bread-like products containing high concentrations of flour made from oilseeds and legumes can be prepared, with little if any impairment to desirable physical characteristics acceptability.

Currently plans are under way for initiating field tests in Morocco of supplemental Arab bread and cous-cous.

## Nutritional Improvement of Rice by Fortification with Synthetic Amino-acids and Vitamins

*Research Contractor  
Principal Investigator  
A.I.D. Monitor  
Duration of Project  
Contract Number*

*Harvard University  
Dr. Frederick J. Stare  
TAB, Office of Nutrition  
June, 1968 to June, 1971  
AID/csd-2170*

## Purpose

The objective is to establish levels and evaluate the quantitative and qualitative effects on infants and young children of fortifying rice with the limiting amino acids, lysine and threonine. The research will include a survey, animal feeding trials and institutional trials with the end view of establishing the basis for a large scale field demonstration and eventually practical introduction through a study of marketing patterns in order to introduce fortification into the usual commercial channels. The study is to be made on rice in Thailand. Fortification additives will include Vitamins A and B to offset the possibility of developing Xerophthalmia or Beri-Beri and other vitamins or minerals considered necessary. Fortification will be added in the form of a synthetic "rice fortified grains" (RFG).

The first phase was to be a survey in Thailand to study marketing distribution of rice, determine the kind of fortification which would reach the greatest number of people, and collect information on the food habits of village populations who might be used for mass feeding trials in future research.

Phase two was to be studies with experimental animals to determine the appropriate levels of fortification.

Phase three would be a feeding trial of children in an orphanage or hospital under controlled metabolic conditions. The effectiveness of amino acid and vitamin fortification would be determined by tests of nitrogen balance, hemoglobin, total serum protein, serum albumin and other physiological studies deemed pertinent.

## Results

(1) A raw control, (2) a placebo control, includes a Day Care Center but no fortification, (3) a restricted treatment in which a Day Care Center plus vitamin and minerals are added and (4) a full treatment.

Before experiments were started, the pre-school children were subjected to clinical examination, fecal parasite examination and a series of anthropometric and biochemical measurements. In comparison with Iowa standards, the pre-school children were considerably below the 50th percent, i.e., about 25% showed delayed bone growth. Head circumference was also much smaller than Iowa children of the same ages. These pre-school children were also lighter in weight and smaller than children of Bangkok parents.

The merit of conducting a pilot study before proceeding with a full field study has been amply

demonstrated. As a result of the pilot study, improvements were made in the RFG; anthropometric measurement, data collection, etc. Results of the pilot study justify initiation of a full field study. This will soon be undertaken.

The initial survey indicated that institutionalized (orphanages, etc.) Thai pre-school children received excellent care. Their use in malnutrition studies was contra-indicated. Instead, all children in four villages were selected for the pilot study. The total population of each of these villages is approximately 725; about 70 in each village are pre-school children.

The initial survey also indicated that synthetic "Rice Fortified Grains" (RFG) would prove acceptable

to the villagers. As a result of animal studies the grains were manufactured to contain L-lysine hydrochloride 20%; L-threonine 10%; thiamine 0.05%; vitamin A 0.02%; and ferric phosphate 0.8%. The grains are added to natural rice at the 1% level.

In each pilot-study village rice for the entire village is milled in one mill. Feeders for adding the RFG during the milling operation were designed and constructed. These have proven satisfactory. The logistics of fortification have been solved in a relatively simple manner.

In each village a Day Care Center serves as the operational base for the project.

### **A Practical Approach to the Lysine and Tryptophan Supplementation of Lime Treated Corn**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*Rutgers University*  
*Dr. Ricardo Bressani*  
*TAB, Office of Nutrition*  
*June, 1969 to June, 1973*  
*AID/csd-2500*

#### **Purpose**

Studies conducted by the Institute for Nutrition of Central America (INCAP) indicate that Guatemalan corn varies from about 6.5 to 10.0% protein. Amino acid content as a percentage of the grain showed a similar variation. The tests verified that lysine and tryptophan are deficient amino acids.

Corn is consumed in Central America in the form of tortillas. Cooking corn for tortillas leads to: an increase in protein concentration due to loss of the seed coat and soluble carbohydrate; an increase in ash and calcium content; losses in thiamine, riboflavin and niacine, and changes in nitrogen solubility with the highest increase in the zein fraction.

The protein efficiency ratio (PER) of lime-treated corn is about 1.2 and it increases to about 1.5 with 0.31% lysine. The addition of 0.31% lysine and 0.05% tryptophan increases the PER to 2.76. When these products are added to the ground cooked corn ("masa") they are not destroyed during the baking of the tortillas.

Phase one of the study will determine the form which offers the greatest efficiency in supplementing

masa with lysine and tryptophan. Phase two will consist in the practical application of the findings in phase one through education and extension in small communities and coffee plantations in rural areas of Guatemala.

#### **Results**

The quality of corn proteins in the form of tortilla can be significantly improved through the addition of 0.30% L-Lysine.HCl and 0.10% DL-Tryptophan; or 8% skim milk and 0.15% L-Lysine.HCl; 3% torula yeast, and 0.15% L-lysine.HCl. It was also found that the conditions used for preparing tortillas do not significantly destroy the added supplements.

The distribution of amino acids during milling was studied. The amino acids were added as (a) a powder, (b) synthetic corn kernels or pills and (c) an aqueous solution. The synthetic corn kernels or the powder were the most efficient ways to fortify corn at the mill.

Considering all information thus far available, the most promising method which has the greatest chance of practical success may be the use of synthetic kernels made from soybean flour and lysine, to which riboflavin, vitamin A or other nutrients can also be added.

## Coconut Protein Products for Use in Foods

<i>Research Contractor</i>	<i>Texas A &amp; M University</i>
<i>Principal Investigator</i>	<i>Karl F. Mattil, M.D.</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>March, 1970 to March, 1972</i>
<i>Contract Number</i>	<i>AID/csd-2804</i>

### Purpose

Coconuts are an import food and a major export for many tropical nations of the less developed world. Fresh coconut meat contains about 20% protein in the dried solids, and protein has a favorable amino acid profile for human consumption. In order to realize the food value of dried coconut meat through commercial channels, it is necessary to substantially alter processing techniques and marketing practices.

A former reconnaissance survey found no evidence that any process was operating successfully on either a production or pilot plant scale. Private firms have been hampered by lack of a suitable source of raw materials and lack of sufficient process clarification to permit food product formulation and planning for commercial investment.

The project will: (1) conduct a thorough laboratory investigation of the physical characteristics and chemical and nutritive properties of coconut and of processed coconut; (2) investigate the technical feasibility of the key unit operations of three processes; (3) outline the processing economics of the proposed processes; (4) investigate the food use potential of protein products of each of the three processes; (5) train

scientists and engineers in processing food grade protein products; and (6) define the parameters of a pilot plant to demonstrate the commercial viability for the most favorable processing alternative.

### Results

A senior scientist and four scientific trainees have been recruited from the Philippines. A second trainee from Thailand will be joining the Texas A&M group.

The program involving the study of unit operations has been moving slowly, primarily because of slow deliveries of equipment.

The effect of storage on coconut meal has shown that defatted coconut meal is a stable commodity that requires no unusual storage conditions.

Pertinent properties of coconut proteins are being measured. A high and a low molecular weight component has been isolated. Studies indicate that there are considerable differences in amino acid analyses of the two fractions, the high molecular weight fraction being higher in aliphatic amino acids and contained reactive SH groups. Results also indicate that processing temperatures of 60°C or lower are apparently safe for the wet processing of coconut protein.

## Research on New Processing Technology for Oilseed Proteins

<i>Research Contractor</i>	<i>Agricultural Research Service, USDA</i>
<i>Principal Investigator</i>	<i>F. R. Senti</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Nutrition</i>
<i>Duration of Project</i>	<i>June, 1964 to June, 1968</i>
<i>Contract Number</i>	<i>PASA RA-12-00</i>

### Purpose

A dietary deficiency in protein, especially in children 1 - 5 years of age is recognized to be one of the major nutritional problems of the developing countries. The major oilseeds: cottonseed, peanuts and soybeans are produced in all regions of the world, yet they are processed for human food to only a very limited extent. The widespread availability of oilseed protein, not now used for human food, in areas of food deficit, is in itself strong evidence of the need for improved processing technology.

The specific objectives of this project were:

(a) To establish optimal and minimal conditions for use of a process to produce fullfat soy flour by the cooker-extrusion process. To develop simpler

processing methods and equipment than the cooker-extrusion method.

(b) To develop a solvent extraction process for cottonseed and peanut flours. This is a laboratory process in which a new azeotropic solvent system is used to extract the oil, leaving a bland protein of excellent nutritive value.

(c) To study the nutritive value and use in foreign foods of the products developed. The uses of these products in formulating beverages and gruels, and in bread, noodles, tortillas and chapaties were to be studied.

(d) Acceptance of the food products and formulations in selected countries were to be

investigated in cooperation with other interested agencies.

(e) By amendment, to perfect the "village process" for soy flour; to develop a partially defatted soy process; to conduct research on the cooker-extrusion process; to study alternative aflatoxin removal from oilseed proteins; to develop engineering design and scale up of the alcohol-hexane-water process and combined processes to remove toxic factors in cottonseed and peanut meals.

#### **Results**

A simplified process for producing soy flour at the village level was developed. Cooker-extrusion equipment for preparing soy flour was fabricated and studies were made on processing parameters.

Limited quantities of peanut flour have been processed. Food indigenous to LDCs, containing cottonseed, soy and peanut protein have been prepared and tested for quality characteristics such as flavor, color and texture.

### **Adaptation of an Integrated Rice Milling Process and Development of Resultant Food Products for Use in South East Asia**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*Riviana Foods, Inc.*  
*Lawrence Lynn*  
*TAB, Office of Nutrition*  
*June, 1967 to June, 1968*  
*AID/csd 1583*

#### **Purpose**

The objective of this project was to determine the applicability and adaptability of a rice milling process newly developed in the U.S., which would offer major economic and nutritional advantages to countries in Southeast Asia. The project was intended to provide knowledge which is required to make the technologically advanced process commercially viable in a developing region.

Riviana Foods was to adapt its potential integrated rice milling procedure (X-M Process) involving the use of hexane solvent to needs and conditions prevailing in the rice producing and consuming areas of S.E. Asia as follows:

(1) Develop and/or adapt miscella refining techniques specific for rice oil produced by the new X-M technology to render in-line refining economically feasible in foreign X-M plants for the production of edible oil.

(2) Develop several nutritious consumer food products based on projected availability of a source of X-M rice bran oriented toward use of other inexpensive raw materials in S. E. Asia, including "bar good" products and a beverage.

(3) Determine the projected overall added value, in terms of rice milling yields, oil and wax yields, and high protein bran properties, which would be derived from the X-M solvent extractive milling processing of selected foreign rice varieties.

#### **Results**

In a report dated January 29, 1968 Riviana Foods reported the following results:

(1) Based on literature review and bench scale experiments, it was learned that at least one approach to miscella refining of X-M rice oil appeared very encouraging. Work on a pilot unit was started and largely completed in which the process will be developed and demonstrated by June 1968. The bench scale work has shown refined product oil samples which were felt to be storable, edible and relatively attractive.

(2) Results from bench scale experimental work on the beverage concept and on two of the solid product concepts have been encouraging. A prototype beverage has been synthesized from X-M rice bran by a non-enzymatic method with a composition similar to cows' milk and with a color and texture somewhat similar to Vitasoy, a new Asiatic beverage which is reported to have outsold Coca Cola in 1966-67 in Hong Kong.

(3) Scarcity of worthwhile varieties of key foreign rices created difficulty in resolving conflicting information about the varieties. Riviana is proceeding to get larger quantities of 3-4 of the 15 varieties appraised (those in widest availability in Thailand and the Philippines) for larger scale milling tests by conventional Thai and Filipino and a short single-shot X-M milling trial run in the U.S.

## IV. POPULATION

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# POPULATION DYNAMICS AND DESCRIPTIVE DEMOGRAPHY

## Family Planning Research and Evaluation Center

*Research Contractor*      *Pathfinder Fund*  
*Principal Investigator*    *Dr. Roger P. Bernard*  
*A.I.D. Monitor*            *TAB, Office of Population*  
*Duration of Project*        *June, 1967 to June, 1971*  
*Contract Number*          *AID/csd-1573*

### Purpose

The purpose of this project was to establish a Family Planning Evaluation Center within The Pathfinder Fund to plan, implement and evaluate field trials of new contraceptives and family planning approaches in several selected countries. A first task was to evaluate data collected since 1962 from more than 38,000 women in 45 countries, who had been provided with IUDs by The Pathfinder Fund and 131 participating physicians. Rapid and simultaneous field trials of the most promising materials and methods were to be conducted.

In order to accomplish these trials, The Pathfinder Fund would identify key medical and family planning field and clinical investigators and list their cooperation in the provision of contraceptives, follow-up on patients and the formulation of family planning organization and programs. Plans and procedures for shortening the time lag between biomedical research discoveries and utilization in the field were to be developed.

The project has included subcontracts by The Pathfinder Fund (with overall responsibility), to the

Medical Research Foundation, the New York Medical College and the Massachusetts Institute of Technology. The Pathfinder Fund's contribution is primarily medical administration, field trials and epidemiology. The subcontractors' contribution is in the area of engineering approaches to mechanism of action and design of new prototypes of IUDs and those currently available.

### Results

An extensive field testing program for IUDs was established which has employed a maximum of 60 investigators in 40 less developed countries.

The Lippes Loop has been the principal IUD tested in this program. Altogether about two dozen IUDs have been evaluated. Extensive data has been collected on insertions, removals, expulsions and retentions. Long-term follow-up studies have been conducted. The data has undergone extensive computer analysis and the results have been presented in such a way as to allow direct comparison among the various clinics. Over 1000 pages of data have been published describing the findings of the IUD studies.

## The Epidemiology of Outcome of Pregnancy in Diverse Cultures in Selected Countries

*Research Contractor*      *Johns Hopkins University*  
*Principal Investigator*    *Paul A. Harper, M.D.*  
                                         *L. P. Chow, M.D.*  
                                         *John F. Kantner, Ph.D.*  
*A.I.D. Monitor*            *Rowland V. Rider, Sc.D.*  
*Duration of Project*        *TAB, Office of Population*  
*Contract Number*          *May, 1969 to April, 1972*  
                                         *AID/csd-2246*

### Purpose

The object of this project is to determine the incidence of induced abortions and its relationship to health, fertility levels, fertility control measures, demographic and other socio-economic variables. The project will establish the techniques for obtaining such information, so that inter-cultural and inter-country

comparison can be made which will assist those countries desiring to limit population growth and to accomplish it in a manner which maximizes the population's well-being and the country's economic development.

During the three-year period of this contract the contractor is to:

a. Design, refine, test and adapt methods and procedures for initiating and conducting abortion studies in various countries;

b. Conduct these studies in selected countries through techniques utilizing probability sampling, laboratory tests, interviews, questionnaire surveys, etc.

c. Perform statistical and multi-variate, including age-parity analyses, of the data collected through high speed and conventional computers and present these analyses so that data and inferences can be readily related to health, family planning and other program goals.

#### **Results**

On October 14, 1970, a full-fledged review of this project was conducted with Drs. Rowland Rider, Paul

Harper and L. P. Chow, by members of TA/POP and a representative of TA/RUR.

The project is aimed at the consumers of abortion, women, and the dispensers of abortion, medical practitioners. It involves a conventional, one shot KAP survey, including the pregnancy history, of 2,000 women, aged 15-49 in Taoyuan County, Taiwan. This part of the study has not been implemented. No parts of the study which deal with medical practitioners have been implemented due to political difficulties. Therefore, the project is not on target. Additional funds will not be allocated in FY 1971. A decision on extending the research in Taiwan at another site has been withheld until Hopkins can furnish and AID/W can evaluate the results of data collected.

### **Determinants of Family Planning Attitudes and Practices, Phase II**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*Harvard University*  
*David M. Heer, Ph.D.*  
*TAB, Office of Population*  
*June, 1969 to June, 1972*  
*AID/csd-2478*

#### **Purpose**

Phase I of this project was concerned with developing and pretesting a study in the United States which examined the many variables associated with reduced fertility in acceptance of family planning, developed questionnaires to be utilized in Phase II and laid the groundwork for planning Phase II.

The focus of this project (Phase II) is to see answers to a number of questions by conducting a study in an underdeveloped country. Such questions include:

a. How does the actual level of infant and child mortality in a given population differ from the level individuals perceive to exist?

b. What effect does the sex of offspring and the personal experience of infant and child mortality have on a mother's subsequent fertility?

c. What is the effect of (1) level of child mortality, (2) perceived level, (3) experience of infant and child mortality and (4) pronounced preference for sons have on the desired number of children, the proportion wanting additional children and family attitudes and practice?

The project will also examine what effect (a) economic status, (b) educational attainment, (c) extra-familial work opportunities for the wife and other factors have on the number of children desired by couples and their acceptance of family planning.

#### **Results**

A progress report from the contractor covering the period from February 1, 1969 to October 31, 1969 contains the following information:

1. The experience of the Kentucky pretest was reviewed and a revised English language version of the questionnaire was prepared.

2. The English language version of the questionnaire was translated into Mandarin.

3. Dr. Win and staff began a pretest in Shenking township and altered plans somewhat on the basis of the pretest interviews.

4. The questionnaire was revised and an Enumerator's Reference Manual was prepared.

5. The site of the regular interviewing was changed to Junglios Township, near Taipei.

6. TA/POP/R met with Dr. Heer in October 1970 to evaluate project progress. Results to date are inconclusive for determining whether or not to extend the project to a second country. Checking and coding first round interviews is still in progress. Second round questionnaires and an interviewer's manual were translated into Chinese and printed in October. Second round interviewing in Kugliao began November 1970.

## A Theoretical Inquiry into the Determinants of Fertility

<i>Research Contractor</i>	<i>Rand Corporation</i>
<i>Principal Investigator</i>	<i>Dr. Paul T. Schultz</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>January, 1970 to January, 1972</i>
<i>Contract Number</i>	<i>AID/jcsd-2533</i>

### Purpose

The primary objective of this project is to formulate, test, and integrate the components of a theory of fertility as part of a general view of the family decision making process in the context of the social and economic changes associated with development. During the first year of this project the investigators began to examine the fertility determination process as a biologically constrained choice situation, which is jointly determined with a large number of related areas of demographic and economic behavior. Structuring and simplifying this complex, and isolating those alternative views of the process which imply different empirically testable propositions, will be an important goal of this project. In future work for AID, Rand hopes to collect survey data appropriate for testing these alternative theories and improving the information base on which population policy relies.

The project's initial focus in population work has been to develop and refine quantitative tools of analysis from which inferences could be confidently drawn concerning interactions between man's environment and his reproductive behavior. A primary objective has been to use these tools to account for differences in fertility among individuals and among groups in low-income countries in order to isolate and evaluate policy options that might reduce birth rates, slow population growth, and enhance development prospects. In the majority of cases multivariate regression analysis is applied to carefully chosen cross-sectional data, first to regional population aggregates and then to individual family survey records. Guided by simple economic and demographic logic in the selection of probable determinants of desired family size and other economic behavior, Rand has found in each country studied statistical evidence of the anticipated relationships linking fertility to observed features of the parents' environment.

### Results

It is too early to draw conclusions from the work being undertaken by this project, but a number of initial directions of research and their preliminary implications can be enumerated:

(1) General economic theory implies only a few unambiguous relationships between observable attributes of parents' environment and their preferences for offspring. To constrain the general economic model to yield important testable implications requires the imposition of additional assumptions about the way

households work. Careful specification and explicit examination of these assumptions and their empirical implications should be a central output of this project.

(2) Formulating sociological theories of fertility determination in a similar manner for empirical evaluation will also be attempted. Abstracting a few rigorous formulations of these models from the varied and rich literature will necessarily narrow their focus, and limit their applicability. Yet this process of generalization is needed to arrive at a common-denominator for survey information required to discriminate between the different approaches to this field.

(3) Past studies of the determination of fertility at Rand and elsewhere have been severely constrained by the lack of appropriately defined economic, social, and demographic data on families over time. A critical future contribution of AID to the improvement of population and development policy will be to secure the data base for testing our knowledge of family fertility determination and for quantifying the cost-effectiveness of alternative policy strategies. In this project, Rand intends to formulate an integrated information strategy for population and development planning and, if possible, contribute to its trial implementation in several diverse countries.

(4) A family's consumption and savings patterns, both in terms of physical investments and human capital formation, appears to be an observable function of desired and actual fertility. We are increasingly convinced that an important implication of a general household theory of fertility determination is that restricted fertility, whether permitted by improved birth control technology (i.e., family planning programs) or induced by other indirect changes in the parents' environment, leads to increased human capital formation in children, particularly among the remote, rural and less educated classes of a low-income society. Health, migration, schooling, and vocational training may therefore be personally distributed in a society in a very different and more equitable manner due to the adoption of appropriate population policies in many low-income countries.

Various methodological and interim reports should be presented to AID during the remainder of 1971, followed by a summary report on the project's major objective: a distillation and critical evaluation of alternative theories of fertility and the information strategy they imply for improved population policy-making.

## A Study of International Migration and Urban Population Pressures in Latin America

<i>Research Contractor</i>	<i>University of Wisconsin (L.T.C.)</i>
<i>Principal Investigators</i>	<i>Professors William Flinn, Eugene Havens and Marion Brown</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>July, 1970 to July, 1972</i>
<i>Contract Number</i>	<i>AID/csd 2863</i>

### **Purpose**

The population of Latin America will increase from 284 million in 1970 to 379 million in 1980. A major portion of this growth will occur in urban areas. Urban growth rates are nearly twice that of the population as a whole—6% compared with the 3% overall average. Internal migration is the main factor in this differential—more than offsetting the lower urban fertility levels.

While its importance is recognized, the relations between internal migration, urbanization, fertility and economic development remains unclear. Many studies have documented the massive rural to urban flow, and some, such as those of CELADE, have assembled valuable data on the characteristics of individual migrants. Much less is known about the structural correlates of migration, and the relationships between migration and other kinds of economic and social change. Existing studies provide an important basis for structural analysis, but they offer little information on which development policy makers can base programs and policies to affect the process.

The main purpose of the study is to analyze inter-community variation in the selectivity of migrants and to determine differential fertility rates and earning capacities before and after migration and between migrants and non-migrants. The study will utilize a panel design which consists of measurements of the same groups repeated two or more times at substantial intervals. Data from previous surveys are available for Bolivia, Peru and certain Central American countries. This project focusses on Colombia and Chile.

Five research sites are proposed which include areas previously studied by Flinn in Colombia and Brown in Chile. Information previously obtained will serve as the basis for this study's framework. The Land Center's offices in Santiago, Chile and Bogota, Colombia will assist in conducting the research with Professors Flinn, Havens and Brown on the local scene. The migration division of ASCOFAME in Colombia and similar indigenous supporters in Chile will collaborate. Three LTC Ph.D.'s in ASCOFAME will be involved.

### **Results**

The project is barely getting underway.

## Development of Methodology for Estimating Birth Rates, Death Rates, and Population Change from Interview Data

<i>Research Contractor</i>	<i>National Center for Health Statistics, USPHS</i>
<i>Principal Investigator</i>	<i>Walt R. Simmons</i>
<i>AID Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>December, 1965 to August, 1967</i>
<i>Contract Number</i>	<i>(PASA, RA-1-66)</i>

### **Purpose**

The objective of this project was to develop and evaluate a household interview procedure for accurately estimating annual birth and death rates in a given geographic area and which could be analyzed into components which would facilitate the development of procedures suitable to other areas. The areas chosen were parts of the State of North Carolina.

The procedure followed was to first measure the kind and amount of errors in reporting births and deaths from personal interviews in a survey and then to

develop, on the basis of this measurement, a survey instrument which would measure population change from the accurate recording of births and deaths.

The first phase of the project consisted of obtaining household samples from vital records of births and deaths, categorized into types, including special blocks of cases—institutional cases, migratory cases and non-migratory cases. The second phase, called the operating phase, provided for an evaluation of the measuring instrument designed in phase one.

NCHS retained general direction of this undertaking and contracted with the Research Triangle Institute of Durham, North Carolina, for developmental work and data collection. RTI contracted with the University of North Carolina for consultant services and with the North Carolina State Board of Health for data and consultant services.

#### Results

Field work on the project was completed early in 1967 and a preliminary report from RTI to the National

Center for Health Statistics was made in 1967. A final report on this project is still in preparation by RTI and NCHS which should be ready in the fall of 1971.

It was found that approximately 90% of the births and about 80% of the deaths were reported correctly. The final report has been delayed because of the difficulties involved in sorting out and evaluating the various techniques which were employed.

### Determinants of Human Fertility Patterns

<i>Research Contractor</i>	<i>RAND Corporation</i>
<i>Principal Investigator</i>	<i>Dr. T. Paul Schultz</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1968 to September, 1970</i>
<i>Contract Number</i>	<i>AID/csd-2151</i>

#### Purpose

The bulk of the work carried out under the project involved (a) identification of the environmental factors that influence the number of births parents want; (b) estimating their relative importance in parents' decisions; and (c) evaluating the relative cost effectiveness of measures to change them through family planning programs.

The role of public policy in influencing population growth in selected countries is a main focus, attempting to draw what generalizations are possible on both the optimal designs of family planning programs, and the leverage of governmental expenditures on health, education, housing and social infrastructure on family size and population growth. Or, in what ways do social and physical infrastructure and public policy on a variety of matters influence parents' desires toward a small family?

#### Results

RAND has issued to A.I.D. an Administrative Report covering the period from June 28, 1968 to September 30, 1970 and has issued three of four final substantive reports to A.I.D.

Reports on the Philippines, Pakistan, and Puerto Rico have already been distributed and a report on Taiwan is forthcoming.

The administrative report outlines the findings of these studies. Excerpts from the report on these studies are as follows:

(1) *Puerto Rico*

"Estimates for a simultaneous-equations model developed in this study should ultimately

provide a basis for a country-specific simulation model of short-run demographic and economic change."

(2) *Philippines Population Analysis*

"... claimed use of birth control methods influences neither family sizes ultimately attained nor the recent rate of bearing children among currently married women.

"Educational attainment has a pervasive influence on the model... more education is associated with later age of marriage but not with significantly fewer children when other influences are held constant.

"Those families with children participating in the labor force have significantly more children, and those that experience child mortality, and especially infant mortality, tend to exhibit higher 'replacement' fertility."

(3) *Retrospective Study of East Pakistan*

"A direct relationship is also confirmed between the death of a child and the subsequent probability of birth of another child to the mother."

(4) *Effectiveness of Family Planning in Taiwan*

"Presumably, advanced health and education programs in Taiwan are responsible for the widespread reduction in birth rates that emerged in the late 1950's, and these several programs may also have established the preconditions for increasing demand for and use of better methods of birth control in the more recent period."

# POSTPARTUM AND UTILIZATION STUDIES

## Evaluation Studies of an International Postpartum Family Planning Program

<i>Research Contractor</i>	<i>The Population Council</i>
<i>Principal Investigator</i>	<i>Dr. Bernard Berelson</i>
	<i>Dr. Gerald Zatzluni</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1967 to December, 1970</i>
<i>Contract Number</i>	<i>AID/csd-1565</i>

### **Purpose**

The objectives of this project: (1) to provide for additional financial support to the Population Council to continue to test the efficacy of its International Postpartum Family Planning Program through a large scale research demonstration in participating hospitals; (2) to learn how to maximize the amount of effective contraception among the target population in the community by focusing on delivery, abortion and other obstetrical cases; (3) to determine what impact a strong effort along these lines would have on both the direct acceptors (women who were obstetrical cases) and the indirect acceptors (women who were not obstetrical patients but who seek family planning services from participating hospitals).

### **Results**

The postpartum program is now operating under direct support of this project in 88 hospitals and large maternal and child health centers in 12 countries. Nigeria, Thailand, Indonesia, Ghana, Hong Kong, Iran, the Philippines, Mexico, Colombia, Venezuela, Honduras, and Turkey. Hospitals in other countries have continued services after the termination of support by the Population Council, and others have instituted programs independently as a result of the success in supported programs. Experience in Thailand, Malaysia, Singapore, Taiwan and Korea, has shown that MCH centers as well as hospitals can provide family planning information and services effectively, and the progressive extension of this concept to smaller health centers, or

even the midwife in individual practice, is anticipated. The postpartum programs in Nigeria, Ghana and Indonesia in 1969 established new thresholds for development in Africa and Asia. Successful experience with immediate postpartum insertion of IUDs and the administration of oral contraceptive "pills" (before the patient leaves the hospital) has substantially increased the number of direct acceptors. In many facilities the number of indirect acceptors (patients who accept family planning services more than three months after leaving the hospital or non-patients living in the area) has accounted for about half of total acceptors. In the majority of institutions, 10-20% of the total OB/AB case load became direct acceptors, and in some as much as 40-50% became active in family planning.

The active participation of both USAID and host country officials has been enlisted in such countries as Colombia, Venezuela, India, and Thailand, where the postpartum program is now being extended to many or most maternity hospitals, and is becoming a major component of the national programs. A book entitled "International Postpartum Family Planning Program: Report on a Two-year Action-Demonstration Study", will soon be published and widely distributed.

Latest information reveals that during four years, of the approximately 1,708,000 fertile women who received family planning instruction in the participating hospitals after delivering or aborting, over 552,000 women accepted a family planning method. This program is therefore one of the largest in the world in its own right.

## Utilization of Family Planning Services

<i>Research Contractor</i>	<i>Bowman Gray School of Medicine Wake Forest University</i>
<i>Principal Investigators</i>	<i>Clark E. Vincent, Ph.D. David K. Evans, Ph.D. Carl M. Cockrane, Ph.D. Clay Allen Honey, Ph.D. Fleetus Lee Gobble, Jr., M.D.</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1972</i>
<i>Contract Number</i>	<i>AID/csd-2512</i>

### Purpose

The purpose of this project is to ascertain and evaluate those factors which contribute significantly toward acceptance of family planning, those which contribute to indifference or apathy, and those which contribute to strong resistance. An attempt is being made to discover how to get the highest proportion of families to utilize family planning services. The researchers will try to: (a) discover which females do and do not utilize family planning services when they are available and why; (b) to discover necessary changes in approaches to existing family planning services; (c) to create new non-medical approaches; and (d) to evaluate the different family planning models.

Study of the different models involves discovery of different motivation variables involved when the subject is dependent upon a medical health services clinic or when the subject has become knowledgeable through the education system and informal instruction, does not have easy access to a health clinic or hospital. A second rationale is that the non-medical clinically oriented model may be more realistic in the LDCs when organized health services are unavailable. A third consideration assumes that effective fertility reduction will combine the two models, assuming minimum health services.

In general, the survey and measurement aspects as well as the development of the non-clinically oriented family planning model will follow, with modifications, the design already employed by the principal investigators during their work in North Carolina.

### Results

The contractor submitted to A.I.D. a "twelve-month Progress Report", covering the period from 7/1/69 to 6/30/70. This report describes the following accomplishments:

1. The project in Costa Rica was located within the organizational structure of Centro de Estudios Sociales y de Poblacion (CESPO) which is part of the University of Costa Rica. Authorization was obtained from A.I.D. for a subcontract by Wake Forest University with the University of Costa Rica. Mr. Daniel Gonzales was selected as the full-time Costa Rican Project Director.

2. In the period April-June 1970 - 1,128 interviews had been completed in six different clinic communities in Costa Rica.

3. Continuous feedback of data relevant to the action program will accompany the coding, data processing and analysis. Arrangements were completed to have all data made available to both the Costa Rican and U.S. professional personnel involved in the project.

4. The research instruments and the design were reviewed with Vincent at an August, 1970 meeting. A site visit to Bowman Gray was made in December, 1970. The project is on schedule. Questionnaires have been developed and data has been collected. A decision was made not to consider a second site until after the end of FY 1971.

## IMPROVED METHODS OF FERTILITY REGULATION

### Research for Development of Once-a-Month Contraceptive Pill

<i>Research Contractor</i>	<i>Worcester Foundation</i>
<i>Principal Investigator</i>	<i>Dr. Michael J.K. Harper</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1968 to February, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2169</i>

### Purpose

This project is aimed at the development of a once-a-month contraceptive pill based on a luteolytic substance produced by the uterus. Factors which control

the corpus luteum, an ovarian tissue necessary for the maintenance of pregnancy, have been studied and luteolytic agents causing regression of corpus luteum have been sought. Once the luteolytic substance has

been isolated, the luteolytic effects will be tested on cell cultures. Those fractions showing high activity will be further tested on ovarian transplants of sheep. The luteolysin substance will be chemically characterized using analytical equipment available at the Worcester Foundation.

If the above procedures can be carried out satisfactorily, a once-a-month contraceptive dose could be developed which can lead to a "natural regression" of the corpus luteum and prevent pregnancy from being established.

The research has the following objectives: (a) The establishment of basal steroid secretion rates from the transplanted ovary of sheep throughout the course of the cycle and the response of the ovary to gonadotrophins; (b) the isolation of the luteolytic substance or substances from the uterus of the sheep which have the property of diminishing steroid secretions from the transplanted ovary with particular reference to progestins; (c) the chemical isolation, purification and identification of such substances by special analytical procedures with a view to establishing

a simple single dose contraceptive; and (d) to test these substances in other mammalian species, including primates.

#### **Results**

The Worcester Foundation has studied factors which control the corpus luteum, an ovarian tissue which produces the hormone, progesterone, necessary for the maintenance of pregnancy. The research has sought luteolytic agents which cause regression of the corpus luteum. Work up to the present has shown that luteolysins can be found in blood coming from the uterus and that the prostaglandins act as luteolysins in several species of animals. The development of new hormone assay techniques has facilitated the collection of fundamental data on the hormonal interplay in the maintenance of pregnancy.

Based on the studies which have been completed, it is the intention for the future to pursue research on luteolysins in primates and to establish the pattern of ovarian and pituitary secretions and the interrelationship of these hormones at critical phases of reproduction.

### **RESEARCH INTO THE CORPUS LUTEUM FUNCTION**

<i>Research Contractor</i>	<i>National Institutes of Health, NICHD</i>
<i>Principal Investigator</i>	<i>Center for Population Research</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>May, 1969 to May, 1972</i>
<i>Contract Number</i>	<i>PASA RA(HA)-8-69</i>

#### **Purpose**

The Center for Population Research in NICHD-NIH has undertaken a long-term research and development effort in contraceptive methods. The purpose of this research is to develop a once-a-month pill or method which could be taken or employed by a woman once during the month or at the time of her expected period which would permit her to have her period and prevent pregnancy.

The corpus luteum is a hormone-producing structure which forms in the ovary shortly after the release of the egg. If the role of the corpus luteum function in the initiation and continuation of the reproductive process in humans can be established and if ways to control its function can be discovered, the way will be open to develop a once-a-month contraceptive.

The areas being covered by the NIH research under 28 contracts with universities and other research organizations include the following:

- (a) Refinement of micro methods to measure various hormones relating to the corpus luteum,

with special emphasis on gonadotrophin releasing factors which link the pituitary and the brain;

- (b) The role of female sex hormones in the initiation and maintenance of early pregnancy;
- (c) Systematic search and analysis of agents inhibiting the corpus luteum function;
- (d) Identification and study of progesterone receptors, development of means to block progesterone binding, and the mechanisms of action of these agents within the cells;
- (e) Identifying and measuring hormone patterns of the menstrual cycle. The temporal relationship of the various hormone secretions and the importance of specific hormones which result in the development of the corpus luteum.

#### **Results**

Funds were not provided beyond 1969. The completion of the project is now being financed by NIH funds.

**Contraceptive Development: A Method to Prevent Pregnancy by  
Direct or Indirect Anti-Progestational Activity**

<i>Research Contractor</i>	<i>Population Council</i>
<i>Principal Investigator</i>	<i>Dr. Sheldon J. Segal</i>
	<i>Rockefeller University</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2491</i>

**Purpose**

The objective of this project is to conduct laboratory and clinical studies of anti progestins as a means of fertility control.

A successful intra-uterine pregnancy requires adequate progestational preparation and maintenance of the endometrium. Interference with progestational stimulation of the endometrium before or at the time of nascent implantation is the fundamental basis on which the proposed new mode of contraception will be developed. Three approaches to achieve this result will be pursued concurrently:

(1) *Synthetic compounds, active orally, that have anti-progestational activity.*

Several pharmaceutical companies and independent organic chemists have sought steroid inhibitors of implantation by examining a variety of compounds for their anti-progestational activity. The toxicology and pharmacology of one of these compounds has been studied so that it is ready for immediate clinical trial.

**Results**

As envisaged, the mechanisms to be pursued include interruption of progesterone production at the site of production; i.e., the corpus luteum, neutralization of circulating progesterone or competitive antagonism of progesterone at uterine cell binding sites. Negotiation of a subcontract with Cutter Laboratories has been authorized to synthesize specific compounds which have anti-fertility activity, prostaglandin derivatives, and to establish an anti-fertility screening test. Three subcontracts have also been let to university investigators working in fields related to progesterone binding or synthesis.

The Population Council is undertaking anti-fertility and anti-progestational tests in primates of promising compounds derived from the above sources.

Immunological studies are also being carried out, targeting on the synthesis of an enzyme involved in progesterone synthesis.

**Development of Inhibitors of L-H Releasing Factor as  
Contraceptive Factors**

<i>Research Contractor</i>	<i>Salk Foundation</i>
<i>Principal Investigator</i>	<i>Dr. Roger Guillemin</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2785</i>

**Purpose**

This proposal to develop a new contraceptive is based on the fact that a part of the brain, called the hypothalamus, controls secretions of the anterior pituitary gland. The anterior pituitary secretes hormones called gonadotropins (e.g., L-H or luteinizing hormone and FSH follicle-stimulating hormone) which, in turn, control endocrine activities of the reproductive organs necessary to initiate and maintain pregnancy.

The brain and the anterior pituitary are linked by chemical agents called releasing factors. This proposal is concerned with determining the chemical structure of one of these releasing factors, particularly luteinizing hormone releasing factor (LRF) which ultimately controls endocrine processes necessary to pregnancy.

When the chemical makeup of LRF is determined, it will be possible to attempt synthesis of chemicals which interfere with its activity and therefore prevent conception and possibly disrupt early pregnancy. It is hoped that these chemicals may be active orally and may be effective on a once-a-month basis with few of the systemic side effects of the present oral contraceptives.

It is proposed: (1) to isolate the LH and FSH gonadotropin releasing factors and establish their molecular structure; (2) to synthesize these molecules as well as a series of various analogs with LRF activity; (3) to synthesize analogs of LRF with anti-LRF activity as inhibitors of the secretion of LH, thus acting as anti-fertility agents; and (4) to initiate chemical studies with these substances.

**Results**

During the first 6 months that this project has been underway, Dr. Guillemin's group has succeeded in

isolating hypothalamic LRF and in establishing its partial structure. Work is proceeding on the total structure.

### Prostaglandin and Contraceptive Research Development

<i>Research Contractor</i>	<i>Worcester Foundation</i>
<i>Principal Investigator</i>	<i>Dr. Michael J.K. Harper</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2837</i>

**Purpose**

Presently available contraceptive techniques still have many limitations when used in the developing countries. A convenient non-toxic contraceptive would both facilitate use by those with lower levels of motivation for family planning and mitigate the necessity for expensive medical and public health infrastructure. The widespread use of abortion in all societies, even where it is illegal and therefore dangerous, points up the importance of developing methods which are effective after conception. Any single contraceptive is not likely to be ideal for all individuals.

This project intends to finance the work of several scholars at the Worcester Foundation in research into several phases of reproductive physiology. Subjects of research include the following:

**(1) Prostaglandin Research**

Prostaglandins are fatty acids with wide distribution in mammalian tissue. The anti-fertility potential of prostaglandins relates to their ability to induce menses and terminate pregnancy.

**(2) Development of Agents Which Inhibit Corpus Luteum Function**

Some experiments have been conducted on women, using a steroid obtained from a pharmaceutical company which was an effective inhibitor. It has been speculated that any steroid capable of inhibiting steroid dehydrogenase activity might decrease the synthesis of progesterone by the corpus luteum, and thus, be an effective contraceptive agent.

**Results**

To date, prostaglandins have been obtained and development of a radio-immuno assay for prostaglandins has been initiated. Also, the following subcontracts are being negotiated:

- (1) Physical Chemistry Assay for Prostaglandin - Dr. Samuelsson - Sweden
- (2) Total Biosynthesis of Prostaglandin - Dr. Corey - Harvard
- (3) Clinical Trials Using Prostaglandins - Drs. Speroff and Anderson - Yale
- (4) Information Center on Prostaglandins - Dr. Shilling - George Washington University

### Safety of Contraceptive Steroids

<i>Research Contractor</i>	<i>Southwest Foundation for Research and Education</i>
<i>Principal Investigator</i>	<i>Dr. Joseph W. Goldzieher</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2821</i>

**Purpose**

Certain steroid hormones are the active agents in the widely used oral contraceptives and in other, as yet experimental methods, using injection and implantation techniques. These methods form one of the major technologies for conception and population control. While their effectiveness and acceptability is proven, their safety in long-term use and in a variety of

populations is not established, and the possibility of undiscovered hazards has received considerable attention. The object of this research is to examine these questions intensively and from a variety of perspectives, ranging from inquiries as to the mechanisms of action, to metabolic fate within the body, and to effects on organ systems not directly involved in the contraceptive action.

Investigation will be carried out in the following areas:

(1) *The metabolism of contraceptive estrogens*

Since these compounds are of fundamental importance in all current oral contraceptive preparations, and since the compounds themselves or their metabolites may be involved in the alleged hazards of these agents, a thorough study of their metabolism and its individual variations is imperative.

(2) *Adverse endocrine effects of contraceptive steroids*

The relative effectiveness of ethynyl estradiol and mestranol as ovulation inhibitors will be studied. There will also be an examination of the hypothalamic-pituitary effects, a study of the adrenal effects and of the interaction of gonadal hormones and the adrenal.

(3) *Long-term studies of carbohydrate and lipid effects*

Studies of long-term uses will be made. Of particular interest is the difference between sequential and combination type oral contraceptives.

The lipid effects studies will include studies of plasma cholesterol, triglycerides and lipoproteins

on patients using various types of oral contraceptives, and correlate these with studies of carbohydrate metabolism, and with studies of the adrenal function.

(4) *Studies of thromboembolic disease*

It is planned to review the reported pathological lesions and, in particular, to see if any such lesions are found in autopsy material from pregnant women, particularly those who have or have not undergone thrombotic episodes.

### Results

(1) Examination of material from endometrial biopsies taken from subjects in Mexico City on oral contraceptives and read as to the morphology of endometrial sinusoids has failed to confirm the British study which allegedly correlated changes in endometrial vasculature accompanying use of oral contraceptives with clinical signs of systemic vascular disorders such as headache, nervousness, etc.

(2) A study was initiated to see if early lesions of diabetes occur in women whose carbohydrate metabolism has been changed by oral contraceptives.

(3) Radio-active reference compounds are being obtained for studies of metabolism of steroidal contraceptives.

### Combined V D - Prophylactic Contraceptive

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Contract Number*

*University of Pittsburgh*  
*Dr. John C. Cutler*  
*TAB, Office of Population*  
*June, 1970 to June, 1973*  
*AID/csd-2822*

### Purpose

A combined V.D.-prophylactic contraceptive will facilitate the introduction of family planning into ongoing V.D. control programs and other public health programs at a minimum expenditure of professional manpower and high probability of utilization. Many LDCs have V.D. control programs. It will be politically acceptable, particularly in countries in Africa and Latin America where family planning efforts are best combined with health and preventive medical programs.

The research will involve two stages:

(1) The testing of vaginal contraceptives and anticeptics for gonococidal and spermicidal effects, conducted in the conventional manner of bacterial sensitivity testing.

(2) Field trials will be conducted in Allegheny County, Pennsylvania and Jamaica, West Indies. The product will be introduced into existing V.D. control programs, and its efficiency in reducing the re-infection rates in recidivist patients will be estimated.

### Results

During the first 6 months of this project, some 40 different commercially available vaginal products have been screened for their efficacy against venereal disease and other infective agents. Certain preparations have also been tested for their spermicidal abilities. Further *in vivo* tests in rabbits are planned using those preparations which look promising from the initial screening.

## I.U.D. STUDIES

### Development of IUD and Controlled Release Contraceptives

<i>Research Contractor</i>	<i>Battelle Memorial Institute</i>
<i>Principal Investigator</i>	<i>Robert G. Wheeler</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>June, 1970 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd-2819</i>

#### Purpose

The Battelle Institute is undertaking to experiment with new materials and designs utilizing bioengineering analysis in order to develop an IUD with minimum side effects.

The program for IUD development will include materials development, materials characterization and appropriate animal and clinical trials. The development of a holograph technique using ultrasound for uterine imaging will support the investigation of uterine reaction to new IUD designs.

The four main tasks selected for study are: (1) intrauterine contraceptive device development; (2) control release of active agents in contraceptives; (3) uterine imaging and (4) fallopian tube imaging.

The reasons for undertaking a project of this kind lie in the fact that existing IUD programs are seriously hindered by problems associated with side effects and a

high rate of expulsion of IUDs. Unless more efficient IUDs can be developed, the progress of family planning programs in many countries will be threatened.

#### Results

Mechanical characteristics and tissue reactions to currently available IUDs and to potential materials for IUD construction have been evaluated.

Potential combinations of polymers and active agents have been identified for use in development of new and improved devices for controlled release of active agents. Preliminary release rate experiments have been performed with various combinations of polymers and active agents.

Further technical development on the acoustic holography technique has demonstrated the feasibility of observing the interaction between an IUD and the endometrium.

## REVERSIBLE STERILIZATION

### Research on Reversible Sterilization

<i>Research Contractor</i>	<i>University of North Carolina</i>
<i>Principal Investigator</i>	<i>Dr. J. F. Hulka</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Population</i>
<i>Duration of Project</i>	<i>May, 1969 to May, 1972</i>
<i>Contract Number</i>	<i>AID/csd-2504</i>

#### Purpose

In some countries, particularly India, sterilization as a means of contraception has been fairly widely accepted. Traditional sterilizations involve the excision and tying off of the vas deferens or fallopian tubes, and reversibility is accomplished only by difficult surgery which frequently is not successful. Sterilization has two major limitations: first, fairly skilled surgeons are required, and, second, acceptability is limited because of the irreversibility of the operations.

This research seeks to develop new procedures for sterilization which require a relatively lower degree of medical skill, and which are more reversible. Research on two types of reversible methods is being carried out. One calls for an evaluation of a tantalum clip which would

serve as an occluding device for the vas deferens and the fallopian tubes. A second method involves the development of a plastic occluding device to block the fallopian tubes.

Both techniques would be evaluated in terms of blood hormone levels, sperm count, and atrophic changes within animals and people. Possible psychological effects in humans are also to be assessed. The animal research, laboratory studies, and clinical studies on female sterilization are being conducted at the University of North Carolina.

#### Results

Comparative studies on "Tubal Occlusion" have been completed, including research on chemical

occlusive agents, electro-cautery through the cervix, cyrosurgery, clips, and comparative animal studies.

Results show that the utero-tubal junction appears to be remarkably resistant to physical or chemical agents inducing destructive lesions.

Results of clip applications were more encouraging.

North Carolina has made arrangements for redesign and development of clips with instrument manufacturers and is experimenting with a variety of devices for inducing occlusion of the vas and the fallopian tubes. Many experiments have been performed on dogs, cows, rats, rabbits and guinea pigs—and some progress has been registered in developing simpler and safer occlusion techniques. As a consequence of findings to date, several new and important areas for further research have been delineated.

Recent progress has involved negotiations with manufacturers to develop a laparoscopic approach to female sterilization by developing a clip appropriate to be inserted through a laparoscope. One such model has been tested in pigs. To date none of the pigs receiving these clips have become pregnant.

An experiment underway for two months for the production of a local antibody to sperm placed in the cervical canal of 6 cows has progressed successfully to date. Antibodies have been detected in the cervical mucus and in the blood, and none of the cows have become pregnant.

A methodological breakthrough in vasectomy studies has been achieved with the successful imbedding of vas tissue in a plastic rather than wax for histological evaluation of various plastic devices implanted in the vas.

## V. EDUCATION AND HUMAN RESOURCES

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## EDUCATIONAL CURRICULA

### Research and Development in Beginning Science Curricula for English-Speaking Tropical Africa (African Primary Science Program)

<i>Research Contractor</i>	<i>Educational Development Center, Inc.</i>
<i>Principal Investigator</i>	<i>James L. Aldrich</i>
<i>A.I.D.</i>	<i>Bureau for Africa, Office of Technical Assistance Coordination</i>
<i>Duration of Project</i>	<i>February, 1965 to June, 1971</i>
<i>Contract Number</i>	<i>AID/CSD-772</i>

#### **Purpose**

The purpose of this project is to demonstrate the feasibility of, and provide the means for, developing new curricula in modern primary school science appropriate to the English-speaking countries of Tropical Africa. It aims at ultimately introducing science in African primary schools where such curricula do not exist and raising the standards of such curricula where they do exist, through introducing new problem solving approaches to primary science teaching in many of the developing nations. There are seven participating African countries: Kenya, Tanzania, Uganda, Zambia, Nigeria, Sierra Leone and Ghana.

The justification for the project lies in the considerations that: (1) a sound grasp of scientific phenomena and problem solving techniques is essential for sizeable portions of the population; (2) the primary science curriculum is either negligent or inadequate in all African countries; and a new primary science curriculum development program, involving Africans from the start, would not only produce superior instruction in primary school science but would also demonstrate an effective process whereby reforms in other subjects could be affected.

#### **Results**

Science curriculum development centers were established in each participating country where instructional materials were developed and tested by teams of U.S. and local science teaching experts. Teacher guidebooks have been developed for use in teacher

training colleges, in-service workshops and by individual classroom teachers. Materials prepared for classroom use have been tested and retested. Expertise in conducting continuing project evaluation is being sought amongst the participating African countries and educational administrators.

A total of 70 science teaching units were planned initially; however, this was later reduced to 50 units. These units with supportive instructional equipment and teacher guides represent a comprehensive program for a primary science curriculum in an African country. The scientific equipment required for teaching can be locally produced, most of it by the students themselves or by their teachers at extremely low cost. Materials are in use in over 3,500 African classrooms and over 3,750 teachers and teacher educators have been introduced to the materials either by helping develop them or in preparation for use of the units in their African classrooms.

Emphasis is being continued on strengthening ongoing curriculum development centers, including personnel training. Efforts are being continued to develop regional and national organizations required to transfer program management to African control. This includes publication and distribution of science units and other teaching materials in primary science. The Science Education Programme for Africa (SEPA) came into existence in 1970 with a governing Representative Council, an Executive Committee, and an Acting Executive Secretary. A formal constitution and the formulation of a plan of action has been developed.

## Mathematics Curriculum Development in Africa

<i>Research Contractor</i>	<i>Educational Development Center, Inc.</i>
<i>Principal Investigator</i>	<i>Prof. W. T. Martin</i>
<i>A.I.D. Monitor</i>	<i>Bureau for Africa, Office of Technical Assistance Coordination</i>
<i>Duration of Project</i>	<i>May, 1962 to June, 1970<sup>1</sup></i>
<i>Contract Number</i>	<i>AID/csd 1567 and RES 21</i>

### Purpose

The purpose of this project was to demonstrate the feasibility of and provide the means for developing new curricula in modern mathematics appropriate to the English-speaking countries of Tropical Africa. The effort was to be aimed ultimately at raising the standard of primary and secondary school mathematics instruction in Africa through introducing the new problem-solving approaches to mathematics instruction which are revolutionizing teaching in the developed nations.

The contractor undertook to accomplish the following things: (a) arrange for key African mathematicians and educators to work with American consultants to develop standards, plan teaching strategies, and write mathematics texts and materials at a series of summer work shops in Africa; (b) arrange for the newly written material to be printed and tried out in schools throughout the African countries and subsequently to be revised; (c) conduct seminars and short training courses for teachers to prepare them for teaching the new mathematics, with methods which emphasize learning through inquiry rather than memorization; and (d) to provide assistance to African ministries of education in planning the utilization of the new curricula.

The participating countries were: Ethiopia, Ghana, Kenya, Liberia, Malawi, Nigeria, Sierra Leone, Tanzania, Uganda, Zambia and Tanzania.

### Results

The Educational Development Center (EDC) developed new mathematics curriculum materials cooperatively with African educators and initiated training programs for African teachers. It also successfully introduced new methods and approaches to mathematics teaching into a number of African countries. Experimental programs were developed in the participating countries named above. Sixty-six volumes of primary and secondary mathematics textbooks and teacher guides and three teacher training films have been developed. By the close of calendar year 1970, 4,700 teacher educators have been introduced to this material at 71 incountry institutes and African children in nearly 2,000 classes were being taught this modern approach to mathematics. West and East African Mathematics Management Committees had been organized.

Beginning in fiscal year 1970, responsibility for managing and funding this project was assumed by the Africa Bureau of AID and it ceased to be a central AID research project. Plans of the Africa Bureau involve continued revision of mathematics materials and the adaptation of teaching methods to local African countries through regional work shops, institutes and meetings. Assistance will also be given to developing the regional and national organization structures required to transfer management and operational responsibilities to African control, including publication and distribution of textbooks and other learning materials. EDC will continue to assist in the various aspects of this project.

<sup>1</sup>Management and funding responsibility was transferred to the AID African Bureau in fiscal year 1970.

## EDUCATIONAL TRAINING TECHNIQUES

### Research on New Techniques for Training Teachers of English

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Paul Schwarz and Robert Krug</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Education &amp; Human Resources</i>
<i>Duration of Project</i>	<i>June, 1962 to February 1970</i>
<i>Contract Number</i>	<i>AID/Repas-13 and AID/csd 1555</i>

### Purpose

This research and development project has had as its purpose the creation of a system of programmed self-instruction for the training of teachers of English in

developing countries. The first three phases were completed by another contractor, English Language Services, Inc., from July 1962 to November 1965. The research and development phases were all conducted in the U.S.

Phase I consisted of a series of analyses of classroom teacher behavior, with the purpose of developing a descriptive statement of high-level teacher behavior and the development of prototype instructional materials. The second phase was a system, which emerged as an integrated program of films, tape recordings, texts and workbooks, designed so that a trainee could train himself to teach within about four months. The third phase consisted of a small-scale tryout of the assembled system using foreign students in the U.S. and American students.

Phase IV, conducted by the American Institutes for Research, was the overseas experimental evaluation. This brought the project to its conclusion. Phase IV as originally conceived provided for tryouts in four major geographic regions.

Sites selected were Hyderabad, India, Caracas, Venezuela and Singapore. Since the Ford Foundation had underwritten tryouts in Nigeria, it was later decided that tryouts in Africa would be unnecessary.

### Results

As a result of the overseas experimental evaluation, it has been concluded that:

1. This self-instructional program can produce measurable changes in some of the component skills of teaching English as a second language.
  2. It can do this without the presence of a linguist or a skilled teacher.
  3. It engages and holds the interest of teachers and students preparing for teaching. This holds for trainees of remarkably diverse backgrounds.
  4. Despite its space-age appearance, the console is relatively simple in terms of its mechanical and electronic components; it is no more complex to maintain than a language laboratory.
  5. The program is no more expensive than traditional classroom approaches. It should, however, be made less expensive in a newer version.
  6. It is flexible; its components can stand alone with very minor modifications.
  7. The program is amenable to local modifications which increase its responsiveness to problems peculiar to a particular first language.
- All in all, the program is a workable alternative to more formal methods and merits serious consideration for a variety of purposes. It can be used with profit as it now stands in many places in the world.

### Evaluation of A.I.D. Participant Training Facilities in the U.S.

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*  
*Duration of Project*  
*Project Number*

*American Institutes for Research*  
*Dr. Robert O. Dugan*  
*Office of International Training*  
*June, 1962 to June, 1963*  
*AID/REPAS - 11*

### Purpose

The objectives of the study were: (1) to learn what kinds of information could be obtained from U.S. training facilities on the content of training programs, the size, quality and character of facilities and the nature of administrative communications; (2) to assess the usefulness to A.I.D. of these types of information in its planning, programming and implementation of training; and, (3) to test various data gathering instruments.

The survey was limited to a pilot study of 41 organizations located in three areas, the Pacific Coast, Chicago, Detroit and New York State. A total of 133 people with widely varied roles were interviewed; the data collected was analyzed and resulted in approximately 51,000 units of information.

### Results

The contractor submitted a technical and an executive report. These reports describe the project and present the findings.

The training facilities had many suggestions for improving the efficiency of the participant program in the U.S. Chief among these was the necessity for over-all improvement of communications between AID/W and the persons who actually carry out the training.

Others dealt with increasing English language efficiency, better methods for evaluating different educational backgrounds to improve placement of participants and a standardization of procedure through the training facilities with the government agencies that program the training.

The Technical and Executive Reports were distributed to appropriate AID/W staff and sent to USAIDs. Comment suggesting remedial action was solicited. AID/W considered these recommendations, together with recommendations from other sources, in reorganizing the staff of the Office of International Training in 1964.

## Overseas Evaluation of the Participant Training Program

<i>Research Contractor</i>	<i>Bureau of Social Science Research, Inc.</i>
<i>Principal Investigators</i>	<i>Dr. Robert Bower and Mr. Albert Gollin</i>
<i>A.I.D. Monitor</i>	<i>Office of International Training</i>
<i>Duration of Project</i>	<i>May, 1962 to November, 1965</i>
<i>Project Number</i>	<i>ICA - 1891</i>

### Purpose

The main objectives of the World-Wide Evaluation survey of the participant training program were: (1) to measure the degree of utilization of training and the dissemination of resulting knowledge and skills to others; (2) to ascertain whether or not training was at an appropriate level, of good quality, and relevant to the need of the participant in his home country context; and (3) to identify weaknesses in program planning and implementation.

The contractor, in collaboration with A.I.D., designed and produced standard survey materials and methods, i.e. questionnaires, instruction manuals, coding systems and tabulation and reporting guides. The standard survey material was used by all countries. The global report analyzed data from 23 countries and the four regional reports cover data from 30 countries. The total number of participants covered in the 30 countries was 25,702. The contractor completed special studies from the data for the Office of Public Safety, A.I.D. Health officials and State Department officials. He also prepared several country reports where the Missions were unable to do them.

### Results

The primary recommendations were: (1) to increase follow-up activities on returned participants, particularly on their contacts with USAID; (2) to involve the participant in the pre-departure planning of his program and establish its link with his last program work more securely; (3) that longer term training should be reduced; (4) that supervisors should be actively employed in selection and planning; (5) that definite plans for using a participant's training on his return should be formulated by the USAID at the LDC at the time the training is planned.

These findings have been given wide distribution within AID/W. Individual country reports were distributed to USAIDs, other government agencies, and to private institutions and universities. USAIDs have been able to establish and maintain follow-up programs based on the findings of the survey. Several manual orders were issued dealing with pre-departure aspects of training and with establishing and implementing a follow-up program. Resulting from this study, an exit-interview for participant trainees, has been incorporated as a routine procedure for trainees departing from the U.S.

## EDUCATION INSTITUTION BUILDING

### Development of an Educational Research Center for Central America

<i>Research Contractor</i>	<i>Michigan State University (and University of San Carlos, Guatemala)</i>
<i>Principal Investigator</i>	<i>Dr. Karl T. Hereford</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Education &amp; Human Resources</i>
<i>Duration of Project</i>	<i>June, 1962 to March, 1965</i>
<i>Project Number</i>	<i>AID/Repas - 7</i>

### Purpose

This project had two related purposes. The first was to provide a mechanism for conducting fundamental research, surveys, and planning studies in secondary, special, and higher education as a service to educational institutions, agencies, and governments in Central America. The training of Central Americans in planning and research was to be a part of these activities. The

second purpose was to attempt to institutionalize, as a regional center for educational research and planning, the apparatus set up to conduct research and training. This attempt was viewed as a two year demonstration project, with the assumption that support from other sources would then become available.

This activity was undertaken in support of the efforts at regional development in Latin America that

were eliminated by the birth of the Alliance for Progress. The studies to be produced were expected to emphasize and support a regional view of educational development, and the institution was expected to provide a basis for cooperation both among the Central American Universities and between them and American educational research and planning experts.

### Results

The project produced a number of research, survey and planning studies on important topics and provided graduate training for a small number of educational leaders. Nineteen research and survey studies in fundamental problems of Central American secondary, technical, teacher and special education were published and widely distributed. Planning studies were

undertaken for the University of Costa Rica, for the University of San Carlos, and, in the area of secondary-school teacher training, for the five Central American Ministries of Education and the seven university level training institutions. Four research assistants and two research associates were trained. Of the former, two became university professors, one became a UNESCO official in Central America, and the fourth became Director-General of Education of the Guatemalan Ministry of Education. A professional materials center was established on Central American education which was turned over to ROCAP.

The full potentiality of this project was not realized for a variety of reasons. It did serve, however, to lay a professional groundwork for educational planning in Central America.

## LITERACY, EDUCATIONAL MEDIA, APTITUDE TESTING AND EDUCATIONAL PLANNING

### Impact of Literacy on a Guatemalan Peasant Community

<i>Research Contractor</i>	<i>University of South Florida</i>
<i>Principal Investigator</i>	<i>Peter C. Wright</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Education &amp; Human Resources</i>
<i>Duration of Project</i>	<i>June, 1965 to February, 1967</i>
<i>Contract Number</i>	<i>AID/esd 843</i>

### Purpose

This project was the third phase of a literacy research program begun in Guatemala in 1961. In the first phase (1961 - 1963), under U.S. Office of Education auspices, four generations in a peasant community were studied in depth in a first assessment of the manner in which literacy effects changes in personal behavior and in social and economic status. In the second phase (1962 - 1964), a general evaluation of a pilot program in literacy was undertaken. (This phase was supported in 1964 by AID/Guatemala.)

This third phase of the research was concerned with intensive studies of the people of two rural communities. One community had an active literacy program; the other had a program which terminated before the study began. All 750 adult villagers in both villages were given a literacy test, and from there, samples were chosen for intensive study. A series of interviews and tests were given. The resulting data includes both information on such socio-economic facts as family background, educational background, housing, and land ownership, and on such individual behavior as agricultural practices, health and nutrition practices, travel, mass media exposure, and use of literacy skills. In addition, underlying psychological differences were assessed in terms of achievement motivation, degree of

dissatisfaction with life, and the ability to imagine oneself in new situations.

### Results

The product of the study was a report entitled "The Impact of a Literacy Program in a Guatemalan Ladino Peasant Community", University of South Florida, 1967.

The advantage of a cross sectional study of this kind lies in information produced which measures differences between populations at a given point in time rather than changes which have taken place in one population over an elapsed period of time. "Whether superior practices in economics, health, diet or greater mobility and exposure to mass media are products of literacy or simply correlatives of a high degree of intellectual functioning and achievement motivation cannot readily be established in a study of this kind. There is evidence that the bright illiterate closely resembles the bright literate in many practices and the dull people, whether literate or illiterate, have much in common. It is certain that the bright, highly motivated illiterate peasant will avail himself of the opportunity to become literate and that literacy classes are a screening device for those brighter individuals.<sup>1</sup>

<sup>1</sup>Remarks of A.I.D. Monitor.

## Research on the Feasibility of Applying New Educational Media in Developing Countries

<i>Research Contractor</i>	<i>International Institute for Educational Planning</i>
<i>Principal Investigator</i>	<i>Professor Wilbur Schramm</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Education &amp; Human Resources</i>
<i>Duration of Project</i>	<i>June, 1965 to May, 1967</i>
<i>Contract Number</i>	<i>AID/csd 844</i>

### Purpose

In respect to the feasibility of applying new educational media in LDCs, the project sought to provide answers to the following questions: (a) what are the actual costs of using these new media (e.g. television, radio, films, programmed instruction and correspondence?); (b) how do initial costs compare with longer range costs?; (c) what practical administrative and logistical problems must be anticipated and overcome?; (d) how much time is required to get the new system functioning satisfactorily?; (e) what problems of cultural incompatibility must be dealt with? Without better understanding of such matters, the feasibility of new proposals can not be appraised and educational planners cannot know how much or little help to expect from the new media.

### Results

Teams of economists, educators, and social scientists observed 24 educational technological projects in some 15 less-developed and developed countries. They

wrote for each a case study, both descriptive and evaluative in character, including the cost analysis for the project as currently operated and cost projections for the operations on a larger scale. Case studies were completed for media projects in the U.S., Italy, Niger, New Zealand, Honduras, Nigeria, Colombia, Peru, the Ivory Coast, Togo, American Samoa, Thailand, India, Japan, and Australia.

In addition to the three volumes of case studies, a summary analysis was prepared, entitled, "The New Media; Memo to Educational Planners" by Wilbur Schramm, Philip H. Coombs, Frederick Kohnert, and Jack Lyle. This publication, issued by the International Institute for Educational Planning, considers (1) what problems are the new media being used to solve?; (2) how effective are they proving to be?; (3) how are they used most effectively?; (4) what do they cost?; and (5) how should their use be planned?

The four volumes were circulated in several thousand volumes to all A.I.D. Missions, UNESCO, and to planners in the developing countries. The Memo volume was also made available in French and Spanish.

## Research and Development of Aptitude Testing

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Dr. Paul Schwarz</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Education &amp; Human Resources</i>
<i>Duration of Project</i>	<i>May, 1965 to August, 1968</i>
<i>Contract Number</i>	<i>AID/csd 798</i>

### Purpose

The objective of this project was to assist developing countries in devising effective selection and guidance procedures for their populations and to establish testing institutions for training of indigenous personnel in the research necessary and the services needed to improve the assessment of human resources in all sectors of the economy.

Three initial phases of this project were limited to the Africa region. During these phases, experimental research was carried on in Nigeria, specialists and an institutional framework were developed and the Nigerian

experience was generalized to other African countries. The fourth phase, with which this project is concerned, was aimed at further extension of the program outside of Africa.

The contractor's representatives worked with indigenous professional personnel in Korea, Thailand and Brazil to devise the tests necessary for the culture in determining aptitude for education at various levels. Indigenous people were to be trained in the techniques required for standardizing reliable and valid measures of aptitudes and abilities and an advisory council was established to determine policy questions for use of the testing services.

Personnel were assigned to Rio de Janeiro, Brazil, Seoul, Korea, and Bangkok, Thailand to work with USAID and ministry of education officials. The ultimate objective was to institutionalize the techniques evolved for aptitude testing in the indigenous environments so that personnel training and placement activities could be carried on after the project was completed. To date, this effort to establish aptitude testing institutions has been successful in all participating countries.

#### **Results**

One of the important products of the project was the development of a "Handbook on Testing in the Developing Nations." This book contained the following chapter headings: I Basic Issues (Tests & Cultural Factors: Study of Needs and Resources); II The Adaptation of Standard Tests to Suit the Needs of Developing Countries; III Illustrative Test Applications; and IV Institutionalizing a Testing Program.

### **Research on Practical Uses of Cost Analysis to Improve Educational Planning and Efficiency**

<i>Research Contractor</i>	<i>International Institute for Educational Planning</i>
<i>Principal Investigator</i>	<i>Dr. Philip Coombs</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1968 to June, 1970</i>
<i>Contract Number</i>	<i>AID/csd 1950</i>

#### **Purpose**

The purpose of this project has been to demonstrate to practicing educational planners and administrators in developing countries the various uses of cost analysis in educational planning. A manual has been prepared covering the uses of cost analysis in educational planning and synthesizing some of the results of the individual studies.

#### **Results**

A total of 27 reports were prepared, some with non-AID funding. The areas of the studies include:

costing and testing the feasibility of educational plans, costing and/or testing the allocation of available resources, rational allocation of available resources, alternative approaches to the same objectives, efficiency and productivity, and cost behavior with the aim of later improvement. The countries studied include five in Africa, four in Latin America, two in Asia, three in the Communist Bloc, and four in the OECD. Studies were made of primary, secondary, technical, higher, student training, and non-formal education.

## VI. INSTITUTIONAL AND SOCIAL DEVELOPMENT

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## BUILDING DEMOCRATIC INSTITUTIONS (TITLE IX)

### Research on Participation Patterns in Modernizing Societies

<i>Research Contractor</i>	<i>Harvard University</i>
<i>Principal Investigator</i>	<i>Prof. Samuel Huntington</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1972</i>
<i>Contract Number</i>	<i>AID/csd 2502</i>

#### Purpose

Under this contract three types of participation - economic, social, and political - in two sectors - rural and urban are being examined. The contractor will seek to examine the interaction between these types of participation and how the links between them in any country contribute to an overall pattern of participation. He will, moreover, analyze the reasons for the emergence of particular patterns of participation. Finally, the contractor will explore the impact on participation of different overall country and sector patterns of development.

To carry out the above, three types of studies will

be made: (1) theoretical models, (2) empirical cross-country studies, and (3) country case studies.

The project is headed by a leading U.S. expert in the field of political and social modernization, and will include scholars from both the U.S. and developing countries. The association of the Harvard Center of International Affairs (research contractor) and other elements of the Harvard community, especially the Project for Quantitative Research in Economic Development, the Development Advisory Service, and the Project on Social and Cultural Aspects of Modernization, promises to result in stimulating insights leading to a rewarding research undertaking.

### Research Into the Implementation of Title IX Objectives

<i>Research Contractor</i>	<i>Northwestern University</i>
<i>Principal Investigator</i>	<i>Dr. Erma Adelman</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>February, 1969 to September, 1970</i>
<i>Contract Number</i>	<i>AID/csd 2236</i>

#### Purpose

This project is designed to provide a set of more clearly defined and measurable criteria of participation in the social, economic and political spheres; a data base on participation; and from analysis of these data and criteria, some new hypotheses regarding the interaction of political, social and economic participation.

#### Results

The researchers have: (a) devised a conceptualization of the category of political participation; (b) classified 74 countries by extent of

political participation; (c) cross-checked these classifications by contact with expert sources; and (d) begun discriminant analysis of salient differences among countries grouped by extent of political participation and level of socio-economic development. In the first phase of the study Northwestern focussed primarily upon political participation. The second focussed on measuring levels of economic participation. The thrust will be directed towards defining and developing statistical correlations on social and economic participation in the next stage of project implementation.

## POLITICAL ATTITUDES

### Study of Political Attitudes of Youth as A Factor Affecting Economic Development

<i>Research Contractor</i>	<i>Brandeis University</i>
<i>Principal Investigator</i>	<i>Roy C. Macridis and Eugene J. Meehan</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1965 to December, 1970</i>
<i>Contract Number</i>	<i>AID/csd 824</i>

#### Purpose

This project, as initially developed, was to have been a comparative study of the political attitudes of young persons in the developing countries, and their implications for the future. By the end of 1967, it was clear that no site could be found for the inquiry though the tools and instruments had been prepared and were ready for use. The contract was then amended to allow the investigation to focus on "the value systems of young persons in developing countries as expressed in attitudes and preferences". Particular emphasis was placed on the way in which such attitudes and preferences might be altered by education and training.

By early 1968 a site was secured in Guatemala. It was agreed that the research would include a study of the impact of AID-sponsored training programs on the Guatemalans who took part. In June of 1969, the contract was amended again to allow for some experimental work relating to the findings. The

particular goal of this additional experimental work is to suggest modifications of existing training programs, or wholly new training programs that might have a greater impact on the developmentally-related attitudes and behavior patterns of the participants.

#### Results

A study entitled "Value Systems and Youth in Developing Countries" was submitted to AID on November 15, 1969. It was developed around 4 principal foci: (1) theoretical - methodological questions; (2) cumulation of information regarding attitudes and behavior patterns current among young persons in Guatemala as they relate to national development; (3) the impact of AID sponsored training on those attitudes and behavior patterns; and (4) ways in which suitable modifications and behavior patterns might most efficiently be achieved.

### Evaluation of Changes in Attitudes Toward Progress of the Alianza in Selected Latin American Countries

<i>Research Contractor</i>	<i>Research and Reference Service USIA International Research Associates National Institute of Social and Economic Studies - Brazil</i>
<i>Principal Investigator</i>	<i>Dr. John Evans</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1962 to March, 1963</i>
<i>Contract Number</i>	<i>62-100-82</i>

#### Purpose

This was a baseline study of attitudes toward the Alliance for Progress held by a large sample of people in seven countries: Argentina, Bolivia, Brazil, Colombia, Chile, Ecuador, and Venezuela. The study design and questionnaire were produced by USIA's Survey Research Division with AID monitoring and concurrence. Field work was carried out in November and December 1962 by local affiliates of International Research Associates, Inc. in six of the seven countries and by the Institute for Social and Economic Studies in Brazil.

#### Results

The principal output was a classified report R-110-63R issued in June 1963 and declassified in April 1966 by the USIA under the title "The Economic and Political Climate of Opinion in Latin America and Attitudes Toward the Alliance for Progress" - subtitle "Results of a Public Opinion Survey in Seven Countries". (73 pages).

The study was widely used throughout the U.S. Government. Copies were distributed to all concerned persons in ARA-LA, including all desk officers. All field

personnel in State, AID, and USIA concerned with Alliance matters received copies. A check with many

individuals revealed that the material has been specifically considered and widely used.

## COMMUNICATION OF INFORMATION

### Diffusion of Information Through Radio and Supporting Media (Pilot Project in Ecuador)

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Paul Spector</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1962 to April, 1964</i>
<i>Contract Number</i>	<i>AID/Ja-27: Repas 18</i>

#### Purpose

The object of this project was twofold: (1) to determine the types of media most likely to provide motivation for acting on a decision as measured by adoption of innovation; and (2) to determine the specific reasons either for adopting or not adopting innovations.

Three types of media were tested: (a) radio, (b) audiovisual media other than radio and (c) a combination of radio and other audiovisual media. It was also intended to investigate the potential effectiveness of word of mouth in comparable control villages where none of the three media were used.

The four innovations selected for survey were: (1) to build latrines, (2) to build smokeless stoves, (3) to prepare marmalade from a local berry, and (4) to vaccinate against smallpox. Six comparable small towns were selected in one area. Three were experimental and three were control. The experimental towns received the following campaign treatments: (1) Town #1 - radio broadcasts only, (2) Town #2 - a combination of radio broadcasts and other audiovisual material (films, slides, posters, demonstrations), and (3) Town #3 - audiovisual materials - but no radio.

The campaign was divided into two periods: (1) the motivation period (two weeks) and (2) an action period to provide specific instruction on each innovation (seven weeks). Nine months after the campaign,

interviews were conducted to determine whether people continued to use the innovation they had adopted.

#### Results

A 131 page report, "Communication and Motivation in Community Development - An Innovation" by Spector, Torres and Lichtenstein emanated from this study. The report findings were:

for Phase I

- (a) \$19,000 was contributed in money and labor on innovations by 366 households
- (b) the percentage of households that adopted the innovations was three times greater for the experimental towns than for control towns.
- (c) Radio is more effective than audiovisual materials in inducing people to participate, but the audiovisual materials were more effective in providing the instructions and specific procedures.

Phase II - Interviews nine months after the campaign - the findings were:

- (a) most of the people continued to use innovations they had adopted.
- (b) radio was more effective in getting people to adopt innovations but less effective as a medium of instruction than other audiovisual communications.

## Development Research Digest

<i>Research Contractor</i>	<i>National Planning Association</i>
<i>Principal Investigator</i>	<i>Frances M. Geiger</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1962 to June, 1964</i>
<i>Contract Number</i>	<i>AID/Repas 6</i>

### Purpose

The objective of the project was to bring the results of current research and writings on development problems and experiences to government officials and others responsible for development policies and programs in the lesser developed countries. The contract provided for supplying the text of a quarterly publication on development for a period of two years and to have its utility for development planners evaluated.

2,000 copies of the first issue in July 1962, to 5,000 copies for the 9th issue in July 1964. A frank appraisal was requested of nine Americans outstanding in the field of development, such as Dr. Albert O. Hirschmann, Dr. Samuel Hayes, and Dr. John Adler. There was unanimous endorsement of the publication by all nine.

Subsequent to the two year financing from research funds, the publication was funded from interregional program funds. It is still continuing, and 10,000 copies of each issue are printed and distributed world wide.

### Results

The number of copies of the Digest increased from

## Symposium on Communication Research in the Development Process

<i>Research Contractor</i>	<i>Michigan State University</i>
<i>Principal Investigator</i>	<i>Professor K. Berlow</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>October, 1964 to December, 1966</i>
<i>Contract Number</i>	<i>AID/csd 732</i>

### Purpose

This project was initiated to convene a symposium to assess the state of knowledge on communication problems in their relation to economic development; to point to problems that needed research and to provide a report presenting the outcome of the discussions.

Thirty-four specialists in various aspects of communications research attended, with representation

from AID, Latin American countries and various universities. Twelve papers specifically prepared for this symposium were delivered and discussed.

### Results

The preliminary papers were believed to be well done. There is no evidence of a final report.

## SOCIAL AND CULTURAL STUDIES

### Comparative Studies of Social and Cultural Change

<i>Research Contractor</i>	<i>Cornell University</i>
<i>Principal Investigator</i>	<i>Dr. Allan Holmberg</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>August, 1963 to August, 1966</i>
<i>Contract Number</i>	<i>AID/csd 296</i>

### Purpose

Cornell's principal analysis aimed toward determining and clarifying factors involved in cultural change as it relates to the modernizing process. This

involves data relating to the integration of social isolates, such as tribal peoples, ethnic groups, classes or castes, and geographically defined sub-societies into national societies with common cultural contents. Particular

attention was paid to revitalization movements such as nationalism, fostering acquisition of modern values, attitudes and skills, in contrast to traditionalistic administration inhibiting such acquisition.

The objectives sought to be achieved through this project were (a) an overview of all relevant available data on the process of social and cultural change, (b) a comprehensive evaluation of selected representative field experience in induced modernization carried out in the last 15 years, (c) a general synthesis of what is presently known about techniques fostering social and cultural change, and (d) a presentation of this synthesis to AID with emphasis on those elements of greatest value for (1) guidance for policy planning and field operations and (2) orientation of AID programming and technical staff.

#### **Results**

The literature produced under this contract is voluminous. In addition to some 27 special studies, most

of book length, a final report entitled "Methods for Analyzing Cultural Change" was produced by Henry F. Dobyns, Allan R. Holmberg, Morris E. Opler and Lauriston Sharp. This volume was transmitted under cover of FRP Summary No. 27 dated March 2, 1968 to all AID missions.

Essentially the report discusses in detail several types of charts (of change) which can be filled out. The charts are devices for analyzing what effects have been brought about when one cultural system (American) has contact with another cultural system (the recipient nation) and innovation changes are accepted or not. The latter portion of the report is given over to a detailed description of the contextual mapping technique. This shows the institutional changes over fifteen years through the impact of various influences on the community of Vicos in Peru. This particular community is only exemplary, for the technique as presented purports to be general enough to be useable to document changes anywhere.

### **Research Symposium on the Development of Administrative Capacity in Emerging Countries**

<i>Research Contractor</i>	<i>Brookings Institution</i>
<i>Principal Investigator</i>	<i>F. W. Luikart</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>November, 1964 to April, 1965</i>
<i>Contract Number</i>	<i>AID/csd 733</i>

#### **Purpose**

The contractor held a four day symposium involving research scholars in the field of public administration to review the status of research on problems of public administration in LDCs. The symposium addressed such questions as: (1) How adequate is the present research base which underpins efforts to develop administrative capabilities in emerging countries? (2) What can be done to improve the research base? (3) How best can the effort to improve the research base be guided and stimulated? (4) Is research knowledge now available, adequately communicated to, and applied to those involved in technical assistance efforts?

The symposium discussed these types of problems in seven papers, prepared in advance of the conference. A planning session was conducted several months previously in which topics, participants and papers to be

written were determined by a steering committee of 14 representatives of AID, UN, Brookings, the universities and foundations.

#### **Results**

The contractor delivered 200 copies of "Prepared Papers and Report of Proceedings: Symposium on Research Needs Regarding the Development of Administrative Capabilities in Emerging Countries." This document is organized in four parts: I Background of the Symposium, II Prepared Papers, III Summary of the Symposium Discussions, and IV Symposium Advisory Committee, Contributors and List of Participants.

The ideas in the material have been found useful and stimulating. The range of potential research topics which have a bearing on and would be practical to the AID program are drawn together in a single section.

## **Research Symposium on Comparative Social Change in Developing Countries**

<i>Research Contractor</i>	<i>Foundation for Research on Human Behavior</i>
<i>Principal Investigator</i>	<i>Hollis W. Peter</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>January, 1964 to June, 1965</i>
<i>Contract Number</i>	<i>AID/csd 756</i>

### **Purpose**

This project organized a symposium to provide AID with information useful to research programming and priority setting in the field of social change and the growth process by (1) assessing on a comparative basis current theories of social change in the various sectors of development (e.g. economic political); (2) interrelating these sector theories toward eventual construction of a unified, more general theory of social change; and (3) pointing to those problem areas most promising for research and eventual application by AID.

The main topic of discussion was "Comparative Theories of Social Change", under the chairmanship of Hollis Peter. The key paper was by Allan Holmberg of Cornell University and Harold Laswell of Yale University. Nine other papers were commissioned by selected professors and distributed to members of the symposium prior to the meeting. Eighteen people, including authors of the commissioned papers, other selected University professors, and representatives of AID and the Foundation for Research on Human Behavior participated in the symposium.

### **Results**

The Foundation for Research on Human Behavior prepared a final report of some 374 pages, entitled,

"Comparative Theories of Social Change". It contained the text of the papers prepared for the symposium with digests of discussions on each paper. The chapter headings of the report are as follows:

- I. Summary - Hollis Peter
- II. Towards A General Theory of Directed Value Accumulation and Institutional Development - Harold D. Laswell and Allan R. Holmberg
- III. Toward A Theory of Power and Political Structure - Karl W. Deutsch
- IV. Wealth and the Economy - Everett E. Hagen
- V. Health and Well-Being Values in the Perspective of Socio-cultural Changes - Charles C. Hughes
- VI. Social Change Skills and Creativity - Morris D. Stein
- VII. Enlightenment and Communication - Daniel Lerner
- VIII. General Equilibrium Model of the Social System - Walter Isard and C. Peter Rydell
- IX. Applying Behavioral Science for Organizational Change - Warren G. Bennis and Hollis W. Peter
- X. Institution Building in National Development: An Approach to Induced Social Change in Transitional Societies - Milton J. Esman and Fred C. Bruhns

## **Research on the Process of Institution Building: Four Case Studies of Educational and Training Institutions**

<i>Research Contractor</i>	<i>University of Pittsburgh</i>
<i>Principal Investigator</i>	<i>Dr. Milton Esman and others</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>December, 1964 to March 1967</i>
<i>Contract Number</i>	<i>AID/csd 763</i>

### **Purpose**

The objective of the project was to examine the process whereby new values, functions and technologies are introduced and fitted into developing societies and to determine how institutions acquire the capacity to sustain themselves and how they influence the larger environment in which they function.

A consortium of four universities (Pittsburgh, Syracuse, Indiana, and Michigan State) used the same conceptual frame and method to gather data on the Thai

Institution of Public Administration (Indiana University), the Public Administration Institute for Turkey and the Middle East (Syracuse), the Central University of Ecuador (Pittsburgh) and the College of Education of Nsukka (Michigan State).

### **Results**

The four universities completed and made available studies of the process of institution building in the four different cultures. Milton Esman of the

University of Pittsburgh prepared a summary and evaluative abstract of the four case studies entitled "The Institution Building Concepts--An Interim Appraisal."

Other studies produced were:

(1) "The Thai Institute of Public Administration" by William J. Siffin of Indiana University

(2) "The College of Education, Nsukka", by John W. Hanson of Michigan State University

(3) "Institutionalization at a Modest Level. Public Administration Institute for Turkey and the Middle East", by Guthrie S. Burkhead of Syracuse University

(4) "The Central University of Ecuador", by Hans C. Blaise of the University of Pittsburgh

### Universities and Political Change in Latin America

*Research Contractor*  
*Principal Investigator*  
*AID Monitor*

*Brookings Institution*  
*Professor Robert Scott*  
*PPC, Office of Policy Development*  
*& Analysis*

*Duration of Project*  
*Contract Number*

*June, 1964 to June, 1967<sup>1</sup>*  
*AID/csd 672*

#### Purpose

The purpose of this grant was to carry out a study of the role played by universities and other institutions of higher learning in the process of political change in Latin America. The study sought to ascertain the effect of the university experience on political attitudes, activities and skills of students; the role of students in the political process after they leave the universities; and the function of the university as an institution engaged in training persons for leadership in the process of social and political change.

#### Results

Part of this project was to be financed by AID funds and part by funds of the Brookings Institution. Extension of the contract was made necessary by the illness of the principal investigator. The amount of money to be provided by AID was reduced and expenditures have not approached the lesser amount.

The only product of this study was a progress report by Robert Scott, dated December, 1964 to which was attached an outline of what a completed study would look like.

<sup>1</sup>This project was never completed. The principal investigator became ill for an extended period of time. Since he has assumed new teaching duties he has not been able to give further attention to this study.

### Interaction of Social Values and Political Responsibility

*Research Contractor*  
*Principal Investigator*  
*AID Monitor*

*University of Pennsylvania*  
*Philip E. Jacob*  
*PPC, Office of Policy Development*  
*& Analysis*

*Duration of Project*  
*Contract Number*

*September, 1964 to October, 1967*  
*AID/csd 719*

#### Purpose

The purpose of this project was to examine the influences of social and cultural values on those decisions made by local political leaders which promote community level activities. The study was designed to: (a) determine what kinds of decisions on the part of local political leaders result in activities which "integrate" communities and regions more closely; (b) identify, measure and compare those values and ideologies held by political leaders which influence them to make decisions which result in increased integration of local village with district, region, and, eventually nation; (c) establish a relationship between those

leadership values and those conditions (e.g., autonomy, communication, socio-economic level) which tend to modify the impact of such values on integrative policies.

#### Results

The project produced several progress reports and a final report entitled, "The Interaction of Social Values and Political Responsibility in Developing Countries", dated October 20, 1967. The chapter headings provide a clue to the content of the study:

- I. Roots of Responsibility: A Probe of the Political Dynamics of Development
- II. Political Values of Local Leaders

- III. The Arena of Leadership: Perceptions of Community and Role
- IV. Autonomy at the Grass Roots: The Range for Action in the Local Political System

- V. The Resource Base: Economic Measures of Capability
- VI. Dynamic Communities: Patterns of Activeness
- VII. Leadership for Development

## SOCIO-ECONOMIC IMPACT OF TECHNOLOGICAL INPUTS

### Socio-Economic Impact of Electric Power on Rural Development in Colombia (Pilot Study)

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Paul Spector</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>December, 1964 to December, 1967</i>
<i>Contract Number</i>	<i>AID/csd 755</i>

#### Purpose

This project, denominated "Social and Behavioral Impacts of a Technological Change in Colombian Villages", was based upon field investigations which took place from January, 1965 to January, 1967. It was a study of the socio-economic impact of a separately conceived AID/W project to place small electrical generators (5 kw - 20 kw) in 14 isolated rural towns in Colombia ranging in size from 28 to 209 households.

#### Results

The AIR research determined that the assumptions behind placement of generators in Colombia were ill-founded. It had been assumed that a technical input of this nature would have a "ripple" effect and might serve as a prime mover in a dramatic transformation of the communities from a "traditional" to a "modern" orientation. A series of derivative hypotheses were formulated postulating changes which might occur in (a) utilization of electricity, (b) social and community relations, (c) personnel changes, (d) economic changes

and (e) infrastructural changes, but virtually none of the anticipated results were realized and the introduction of the new technology had an adverse effect overall.

The presence of the electrical systems, AIR determined, appeared to have increased the townsmen's awareness of their poverty and their concern for economic improvement. A significantly larger percentage of users appeared to be optimistic about the prospects for economic improvements in their community. However, it appears AIR found that many non-users became pessimistic about the prospects of economic improvements in their community, perhaps as a consequence of their realization that the electricity had not contributed to their improvement.

This and other studies support a larger body of evidence indicating that random technical inputs are futile as a means of stimulating development unless the social and economic system into which they are inserted has reached a level of development at which it can absorb and utilize the input.

## MISCELLANEOUS -- INTERNAL STUDIES OF A.I.D.

### Review of AID Publications

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Paul Spector</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>March, 1962 to June, 1962</i>
<i>Contract Number</i>	<i>C2412</i>

#### Purpose

The purpose of this study was to review and analyze for the Administrator the need for publications

in the Agency and the degree to which existing publications meet that need. A questionnaire was developed and distributed to 8,568 AID employees in

Washington and the missions soliciting their views on this subject.

**Results**

The contract resulted in two publications: (1) "Results of Questionnaire Survey of AID Publication

Needs" and (2) "Internal Publications Appendices, Report of the Task Force on Publications for AID", June, 1962. The Task Force Report on Internal Communications was approved by Fowler Hamilton, and most of the major recommendations were carried out subsequently under David Bell.

**Research on Factors Contributing to Maladaptation of U.S. Employees Overseas (Joint AID/State/USIA/Carnegie Foundation Study)**

<i>Research Contractor</i>	<i>Department of State</i>
<i>Principal Investigator</i>	<i>Regis Walther</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1962 to May, 1964</i>
<i>Contract Number</i>	<i>Repas Project 399-020-9</i>

**Purpose**

The object of the project was to throw light on the nature and magnitude of the problem of maladaptation of overseas employees in State, AID, and USIA and to explore the prospects of preventing or minimizing incidents of maladaptation by such means as the appropriate use of psychological or psychiatric screening.

A group of 413 USIA employees who were given a psychiatric screening before employment were compared with a matched group of State employees not psychiatrically screened. Illnesses incurred by the two groups over a period of two years were analyzed. The

study was carried out in Washington, drawing on official and medical records for the raw data. The results were reviewed by a panel of consultants and personnel officers before the final report was written.

**Results**

A report entitled "The Overseas Adjustment of Department of State, AID and USIA Personnel—A Research Study" was produced, by Regis Walther, May 1964, (29 pages). The results of the study were made available to A/PA and are taken into consideration in recruitment and personnel management.

**Research on Job Performance Standards (AID Employees Overseas)**

<i>Research Contractor</i>	<i>American Institutes for Research</i>
<i>Principal Investigator</i>	<i>Paul Spector</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1962 to June, 1964</i>
<i>Contract Number</i>	<i>AID/Repas 10</i>

**Purpose**

The objective of this project was to analyze in 12 USAIDs four key jobs: Deputy Mission Director, Program Officer, Executive Officer, and Chief of a Technical Division (Education or Agriculture). Two general methods were employed in the study: (a) an interview in depth with the job incumbents and their associates and (b) a written questionnaire to obtain data on the four key jobs in USAIDs where the interview method was not employed. Data was analyzed to determine the job requirements and their variations as between USAIDs. The contractor was to report on: (1)

essential responsibility of the jobs, (2) problems and obstacles which affect job performance (3) effective and ineffective ways of accomplishing various functions of the job; (4) desirable personnel characteristics of incumbents; (5) methods of selecting with the required characteristics of each; (6) recommendations for training, orientation and recruitment of personnel assigned to each job; (7) report on changes in administrative procedures or organization suggested by incumbents and their associates; and (8) suggestions for a general evaluation procedure and topical areas to be evaluated.

**Results**

A final report by the contractor contained the following eight parts: (1) a study of key USAID jobs; Deputy Director, Program Officer, Executive Officer, Division Chief, (16 pages.) (2) Appendix A, The Deputy Director, (149 pages.) (3) Appendix B, The Program Officer, (168 pages.) (4) Appendix C, The Executive Officer, (144 pages.) (5) Appendix D, The Division Chief, (97 pages.) (6) Appendix E, Training Suggestions, (34 pages.) (7) Appendix F, Personnel Attributes for Considerations in Recruitment, Selection and

Evaluation, (37 pages.) and (8) Appendix G, Policy and Procedure Considerations. (14 pages)

The A/PA Director appointed a twelve man AIR Report Committee which made a careful study and analysis of the report and issued on January 25, 1965 a memorandum entitled "Recommendations of the AIR Report Reviewing Committee". This report analyzed eight problems and made thirteen specific recommendations. A/PA has seriously attempted to apply these findings to its personnel procedures.

## VII. INDUSTRIAL AND URBAN DEVELOPMENT

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## TECHNOLOGICAL STUDIES

### Research in the Utilization of Latin American Woods (Exploratory Study)

<i>Research Contractor</i>	<i>Forest Service - USDA</i>
<i>Principal Investigator</i>	<i>S. F. Kukachka and J. F. Saeman</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Research &amp; University Relations</i>
<i>Duration of Project</i>	<i>April, 1962 to October, 1962</i>
<i>Project Number</i>	<i>AID-25</i>

#### Purpose

The objectives of the project were: (a) to survey what is known and not known about the properties of the wood species of Latin America in relation to potential uses; (b) to determine the unknown characteristics of wood species that might have potentialities for contributing to the local economy; (c) to train Latin American scientists in forest products research methods as required for the realization of objective (b).

#### Results

Only objective (a) was completed. A report on the work done was made in October 1962, based on a survey of the literature on properties of Latin American tree

species and on a field survey in four Latin American countries. In the field survey, local opinion was consulted as to species warranting further study; laboratory facilities were inspected to see where and to what extent research might be done in LA countries; and local scientists were interviewed. The report contains recommendations for training, for research on species identification and on wood properties and other programs. In general, the report concludes that research on tree species is much needed and could bring large benefits.

See "Report on Investigations in South America Related to a Projected A.I.D. Program in the field of Forest Products Utilization," by B. F. Kukachka and J. F. Saeman, October 1962, (66 pages.)

### Research on Problems of Shortage of Power at the Local Level

<i>Research Contractor</i>	<i>General Electric Company</i>
	<i>Sub-contractors:</i> <i>(Massachusetts Institute of Technology, Stanford Research Institute and Care, Inc.)</i>
<i>Principal Investigator</i>	<i>Dale J. Hekhuis</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Research &amp; University Relations</i>
<i>Duration of Project</i>	<i>March, 1962 to February, 1963</i>
<i>Contract Number</i>	<i>AID/Repas 1</i>

#### Purpose

The General Electric study was actually titled "Generation and Utilization of Power for Rural Communities in Developing Countries." Investigations were conducted in India, Colombia and Peru. The principal objective of the research was to assess the need for and significance of electric power for the development of rural communities, with particular attention to the utility and feasibility of small-scale power generators supplied as a means of providing power to village communities.

The subcontractors named above undertook various social, economic and political studies in support of the main activity. These investigations covered such topics as (1) Analysis of Demand for Electric Power in Rural Communities; (2) Water Treatment Processes for

Rural Communities; (3) Refrigerator-Cooling Systems for Rural Communities in LDCs; (4) Cost Analysis of Electricity Supply Systems for Rural Communities; (5) Small Scale Power Supplies for Rural Communities and (6) An Integrated Program for Village Development.

#### Results

The summary report, produced by General Electric on the basis of its own research and that of the subcontractors, was entitled "Generation and Utilization of Power in Rural Communities in Developing Countries."

The economic conclusions of the G.E. study pointed out that the outstanding contribution electric power can make to economic development is in water-pumping for irrigation because the timely and

adequate supply of water is the basic essential for increased production. Small-scale commodity processing units could serve as a first step to mechanized production in villages but would not be sufficient to justify investment in generation and distribution systems. Illumination for rural households invariably incurs high secondary distribution and service connection costs which would be feasible *only* if irrigation constituted the principal demand for power.

G.E. found through field surveys that while rural populations urgently desire electrification as a status symbol they have a limited perception of the productivity potentials of electric energy. There is little evidence available as to just what effects rural electrification might have on attitudes towards change, urban migration, level of aspiration, village relations with the outside world, etc.

It appears that if the innovation is to be effective it must be accompanied by a considerable amount of

supporting activity, e.g., community organizational work by local leaders, development of transportation and communications, requisite technical assistance, implementation of economic measures and policies which permit maximum exploitation of profit incentives, etc. This study, coupled with findings of related studies, indicates that random technical inputs are futile as a means of stimulating development unless local social and economic systems have been developed to facilitate utilization of the inputs.

One of the participants in this project read a paper in the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas in 1963. Power consultants and workers at universities have used the information in their studies and researches. Information from the study has influenced the planning and execution of technological aspects of later AID studies in Latin America.

#### **Development and Performance Test of a Solar-Powered Battery Recharging Center**

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*

*Hoffman Electronics Corporation*  
*Fred H. Olugier*  
*TAB, Office of Research &*  
*University Relations*

*Duration of Project*  
*Contract Number*

*May, 1962 to May, 1963*  
*GS-005-29802*

#### **Purpose**

The purpose of the project was to design, fabricate, test and supply to A.I.D. (a) one 100-watt output solar-powered panel; (b) one collapsible fibre boat; (c) one integrated electrical system, consisting of lead-acid batteries, a low-voltage d.c. motor, and associated control gear. The solar recharging center consisted of a 100 watt solar generator, made up of one-watt modules. The generator was assembled in two panels hinged so as to protect the cells when closed.

Each panel was 3 ft by 4 ft when folded. A bank of lead-acid storage batteries (120-60 ampere hours) and a control panel that provided for input from the solar panels, and outputs to various end use items, shunting of power to the storage battery and metering equipment, completed the center. The boat was 17 feet long, lightweight and collapsible, with low draft. The recharging center collected and stored solar energy and fed it to the propeller motor as needed.

#### **Results**

The actual design and fabrication of solar panels, integrated electrical system and collapsible fibre boat were procured from Hoffman Electronics, El Monte, California.

Dr. Lloyd, the AID Monitor, and representatives of GSA witnessed the inspection and performance

testing of the equipment on May 14, 1963, at Puddingstone Reservoir, California. Their approval completed Hoffman's responsibilities on the project.

The boat had been included in the project as a test bed and as transport on a river flowing through the Surinam jungle. The objective of such a test was to demonstrate under field conditions the use of solar energy to drive small boats noiselessly.

After Hoffman had completed its phase of the project, the U.S. Army Electronics Command agreed to evaluate the solar-powered battery recharging system, and, with the U.S. Army Test and Evaluation Command, to evaluate the military potential.

The U.S. Army Test and Evaluation Command tested the performance of the device and found (a) that solar cells for the propulsion of light-weight water craft was feasible; (b) that the boat had a potential military application; (c) that the boat was not operable in weed or grass infested water; (d) that the propeller blades broke easily; and (e) the coating on the solar panels blistered.

The U.S. Army Electronics Command found: (a) that the recharging system was adequate for the charging of storage batteries; (b) that modification of the mechanical construction of the panels was desirable; (c) that the circuit control box was very flexible; and (d) that the types of components used in the solar panels

and in the control box would need replacing for military use in equatorial areas.

The A.I.D. Monitor believes that the use of the

solar powered battery recharging system would be impractical in LDCs because of the high cost of solar cells. If these costs were lowered, it might be practical.

## HOUSING

### Research on Foam Plastics for Housing

<i>Research Contractor</i>	<i>University of Michigan</i>
<i>Principal Investigator</i>	<i>Stephen C. A. Paraskauopoulous</i>
<i>A.I.D. Monitor</i>	<i>TAB, Office of Research &amp; University Relations</i>
<i>Duration of Project</i>	<i>June, 1962 to April, 1966</i>
<i>Contract Number</i>	<i>AID/Repas 8 and AID/csd 288</i>

#### Purpose

The objectives of this project were: (1) to make a preliminary research study of alternative ways of using various types of plastics in the construction of low-cost dwellings for the less developed areas of the world; (2) to develop strong liaison relationships with research and development organizations, including the producers of plastics materials; and (3) to collect and correlate information on the use of plastics for housing, with the special conditions applicable to developing countries in mind.

A.I.D. contract Repas 8 was supplemented by A.I.D. contract A.I.D./csd 288. The contracts were amended 10 times in order: to authorize various changes in the direction of the research, to supply additional funds, and to extend the time. A search of the literature revealed little of value, and recourse to industry was indicated. A public announcement of the project produced offers of collaboration from many companies and resulted in valuable exchanges of information, release of supplies of experimental materials, access to industry laboratory facilities and general assistance in the development of the project. The latest achievements in plastics technology both in terms of materials and methods of production were made available to the Michigan staff.

#### Results

Two published reports, "A Preliminary Investigation of the Potential Use of Foam Plastics for Housing in Underdeveloped Areas" and "Structural Potential of Foam Plastics for Housing in Underdeveloped Areas" give a complete record of the project. These reports were distributed to private industry, research organizations at home and abroad, universities and A.I.D. Missions. The research staff received a 45 foot diameter structure from the Dow Company and a Plydom 19 ft. x 17 ft. unit from International Structures Corporation, for observation

and experiment. These, along with five structures exemplifying structural systems originated by the staff, were placed and are currently on exhibition at the project site in Ann Arbor. It is indicated that the 45 ft. diameter hemispherical shell finished on interior and exterior surfaces was constructed for \$2.75 per square foot of enclosed area. Projected costs of other domed shell systems are estimated at 24% to 40% of the cost of reinforced concrete. A paper laminated foam board two-story prototype cost \$3.30 per square foot for a prototype 576 sq. ft. floor. A filament-wound prototype structure was costed at \$7.45 per sq. ft. for a floor area of 176 sq. ft.

The Research Advisory Committee reviewed evaluations of the project at a late stage and concluded that the research team had been "quite successful technically." The Director of the Institute for Applied Technology of the National Bureau of Standards inspected the work at the site and considered it the "most exciting . . . in building research in the United States." The University of Michigan established a study group to prepare recommendations on a suitable University organization to continue work on plastics utilization. The International Structures Corporation is supplying some 1,000 of its plydom structures to California for the housing of migrant workers. Some plydom structures are under test in Vietnam. Large scale utilization of major findings is feasible only if positive indications result from their test and evaluation in the field, but AID could not undertake this test and evaluation phase.

The former Principal Investigator on this project recently estimated that more than 4,000 copies of the final report had been distributed and that a fourth printing to meet the continuing demand was planned. Of the developing countries, Brazil has shown greatest interest. It's design engineers and highly placed administrators have studied the development for potential applications in their national housing programs.



jointly by SRI, the School of Planning and Architecture of New Delhi, and the Small Industry Extension Training Institute of Hyderabad. A basic purpose of the study was to strengthen the research capacity of the two collaborating Indian institutions, by involving them in work on an issue in regional planning with long-term significance for India.

The work was divided into two phases. The first phase was an extensive review of literature in fields bearing on the subject, (individual development, urban and regional geography and planning, engineering and other requirements of specific infrastructure elements, etc.). In the second phase (the field work) urban infrastructure was defined fairly broadly. It was taken to be both *physical facilities and services*, (power water, sewerage, transport, communications, land for industrial sites) and *supporting services*, (housing, certain types of education and training, medical, fire, and police protection, etc.) Only those industries which could typically be found or could locate in urban centers of varying size (with minimum size set at 50,000 population) were included.

### Results

The study succeeded in getting good data, and working out methods for estimating costs which can be used in other urban and regional planning efforts. A final report entitled "Costs of Infrastructure for Industry as Related to City Size in Developing Countries" was produced by the three cooperating organizations. It is dated October 1968 (435 pp.).

The study measures the direct costs of equipping cities of different sizes with the basic facilities for industrial development. The costs of social infrastructure for new urban industrial employees and their families are

included. It does not assess at length policies and strategies for decentralized industrial development, but the cost analyses presented are fundamental elements for working out such policies.

The study develops new information on the association between types of industries and city size and on the cost characteristics of specific facilities and services. The data are given in a form useful to industrial development agencies, investors, city and regional planners and urban facility managers. The information is valuable for evaluating costs and proposed levels of public investment, facility expansion, and site development required in support of new industry.

A partial list of uses of the study are as follows:

(a) The State Governments of Bihar, Madhya Pradesh, Arissa and West Bengal have used the study in preparing regional and industrial plans for the Southeast Resource Region of India.

(b) The cost methodology and other information developed in the report are being used by: (1) the Operations Research Group, Atomic Energy Commission of India; (2) The National Industrial Development Corporation, Ltd., New Delhi; (3) The Power and Water Division, Indiana Planning Commission; and (4) The Bechtel Corporation, for urban and regional planning in Southern Iran.

(c) The World Bank is using analyses, cost methodology, and cost findings of the report as baseline material for planning and evaluating urban development and renewal loans in India, Pakistan and other countries.

(d) The AID Mission in Colombia has used the report in developing a new urban sector loan program which is to foster industrial development in smaller cities.

The report was sent to all Missions with an explanatory airgram. The Korea AID Mission has used the findings in a regional planning effort.

# STIMULATION OF LDC INDIGENOUS ENTERPRISE

## Study of U.S. Public and Private Cooperation in Stimulating Indigenous Enterprises in Latin America and Africa

<i>Research Contractor</i>	<i>National Planning Association (thru Dept. of Commerce)</i>
<i>Principal Investigator A.I.D. Monitor</i>	<i>Dr. Theodore Geiger PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>May 1962 to May, 1964</i>
<i>Contract Number</i>	<i>C-4756</i>

### Purpose

The object of this study was to investigate how U.S. Government Agencies and U.S. private enterprise might cooperate more effectively in stimulating the development of indigenous non-governmental enterprises in developing countries. The first phase involved an examination of published materials and of un-published data accumulated by the contractor in the course of his program of case studies on the performance of U.S. business firms abroad. The second phase involved field studies in Argentina, Brazil, Chile, Colombia, Mexico and Venezuela, in Latin America, and Ghana, The Ivory Coast, Kenya, Liberia, Nigeria, Senegal, Tanganyika and Uganda in Africa.

The study focused on six topical areas

(a) how indigenous economic enterprises are established and grow; . . . .

(b) the ways in which financial, managerial and technical assistance is provided by foreign business firms to indigenous enterprises;

(c) the roles of joint ventures and of other types of common arrangements in stimulating local enterprises of various kinds;

(d) how other kinds of U.S. private organizations stimulate and strengthen non-governmental economic activities in less developed countries;

(e) specific ways in which U.S. Governmental and non-governmental agencies stimulate and strengthen private sector activities in the LDCs;

(f) how the growth of indigenous private economic activities contribute to their political and social evolution.

### Results

Products produced by the study were: "The Development of African Private Enterprise" by Theodore Geiger and Winifred Armstrong, and "The Development of Latin American Private Enterprise" by

Frank Brandenburg. French editions of the African report and Spanish editions of the Latin American report were produced and distributed widely.

The introduction to the Latin American report examines and refutes criticisms that: (1) modern Latin American private enterprise is not dynamic and hence cannot contribute to economic growth; (2) the goals served by private entrepreneurs are often inconsistent with national development; and (3) private profit is immoral because it necessarily involves exploitation and injustice.

The African report contains the following chapter headings:

I African Entrepreneurship: Background and Development

II Characteristics and Problems of African Entrepreneurs

III The Role of Foreign Companies in Stimulating African Entrepreneurship

IV African Governments and African Entrepreneurs

V Foreign Aid Programs Affecting the Development of African Enterprise

Responses to these studies have been very favorable and indicate that they are being widely used in North America, Western Europe and Asia as well as in LA and Africa. The Development of African Private Enterprise was printed in 11,000 copies, of which 3,000 were in French. 9,900 copies have been sold or distributed. The Development of Latin American Private Enterprise was printed by NPA in 19,000 copies of which 6,000 were in Spanish and 3,000 in Portuguese. A total of 10,300 have been distributed or sold.

Many copies of these reports have been requested by LDC Ministries, planning and promotion groups, American Universities, indigenous banks and a variety of other officials in more than 35 LDCs. American corporations have used the volumes in large numbers for the Training of U.S. and indigenous personnel serving in their Latin American and African subsidiaries.

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# PLANNING AND RESOURCE ALLOCATION

## Comparative Studies of Resource Allocation and Development Policy

<i>Research Contractor</i>	<i>Harvard University</i>
<i>Principal Investigator</i>	<i>Dr. Walter Falcon</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1967 to November, 1971</i>
<i>Contract Number</i>	<i>AID/csd 1543</i>

### Purpose

This project consists of two phases. Phase I covers the funding period to November 30, 1969 and Phase II covers a period commencing with the date of the contract extension through November 30, 1971. Under Phase I, the Harvard group has concentrated its efforts on a coordinated series of studies in three areas of development economics: (1) the economic aspects of several major sectors (agriculture, education and transportation); (2) comparisons of resource allocation in several important countries (India, Pakistan, Korea, Greece, Argentina, and Colombia); and (3) studies of development policy, particularly as it relates to trade and aid.

Phase II of the contract has addressed itself to three central development issues: (1) the magnitudes and characteristics of the rapid structural changes underdeveloped countries are undergoing; (2) the principal policies that affect this transformation; and (3) the economic and social consequences that result from this change.

### Results

Work under the contract has been performed mainly by two development groups within Harvard's Center for International Affairs - the Project for Quantitative Research in Economic Development, given over to theoretical considerations, and, the Development Advisory Service, given over to consulting work for the developing countries.

Harvard has published a series of sectoral studies in the fields of Agriculture, Education, Industry and Manpower. The contractor has gone also into the fields of resource allocation and structural change by examining development strategies in selected countries and development policies.

These efforts have resulted in some 13 books, 57 articles and 150 research papers which have led to briefing and conferences with A.I.D. development officials. Harvard has also responded to USAID's inquiries in economic development matters and in several cases has done direct consulting work with officials of the developing countries.

Direct and indirect uses of the Harvard research program include the following:

(a) Richard Bird's general analysis of "taxation in Colombia" was used as a major input into the report of the tax reform commission in Colombia. A separately financed study on fiscal reform in Colombia, by S. Malcolm Gillis and Charles McClure, examined the principal objectives of tax reform. Many of its recommendations were accepted in principle by the Colombian Finance Minister.

(b) Christopher Dougherty and Marcel Selowsky's study of rates of return to education had a major effect on altering the allocation of educational expenditures in Colombia between primary, secondary and university education.

(c) A sophisticated sectoral model on transportation, developed in close collaboration with the Colombians, influenced several project investment decisions on projects which A.I.D. was being asked to finance.

(d) David Cole and Princeton Lyman collaborated on a book on Korea's political and economic development.

The Cole and Lyman book, along with an inter-industry investment model for the Korean economy, prepared by Larry Westphal, has laid the groundwork for a set of issues to be incorporated into the forthcoming Korean development plan.

(e) The Harvard Advisory group in Pakistan proposed a rural works program for East Pakistan. This has evolved into a very large and successful program.

(f) Wouter Tims provided the planning model that was used in Pakistan's Third Plan. This model was extended by Stern, Kresge, MacErvan, Azfar, etc. for use in the Fourth Plan.

(g) The work of Carl Gotsch and Walter Falcon on the sources of agricultural growth and on agricultural policies affecting this growth has been incorporated into the Pakistan Plans.

(h) The "Typical" pattern of development, evolved from Hollis Chenery's and Lance Taylor's work, has been used by several A.I.D. missions in assessing where particular countries stand relative to economies similar to that of India.

(i) Comparative studies on Pakistan and Indian import liberalization, agricultural production, and export promotion have had an impact on A.I.D. policy moves.

## Import Substitution and Economic Policy in Economic Development

*Research Contractor* Williams College  
*Principal Investigator* Dr. Paul Clark  
*A.I.D. Monitor* PPC, Office of Policy Development  
& Analysis  
*Duration of Project* December, 1964 to June, 1972  
*Contract Number* AID/csd 736 & 2475

### Purpose

Applying the case study technique and supplementary analysis, work under this contract has been directed towards studying the governmental policies of selected countries which have attempted to industrialize through import substitution. From these studies an effort will be made to develop a theoretical framework underlying these efforts, prepare a critique, and formulate generalized development guidelines for successful industrialization related to import substitution.

### Results

This contract may be said to have developed into two phases. The first phase, commencing with the start of the research through 1968, was given over to making a complete theoretical investigation of the subject and then mounting a research drive directed towards examining: protection and industrial structure in import substitution, import demand liberalization and devaluation, and export expansion. Williams has prepared more than thirty research papers, ranging from short memoranda to book length studies. These studies have contributed to enhancing a general awareness of import substitution as a contributing factor to economic development, and to identifying important difficulties in

an import substitution strategy for development.

In Phase II of the contract—commencing January 1, 1969 to December 31, 1971—Williams will be concentrating research on aspects of capacity utilization and agriculture development, as an import substitution strategy.

Specific uses of the Williams College research include the following:

(a) Both general and specific studies on Brazil formed part of the rationale for A.I.D. program loan negotiations in 1967.

(b) The original analysis of Stephen R. Lewis, Jr. and John H. Power on relative prices were influential in the writing of an evaluation of Pakistan's Third Five Year Plan. John Lewis's analysis of Pakistan growth and Gordon Winston's studies of excess capacity have been utilized by the Pakistan Planning Commission and the USAID Mission.

(c) The Board of Investments of the Philippines uses effective rates of protection and shadow prices of foreign exchange based on studies that grew directly from the Williams project.

(d) Williams findings have been discussed with members of the Colombian Department of Planning and have been used in shaping investment policies and tariff decisions.

## Development of Planning and Planning Assistance Criteria

*Research Contractor* National Planning Association  
*Principal Investigator* Dr. Douglas P. Auw  
*A.I.D. Monitor* PPC, Office of Policy Development  
& Analysis  
*Duration of Project* June, 1962 to September, 1970  
*Contract Number* AID Repas 9

### Purpose

This project has had two objectives. In its first phase, the purpose was to review, synthesize and devise new planning techniques; to improve A.I.D.'s capacity to provide assistance in development planning; and to make advanced planning techniques available to development planners in cooperating countries. Beginning in 1965, the focus switched from planning methods to development strategies and the NPA began an intensive investigation of the development process in open, dualistic economies. Extensive contacts and cooperation of LDC nationals was solicited by NPA field staffs in South East Asia over a period of years.

### Results

From the beginning of the project until its close, NPA has produced some 80 papers, covering planning procedures in countries in South East Asia and the development problems of open dualistic economies. The four countries selected for intensive economic analysis were Thailand, the Philippines, Indonesia and Malaya. Much of the field work was concentrated in Thailand and the Philippines, with shorter visits to other S.E. Asian countries. Heavy dependence was placed upon LDC professionals and government people in the development of various aspects of the studies.

NPA submitted a final report in two volumes in

August, 1970 entitled: "The Transition in Open, Dualistic Economies." This report pulled together the work on development in open, dualistic economies and drew policy conclusions about problems of import substitution, export promotion, export substitution, economic nationalism, and neo-colonialism. In addition, a much abbreviated summary report of about 100 pages was prepared, covering the material in the larger report as well as implications for A.I.D. policy.

The uses of the NPA papers and publications are

principally confined to scholars and to officials and faculties in the University of the Philippines, Thammasat University in Thailand, The National Institute of Development Administration in Bangkok, the IBRD, the University of Wisconsin and a variety of others. The discussions and findings of the research have undoubtedly influenced the world planning community in view of the fact of world-wide dissemination of findings.

### Improved Analytical Methods for Development Planning

<i>Research Contractor</i>	<i>Massachusetts Institute of Technology</i>
<i>Principal Investigator</i>	<i>Dr. Richard Eckaus</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1964 to March, 1966</i>
<i>Contract Number</i>	<i>AID/csd 467</i>

#### Purpose

Basically, this research contract provided an opportunity to implement and test a general planning model that had been in the process of development by Professors Eckaus, Lefebvre and Chakravarty for some time. The principal effort was devoted to (a) implementing the model using empirical data from India, (b) developing the necessary computer programs so that the numerical results could be obtained and studied quickly, (c) testing the sensitivity of the model's solutions to changes in various constraints (savings rates, initial capacities, discount rates, capital-output ratios, foreign exchange availabilities, etc.) and (d) comparing its results with those of the Third and Fourth Indian Five-Year Plans.

The model is best characterized as a multisectoral, inter-temporal linear programming model. The objective or criterion function to be maximized was the present discounted sum of aggregate consumption over time.

The model is applied to a study and analysis of the Indian Five Year Plans. Some of the data were obtained prior to contract signing and the remainder was obtained from persons and institutions in India. The development,

implementation and testing of the models took place at MIT using the MIT computer facilities.

#### Results

Preliminary results were presented in a paper entitled "Planning in India" at the National Bureau of Economic Research Conference in November 1964. A paper, entitled "A Comparison of Calculations of Investment and Savings Requirements for India's Fourth Five Year Plan" was prepared by Professor Eckaus and Dr. Kirit S. Parikh. The final report, entitled, "Planning for Growth—Multi-sectored Inter-temporal Models Applied to India," was prepared in April 1966.

"As an illustrative study meant to implement and test more comprehensively than before the usefulness of the model as a planning tool, the study (cited above) is first rate."<sup>1</sup> . . . "as a planning tool the findings of which are meant to be operationally useful, the model leaves something to be desired."<sup>1</sup>

"The model, which is now in operational form has a considerable value to AID as a device from which first approximation answers to a number of alternative policy questions can be quickly and easily obtained."<sup>1</sup>

<sup>1</sup>Comment by Dr. Ronald Ridker

## Capacity Expansion Planning Factors

<i>Research Contractor</i>	<i>National Planning Association</i>
<i>Principal Investigators</i>	<i>Marshall Wood, John DeWitt Norton Philip M. Ritz, Robert M. Waddell</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>January, 1965 to April, 1966</i>
<i>Contract Number</i>	<i>AID/csd 753</i>

### Purpose

The object of this project was to provide quantitative guidelines on the amounts of capital and other inputs required to achieve increases in production, adapting data on the United States for use in the developing countries. The project compiled for 252 industrial activities the following pieces of information expressed in terms of normal capacity: (a) fixed capital cost; (b) total equipment cost; (c) equipment requirements broken down by major processed equipment items, etc. and including lead times from time of leaving factory to full scale production of the new plant; (d) total construction costs over time; (e) construction requirements by different types of construction activities, including mean lead times from start of construction to full-scale production of plant; and (f) detailed equipment and labor inputs for approximately 6 equipment installations, 4 construction, 3 building accessory and 15 auxiliary facility activities.

The material was largely adopted from data prepared for the U.S. economy by NPA and the investigators from 1959 on at an NPA cost of \$125,000. The A.I.D. financed project covered additional costs of refining and revising this data, substituting new and better data in a few instances, organizing the material in manual form, writing procedures and definitions and publishing a final report, which included two chapters of explanatory material.

### Results

The final report was entitled "Capacity Expansion Planning Factors: Manufacturing Industries," by Robert M. Waddell, Philip M. Ritz, John DeWitt Norton and Marshall K. Wood. (Published by the National Planning Association, April 1966, 374 pages.)

An early draft of the study was of some assistance in preparing a sectoral planning model for the Korean second five year plan.

A first use of such a study is for growth models either for the economy as a whole or for particular sectors of the economy (cf. Korea). So called "Capital Coefficient Matrices" are an essential part of most detailed dynamic planning models. These same matrices can also provide partial data of value in forecasting future demand for particular industries or for particular types of industrial goods.

A second potential use of the data is for an initial selection of candidate industries for a particular country or region, namely, a capital requirements yardstick for establishing certain industries under U.S. conditions. The yardstick can be modified by skilled users to fit local conditions and give a first approximation of cost, skills, local manufacturing inputs, foreign exchange requirements, lead times, etc. Using this material, certain industries may be chosen for a more detailed round of investigation as part of a formal "pre investment" process.

## Research on Improved Methods of Planning and Allocating U.S. Assistance

<i>Research Contractor</i>	<i>RAND Corporation</i>
<i>Principal Investigators</i>	<i>R. R. Nelson, R. L. Slighton and P.T. Schultz</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>November, 1963 to June 1969</i>
<i>Contract Number</i>	<i>PASA RA-1-00-Air Force</i>

### Purpose

RAND's work was focussed primarily on the broad problem of identifying and investigating policy options for U.S. foreign assistance strategy. This effort consisted largely of developing a better understanding of the present day economic and political environments within which U.S. assistance programs must operate in several of the most important recipient countries; in identifying

and appraising the hierarchy of U.S. objectives and the means of obtaining these objectives in these countries, given the different situations encountered in each; and helping to improve the framework and techniques used by A.I.D. in deciding on levels and composition of foreign assistance, both within and among countries.

This project was financed under two contracts executed by the Air Force with the RAND Corporation

under an AID Participating Agency agreement (PASA) numbered RA-100-Air Force. Under the first contract AF 49(638)-1293, operational from November, 1963 to May, 1968, the project undertaken was titled "Planning and Allocating U.S. AID." The second Air Force contract with RAND, (Contract F 4460-67-C0050), began in 1966 and was completed in January 1970. The second contract involved an expansion of the other RAND work but concentrated specifically on Colombia and the Philippines.

**Results**

Most of the larger studies and reports produced by RAND under the first contract were classified. A voluminous body of reports was prepared in this category. In addition, a number of unclassified reports were issued. The titles of these reports which might be available from the RAND Corporation are as follows:

- (1) "Investment Strategies in Peruvian Agriculture": by D. A. Fitchett, March 1966 (RM-4791-AID)
- (2) "Problems of Industrialization in Chile: Some Preliminary Observations", by L. L. Johnson, December 1965 (RM-4794-AID)
- (3) "AID Bargaining with India: Approaches to More Effective Use of U.S. Bargaining Power", by A. P. Carlin and W. A. Johnson, December 1965 (RM-4495-AID)
- (4) "A Possible U.S. Policy Towards Indian Transportation: An Illustration of Improved Sectoral Policies", by Alan Carlin, June 1965 (RM-4379-AID)
- (5) "The Effect of Savings and Foreign Aid on National Growth Rates", by R. E. Johnson, August 1964 (RM-4042-AID)

- (6) "A Note on Foreign Assistance and the Capital Requirements for Development," by Richard N. Cooper, January 1965 (RM-4291-AID)

Many of the RAND team members engaged in the RAND studies for AID participated in a study of security and assistance in Thailand and Laos. U.S. Ambassadors William Sullivan and Graham Martin were briefed and took an active role in reviewing the findings. Results, in part growing out of the RAND studies, were increased priorities to educational programs in Laos, increases in Government wages, and shifts away from a U.S. import program, toward support for Laos's foreign exchange.

In Thailand, suggestions were made on the reorganization of the national police, increasing their pay, and on improvement in rural local administration.

Under the second contract RAND has produced thirteen research memoranda (or reports) on Colombia. A book which will be published commercially in 1971 will be largely based on the major study written under RAND auspices: "Colombian Development Policy", by R. R. Nelson, R. L. Slighton and P.T. Schultz. The new book will be titled "Structure and Change in a Developing Economy: Colombian Problems and Prospects", to be published by the Princeton University Press.

RAND issued two research memoranda (or reports) on the Philippines, the major one being: "Crisis of Ambiguity: Political and Economic Development in the Philippines", by H. A. Averch, F. H. Denton and J. E. Koehler, January 1970, to be published by the Princeton University Press under the title: "The Matrix of Policy in the Philippines."

**FOREIGN AID AND TRADE**

**Growth and Development Effects of Food Aid Shipments Under the Food for Peace Act of 1966**

<i>Research Contractor</i>	<i>Iowa State University</i>
<i>Principal Investigator</i>	<i>Dr. Early Heady and Dr. Leo Mayer</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1968 to June, 1971</i>
<i>Contract Number</i>	<i>AID/esd 2163</i>

**Purpose**

The main objective of this study is to define and examine the essential relationship between food and agricultural development and economic growth. The study has been divided into two phases: (1) a domestic phase, to be carried out at Iowa State University; and (2) a foreign phase which is in process in India.

The domestic phase is divided into three projects. The first project will establish a theoretical framework

within which the welfare effects of food shipments can be compared with other forms of developmental aid. It will evaluate the role of food in encouraging or discouraging economic development through its effect on the agricultural production sector, the consumption sector, the public sector, and on industrial production. The second project will concentrate on the factors which stimulate or retard agricultural development in less developed areas. A framework of institutional structures,

resource restraints, objectives and incentives will be established which can provide the initial foundation for agricultural planning in less developed countries. The third project will undertake to establish models of development with emphasis on the area of development planning.

The foreign phase of the study is also divided into three projects. The first will project Indian food supplies and demand and evaluate the required resources which are necessary for food self-sufficiency to be achieved during the 1970's. The second will study the need for buffer stocks in India. It will take into account trends in weather fluctuations, in cereal supplies, procurement and storage costs, and locations at the optimal source for procuring stocks, including PL 480. The third will focus on repayment provisions of food loans under the Food

for Peace Act of 1966 with an evaluation of the eventual effects on agricultural and economic development.

#### Results

A major review of the study was made in November 1970. At that time the results of the following projects were discussed: (1) "An Analysis of Costs Incurred and Prices Charged for Food Shipments Under Public Law 480", (2) "Impact of P.L. 480 Aid on India's Money Supply and Balance of Payments Position: A Look Ahead", (3) "Demand and Supply Projections of Food Grains for India, 1970-71 to 1985-86", (4) "An Intersectoral Model of Agricultural and Industrial Developments of a Dual Economy". Individual reports on the first three projects are available from the monitor. The researchers have actively interacted with AID/Washington staff members as well as with USAID/India Mission personnel.

### Projection and Analysis of Foreign Trade Patterns

*Research Contractor*  
*Principal Investigator*  
*AID Monitor*

*Duration of Project*  
*Contract Number*

*Yale University*  
*Dr. Bela Balassa*  
*PPC, Office of Policy Development*  
*& Analysis*  
*May, 1962 to August, 1963*  
*AID/Repas 4*

#### Purpose

The purpose of the study was to estimate export earnings of less developed countries for the years 1970 and 1975 using an improved method of analysis. Probable future trade patterns of major commodity groups were derived from projected primary product import demands of highly developed areas. Exports and imports of LDC's other than primary products were projected in relation to anticipated growth. The policy alternatives open to the LDCs were examined for closing the trade gap. The project treated separately the world demand for tropical and non tropical foods, agricultural raw materials, minerals, fuels and metals.

#### Results

The published result of the contractor's study was entitled "Trade Prospects for Developing Countries" by Bela Balassa, Richard D. Irwin, Inc. Homewood, Illinois, 1964. This was study number two of the Yale Economic

Growth Center and presented a voluminous treatment of import demand requirements of the developed areas for major product components of support interest to the LDCs for 1970 and 1975. The book also focusses upon the intraregional trade probabilities among the four major developing areas and on the probable growth in LDC export of new primary commodities.

While the manuscript was still in draft it found direct application in AID's development and review of long-term country assistance plans and in joint AID/State preparation of U.S. positions for the 1964 UN conference on Trade and Development. The book has been used by the IBRD, FAO and GATT in making export projections. It has been widely read in many LDCs. Opinion is that this is the only book presenting comprehensive, long-term projections for the exports of LDCs in a detailed commodity breakdown, and, as such, is extremely useful to the LDCs for planning purposes.

## Effects of Foreign Aid on the U.S. Balance of Payments

*Research Contractor* Haverford College  
*Principal Investigators* Philip Bell of Haverford and  
Lawrence Lynn of Yale  
*AID Monitor* PPC, Office of Policy Development  
& Analysis  
*Duration of Project* May, 1963 to September, 1963  
*Contract Number* AID/csd 275

### Purpose

The objective of the project was to conduct research on and submit a current report to AID on the relation of foreign aid expenditures, U.S. exports, and the allocation of AID expenditure to the U.S. balance of payments.

### Results

The principal accomplishment of the Lynn study was to relate U.S. exports in a quantitative manner to disbursements of U.S. aid. The work was of considerable usefulness to AID and constituted the beginning of a very useful and fruitful research effort. The products produced during the time of the study and after its close includes:

- (1) "U.S. Foreign Economic Assistance and the

Balance of Payments, 1954-1962" (mimeographed, December 1963)

- (2) "The Analysis of Tied Aid: Some Concepts and Methods" (typewritten, May 17, 1965)
- (3) "The Scope of Tied Aid Substitution in Selected Less Developed Countries" (typewritten memorandum for Dr. Gustav Ranis, September 12, 1965)

The studies of Dr. Lynn and the comments of Professor Bell on the analyses were complementary to and in general support of the analysis which the Office of Program Coordination of AID had been undertaking on the relationship between U.S. aid and U.S. exports. The Lynn results were used extensively in P.P.C. paper entitled "Foreign Aid and U.S. Exports: A Statistical Analysis" of April 1964.

## Analysis of Certain Effects of Foreign Aid on the Economic Growth of Selected Countries

*Research Contractor* Johns Hopkins University  
*Principal Investigator* Dr. Irma Adelman  
*AID Monitor* PPC, Office of Policy Development  
& Analysis  
*Duration of Project* May, 1964 to June, 1965  
*Contract Number* AID/csd 445

### Purpose

The purpose of this project was to investigate in detail some of the basic effects of foreign aid upon the rate of growth of a developing economy through the construction of alternative versions of linear programming models. These models were intended to provide a better understanding of certain complex questions such as the relative efficiency of alternative policy measures permitting successful transition to self-sustained growth, and the relationship between the planned and actual savings - investment gap to the actual foreign exchange gap. It was hoped that the models would provide a general framework and methodology for similar studies of a number of nations.

Two types of econometric models were designed. The first, Type A, is a linear programming model consisting of a set of disaggregated data which describe economic behavior in four spheres of activity: (1) private and government savings; (2) private and public gross capital formation; (3) imports of goods and services; and (4) exports of goods and services.

The type B model is a dynamic linear programming model in which the objective function is optimized subject to a set of linear constraints which represent the economic and technological limitations upon policy. In this model, the economy is disaggregated into fourteen sectors.

The type A model was used for Taiwan and Greece and the type B model was used for Colombia and Argentina.

### Results

#### Publications

(a) Irma Adelman "Taiwan--A Case Study in Successful Economic Development" (June, 1965, 25 pages mimeo)

(b) Irma Adelman and Frederick T. Sperrow, "Dynamic Linear Development Planning: Two Case Studies" (June, 1965 39 pages mimeo)

(c) Irma Adelman and Hollis B. Chenery, "Foreign Aid and Economic Development: The Case of Greece" (October, 1964)

# GENERAL ECONOMIC DEVELOPMENT

## Venezuela Development Study

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*

*Simulmatics Corporation*  
*Edward Holland*  
*PPC, Office of Policy Development*  
*& Analysis*

*Duration of Project*  
*Contract Number*

*July, 1963 to September, 1966*  
*GMA 1-63 (USAID/Caracas)*

### Purpose

The objective of this project was to produce and apply simulation models to the economy of Venezuela to explore the effects on income and output of alternative choices of policies that the government might elect to pursue. Policy devices include changes in several kinds of tax rates, import policies, and expenditure programs. A supplementary objective was to intensify the effort for improving the collection and processing of basic economic statistics.

A series of three models of increasing complexity were to be constructed, simulating the Venezuelan economy. The simplest was intended to marshal the basic data and provide a preliminary feasibility test, using the University (Central University of Venezuela) computer, and ultimately to be used by the University as a training device. The second model was to explore the possibility of simulating in greater detail, and pave the way for the third. The third was to be designed to deal with a range of problems likely to be of interest to

CORDIPLAN. (Venezuela Government Plan Organization.)

The work on the project was done principally in the CENDES (Center for Development Studies, within the Central University of Venezuela) offices in Venezuela. Initially the project was administered from the contractor's New York headquarters.

### Results

The first model has been in use at the Central University for training purposes. The second model has been used for exploring alternative provisions of the 1965 - 1968 plan. The Venezuelan staff of CENDES has been trained by the contractor and is engaged in building the third model from the design prepared by the contractor.

The definitive work on the project is entitled "Dynamic Models for Simulating the Venezuelan Economy," prepared by the Simulmatics Corporation (Cambridge/New York/Washington) July 1966, (267 pages.)

## Study of Regional Cooperation in South and South East Asia

*Research Contractor*  
*Principal Investigator*  
*A.I.D. Monitor*

*University of Wisconsin*  
*Professor Theodore Morgan*  
*PPC, Office of Policy Development*  
*& Analysis*

*Duration of Project*  
*Contract Number*

*March, 1964 to June, 1970*  
*AID/CSD 355*

### Purpose

The purpose of this project was to ascertain the extent of benefit which might accrue to certain Asian countries through increased economic cooperation, and to identify the conditions required to realize these possibilities. The contractor sought to identify within existing plans and institutions of certain Asian countries the possibilities for extended economic cooperation that would contribute to develop in the region and what is needed to bring these possibilities about. The study was pursued along two lines: (a) an analysis of the economic plans of the countries in comparative terms; and (b) case studies of those regional and national institutions among which some cooperation may be beneficial through

providing adequate-size markets. (the coordination of investments or other practices conducive to specialization of activities according to comparative advantage.)

### Results

In the spring of 1969 the preliminary papers developed under this research were used by a State Department Task Force on South East Asia. A preliminary version of the final report was also widely used in A.I.D. and State for policy purposes.

A report "Economic Interdependence in South East Asia," edited by Theodore Morgan and Nyle Spoelstra, was published by the University of Wisconsin

Press in 1969. The chapter headings group together papers produced at a conference in Bangkok in January 1967. The comments offered by selected commentators are also included. The chapter headings are as follows:

Part I - The Context of Economic Cooperation  
Part II - Evidence in Trade Policy and Economic Development

Part III - Export Performance in New and Traditional Products and Markets

Part IV - Inflation and Asian Trade

Part V - The Possibilities for Economic Cooperation in South East Asia

### Relation of Investment in Housing to Economic Growth

<i>Research Contractor</i>	<i>University of California at Los Angeles</i>
<i>Principal Investigator</i>	<i>Leland S. Burns</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1964 to June, 1968</i>
<i>Contract Number</i>	<i>AID/csd 464</i>

#### Purpose

The purpose of the project was to prepare a quantitative analysis of those factors associated with investment in housing which have beneficial effects on economic development, e.g., increased worker productivity, savings in the cost of medical care and hospital investment, and to evolve from them improved criteria for evaluating investment in housing.

The initial contract called for a preliminary case study to test the feasibility of the analytical method developed for the project at a Sioux Indian reservation in South Dakota and two case studies; one in Korea and one in Mexico. Added studies were conducted in Kenya, Mexico, and Venezuela.

#### Results

Studies produced have indicated that investment in housing in LDCs has a very high rate of return in terms of production. A.I.D. and LDC's investment policies and programs should start from productivity as well as from the customary welfare considerations. However, preliminary studies in Mexico indicated that improved housing may have contributed to job absenteeism. Of the dozen reports produced prior to the

final report, the ones on Korea, Venezuela, and Mexico are of special interest; they appear as ERP Documents No. III-55, III-152, IV-19, and IV-20.

The final report was issued in February 1970. It covers the analysis of the findings of six case studies in low cost housing construction and the national economy. The title is "Housing, Symbol and Shelter"; by Leland S. Burns, Robert Healey, Donald McAllister and B. King Tijioe.

Selected materials from the reports and the eleven articles in professional journals have been read before meetings of regional planners in the U.S. and abroad, including the U.N. Meeting of experts on Cost-Benefit Analysis, The European Congress of the Regional Science Association, the Industrial Relations Research Association, The American Statistical Association, The Western Regional Science Association, and the Pan American Union. The University of California has circulated 2607 copies of reprints and preliminary reports over and above the circulation of articles in the professional journals.

At the close of A.I.D. financing, the U.S. Public Health Service allotted a three year grant to continue this work at study sites in the United States.



and systems analysis. Applications were made to: Sudanese railway and/or road development to Port Sudan; Gabon railway and iron ore development; Central African copper, oil and coal energy and several others.

**Results**

Some 15 volumes on transportation and transportation planning have been produced which were financed in part by the study or are attributable to work begun by the contractor. Brookings and Harvard have been heavy financial and manpower contributors to the overall group of transportation studies. Some of the AID regions have used the techniques developed in the studies for assessing the validity of LDC transportation planning. Harvard University has developed a series of courses on transportation planning based in part on the work accomplished. Brookings and Harvard have supplied planning consultants to LDC governments.

Of the 15 major studies produced the following

are particularly noteworthy: "Strategy for Mobility" by Wilfred Owen, 1964; "Transport Investment and Economic Development" by Gary Fromm, editor, 1965; "Distance and Development" by Wilfred Owen, 1968; "Preparation and Appraisal of Transport Projects" by S. Harrall. A description of Transport Study Findings was prepared by Wilfred Owen and others in ERP summary no. 56, issued by PPC on 5/22/70.

The Harvard-Brookings economic and transportation models have been taken over by the IBRD. Experiments with the model are proceeding in Colombia, Thailand and Central America. Brookings has participated through the IBRD in the Fourth Plan transportation sector preparation in India. This plan has included many of the recommendations of the Brookings program.

**International Air Transport Study  
(AID and Other U.S. Government Agencies)**

<i>Research Contractor</i>	<i>Robert Nathan Associates and Systems Analysis and Research Corporation</i>
<i>Principal Investigator</i>	<i>Franz Wolf (Nathan Associates)</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>October, 1961 to August, 1962</i>
<i>Contract Number</i>	<i>E-B87 (BOR)</i>

**Purpose**

The purpose of the project was to develop and organize the principal data and analyses required to develop a basis for judgment in adopting international air transport policies and programs that would best serve the national and international interest of the United States. ICA wished to assure that policy finally adopted would take into account the special air transport needs of the LDCs.

The agency provided an overall summary of assistance to international civil aviation given by the U.S. in the foreign aid program and detailed studies of the programs in Thailand, Afghanistan, Ethiopia and Iran. An interdepartmental steering committee was formed

and the goals pursued were those of the separate agencies represented on the steering committee. Each participating department provided manpower to work on specific portions of the study along with the contractors.

**Results**

The final report (classified) was not published. The steering committee considered the final report, and on the basis of it, developed an interagency report to the President, which included a series of specific recommendations. Thereafter, on April 24, 1963 the President issued a comprehensive air transport policy statement.

## FOREIGN EXCHANGE AND DEVELOPMENT

### Comparison of India Real Per Capita Income and Currency Purchasing Power with the U.S. and Japan

<i>Research Contractor</i>	<i>University of Pennsylvania</i>
<i>Principal Investigator</i>	<i>Professor Irving Kravis</i>
<i>AID Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1969 to December, 1971</i>
<i>Contract Number</i>	<i>AID/jcsd 2481</i>

#### Purpose

With partial AID financing the University of Pennsylvania is developing a methodology for comprehensive comparison of real national product and purchasing power between countries. This work is important in that basic operational concepts such as a developing, as opposed to a developed country, the degree of aid burden-sharing, etc., are defined in terms of comparative per capita income levels. The per capita income and currency power of India is being compared with the U.S. and Japan. This is a part of a larger series of comparative studies including a number of other countries financed by the Ford Foundation with the cooperation of the Statistical Office of the U.N. and a contribution from the World Bank. Means of making multilateral comparisons will be developed from the initial two country comparisons. The work also involves developing a shortcut methodology for multilateral comparisons which the U.N. could employ on a continuing basis. Ideally the institutionalization at the U.N. will gradually increase so that eventually such comparisons will be routine, include most countries, and

be widely accepted in lieu of the current method based largely on official exchange rates.

#### Results

The staff required to implement this project has been recruited. Contact has been made with the Government of India and their complete project cooperation assured. As required, rupee support for cost in India, has been provided. Refinement of the methodology and collection of data are underway.

The project has advanced steadily although there has been a year's delay for the following reasons:

1. The complexity of the work underestimated
2. The investigators decided to produce a manual of instructions for collecting and interpreting relevant data, and finally for producing the desired statistical computations. This will greatly aid institutionalization although it has resulted in short term delay. The manual is to be completed in calendar year 1971.

### Exchange Control, Liberalization and Economic Development

<i>Research Contractor</i>	<i>National Bureau of Economic Research</i>
<i>Principal Investigator</i>	<i>Dr. J Bhagwati</i>
	<i>Dr. Anne O. Krueger</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1970 to December, 1972</i>
<i>Contract Number</i>	<i>AID/jcsd 2783</i>

#### Purpose

The purpose is to investigate the impact of exchange control and liberalization in 12 developing countries through systematic and comparable studies by different authors. Specifically, the project will investigate: (a) what type of economic and political factors lead to the adoption of restrictionist measures, and (b) once adopted, what type of economic and political pressures operate to increase restrictions and what factors resist greater control. In addition, the study will be devoted to the types of measures employed in restrictionist regimes, their effects on resource

allocation, income distribution, and economic growth and on whether some types of regimes are more amenable to liberalization than others.

#### Results

Scholars and other specialists have been selected to participate in the study and an advisory group has met and discussed at some length a comprehensive analytical framework. This approved analytical framework will be used as a guide for the work of all scholars participating in the studies.

# EMPLOYMENT AND UNEMPLOYMENT

## EMPLOYMENT AND UNEMPLOYMENT IN THE DEVELOPING COUNTRIES

<i>Research Contractor</i>	<i>Yale University</i>
<i>Principal Investigator</i>	<i>Prof. Gustav Ranis</i>
<i>A.I.D. Monitor</i>	<i>PPC, Office of Policy Development &amp; Analysis</i>
<i>Duration of Project</i>	<i>June, 1969 to June, 1973</i>
<i>Contract Number</i>	<i>AID/csd - 2492</i>

### **Purpose**

The purpose of this project is to perform fourteen research studies on problems of employment and unemployment in developing countries, for the purpose of evaluating policy alternatives for A.I.D. and cooperating countries in overcoming these problems. The fourteen studies include eight country studies on Brazil, Chile, Colombia, Kenya, Korea, Pakistan, Taiwan

and a yet-to-be determined eighth country, plus six sectoral studies on employment problems as related to transfer of technology, choice of technology, capital markets, agriculture, services, and education.

### **Results**

Preliminary results from some of the studies are expected by summer 1971.

Supplement to  
THE AID RESEARCH  
PROGRAM, 1962-71  
Project Objectives  
and Results

This publication includes 26 new projects initiated since April, 1971. It supplements the earlier volume which covered 1962 to March, 1971. Together the two publications provide a list of all active and completed projects that have been funded under the Central Research Program up to December, 1972.

AGENCY FOR INTERNATIONAL DEVELOPMENT

## Contents

<u>Area and Project Title</u>	<u>Contractor</u>	<u>Duration</u>
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Agriculture Sector Analysis and Adaptation Model	Michigan State University (csd-2975)	6/21/71 - 6/20/74
Agriculture Diversification and Trade (Latin America)	North Carolina State (csd-3283)	4/1/72 - 3/31/75
Agriculture Diversification and Trade (Philippines)	USDA Economic Research Service PASA-RA(AJ) 13-71	4/1/72 - 3/31/75
<u>Health</u>		
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<u>Nutrition</u>		
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<u>Population</u>		
Prostaglandin/human Reproduction Research	Makerere University (csd-3300)	6/15/71 - 6/14/74
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<u>Area and Project Title</u>	<u>Contractor</u>	<u>Duration</u>
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International Fertility Research	University of North Carolina (csd-2979)	6/15/71 - 6/14/74
Surgical and Engineering Research on Means of Fertility Control	Battelle Memorial Institute (csd-3152)	6/15/71 - 6/14/74
Cross-cultural Research in Fertility Behaviour	American Institute for Research (csd-3155)	6/15/71 - 6/14/74
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<u>Area and Project Title</u>	<u>Contractor</u>	<u>Duration</u>
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Evaluation of Analytical Services Relating Communication Technology to Development	American Technical Assistance Corp. (csd-3376)	6/15/72 - 12/31/72

## AGRICULTURE

### Employment Generation in West and Central African Agriculture

Research Contractor  
Principal Investigator  
Date of Initiation  
Contract Number

Michigan State University  
Dr. Carl K. Eicher  
June 15, 1971  
CSD-3306

#### Purpose

Rising unemployment is a major social, political and economic problem in most West and Central African countries. Much of the research on employment problems in the LDCs has been in the form of country-wide surveys which have pointed the planners to the agricultural sector as an area for labor absorption but have not provided operational guidelines for the planners. This research project will help fill this vacuum in agricultural planning through the cooperation of American and African scholars in jointly planning and executing a series of studies of employment problems in agriculture in several LDCs.

The project will focus on the examination of how trade, wage, fiscal, and pricing policies affect the expansion of production and employment in major import and export crops. The study will produce information on the choice of technologies which can expand and absorb labor and on the attendant policy guidelines to improve decision making.

## AGRICULTURE

### Adapting and Testing of Agricultural Simulation Model to Sector Analysis

Research Contractor  
Principal Investigator  
Date of Initiation  
Contract Number

Michigan State University  
Dr. Glenn Johnson  
June 21, 1971  
CSD-2975

#### Purpose

The purpose of this project is to test, apply, and further develop, under field conditions, a simulation model as an effective tool for better agricultural sector planning. The choice of the "best" agricultural policies and programs depends upon an ability to forecast the results of policies and programs on production, income and related goals in agriculture and other sectors. The development of the simulation model will lower the costs of making the forecasts necessary to choose the "best" policies and programs in agricultural development.

The simulation model was set up and pre-tested in Nigeria. Michigan State University is under contract to refine and apply it in Korea in collaboration with the Ministry of Agriculture in Korea, and to train members of the Agricultural Economics Research Institute of the Ministry in its use. The model was used to support an ongoing Korean Agricultural sector study with considerable time saving to the sector study. The contractor is continuing work with Korean professionals to improve the model, resolve data problems, and to train personnel.

## AGRICULTURE

### Agricultural Diversification and Trade (Philippines)

Research Contractor	USDA Economic Research Service
Principal Investigators	L. J. Atkinson D. Kankel
Date of Initiation	March 30, 1972
Contract Number	PASA-RA(AJ) 13-71

#### Purpose

The purpose of this project is to develop the data and analysis for agricultural diversification in The Philippines, and in collaboration with the Department of Agriculture and Natural Resources and The University of The Philippines to develop the mechanisms for continued analysis as circumstances change.

Four phases of study are planned. The first is an intensive study and evaluation of existing data, analyses and programs, including attention to an identification of homogeneous agro-economic regions, existing farm surveys, supply, demand and special industry studies. The final three stages will build on this preliminary work by filling some of the critical information gaps identified; preparing regional and industry micro studies; and preparing macro analyses of trade prospects and directions for diversification.

This is one of three research projects funded (or to be funded) on agricultural diversification. The others focus on Latin America and Thailand.

## AGRICULTURE

### Agricultural Diversification and Trade (Latin America)

Research Contractor	North Carolina State University
Principal Investigator	R. Simmons
Date of Initiation	April 1, 1972
Contract Number	CSD-3283

#### Purpose

Recent technological breakthroughs and additional improvements in farm practices have made possible a substantial increase in food grain production in a number of countries. This together with the limits of international grain markets will require greater diversification of agriculture. Some LDCs are seeking agricultural diversification for reasons of: (1) finding alternative uses of land resources, (2) creating larger income for farmers, (3) seeking to produce more products for domestic and international markets, and earn larger and more secure amounts of foreign exchange.

This is the second of three projects funded or planned for funding by AID. This contract will focus on collaborative research plans with Guatemala, Salvador, Mexico, and probably Honduras for joint studies of the export market possibilities for selected farm products.

The research team will collect data on production costs, marketing costs and bottlenecks, export costs, and local and foreign demand. These data will then be adjusted to incorporate possible new technology, changes in market structure, institutional changes, government policy, and possible capital investments. The research will examine the export possibilities for selected high labor input crops, particularly vegetables in Central America. It will examine them in comparison with established exporters in Mexico and give attention to possible competitive relationships when considering the East Coast markets of the U.S. Starting with a few commodities, other products or other Central American Countries may be added at a later date, if preliminary results warrant such an extension.

## HEALTH

### Field Research of a Water Pump for Developing Countries

Research Contractor	Battelle Memorial Institute
Principal Investigator	Mr. D. W. Frink
Date of Initiation	June 30, 1971
Contract Number	CSD-3305

#### Purpose

Perhaps three-quarters of the population of the less developed countries depends upon wells and ground water supplies for domestic water needs. In most cases a hand pump is the main item required for extracting water without contaminating the source. To be satisfactory the pump must be dependable, be able to operate under severe use with a minimum of repairs, be of simple construction with as few points of wear as possible, be of moderate cost and, preferably, be capable of manufacture in the country of its ultimate use. In two previous A.I.D. research contracts such a pump has been designed. This contract continues the quest for a superior pump by providing the funds for a two year field test of the current design and for modification of that design, if necessary, based upon evaluation of the test data compiled.

## NUTRITION

### Clinical and Subclinical Malnutrition: Influences on the Capacity to Do Work

Research Contractor	Medical College of Wisconsin
Principal Investigator	Dr. G. B. Spurr and Dr. Kshetrabasi Tripathy
Date of Initiation	June 30, 1971
Contract Number	CSD-2943

#### Purpose

This is one of several projects which support the major A.I.D. objective of alleviating malnutrition in the LDCs. The objective here is to provide information which might arouse the interest of an LDC government in improving the nutritional status of its workers in order to increase their work potential and hopefully their work output. This research is designed to measure the increase of productivity that results from alleviating chronic malnutrition. A relationship between changes in work capacity and initial severity of malnutrition will be sought to document the loss of labor potential.

Research on the physical work capacity of malnourished human adults is not new but earlier experiments were limited to subjects with experimentally induced malnutrition. The wide differences between the indices of malnutrition for the induced and the chronic cases have cast grave doubt upon the identity of the two phenomena and hence upon the transferability of experience between them.

The specific aims of the project are as follows:

(1) to determine the ability of malnourished subjects to respond to a superimposed stress (exercise);

(2) to ascertain whether physical exercises will reveal the sub-clinical malady (malnutrition);

(3) to determine the feasibility of quantifying the reduction in work capacity and/or efficiency and relating this to the nutritional status of an individual; and

(4) to develop, if possible, a simple work test for revealing malnourishment in overtly healthy individuals.

The studies are being carried out at the Faculty of Medicine Universidad del Valle in Cali, Colombia where a well-staffed metabolic ward exists, where chronically malnourished individuals are available, and where an active interest in studying adult malnutrition exists.

## NUTRITION

### Influence of Maternal Diet on the Offspring: Growth, Behavior, Feed Efficiency and Susceptibility to Infection

Research Contractor  
Principal Investigator  
Date of Initiation  
Contract Number

Johns Hopkins University  
Dr. Bacon F. Chow  
June 1, 1971  
CSD-2944

#### Purpose

This long-term study has been planned to examine the effect of maternal nutrition during pregnancy and lactation on the physical and mental development of the child.

The specific objective is to determine if the addition (a) during lactation and (b) during pregnancy and lactation of a daily high protein supplement to the diets of pregnant women normally consuming approximately 30 grams of vegetable protein has measurable effects on the child's growth, efficiency in food utilization, neuromotor and mental development and susceptibility to infectious disease.

The research is being conducted under cooperative arrangements, with scientists and government officials in Taiwan. It is a continuation of an earlier study which was started in January 1967 and jointly funded by the Navy, Johns Hopkins University and the Rockefeller Foundation.

## NUTRITION

### Evaluation of Corn Fortification with Amino Acids in a Human Population

Research Contractor

Principal Investigator

Date of Initiation

Contract Number

Institute of Nutrition of  
Central America and Panama (INCAP)  
Dr. Leonardo J. Mata  
September 15, 1971  
GSD-3357

#### Purpose

The proposed project is designed to evaluate the nutritional improvement obtained in a Guatemalan community by fortification of corn during the milling process with synthetic lysine, tryptophan (derived from soy) and vitamins. This is part of a program for the improvement of the nutrition of preschool children and pregnant and nursing mothers in a rural community in a developing country. The investigators plan to study the feasibility, from the standpoint of management and cost, of corn fortification with amino acids at the village level, to determine the effect of this fortification on the nutrition of pregnant women and on the growth and development of children. In addition they will evaluate the effect of the fortification program on disease incidence of children and on colonization of the intestine by *Shigella*.

The study will supplement on-going AID studies involving lysine fortification of wheat in Tunisia and lysine and threonine fortification of rice in Thailand. The addition of lysine and tryptophan to corn masa at the village level is potentially a practical method of improving the protein value of the diet. The demonstration that this degree of protein improvement in the village has a positive effect on the parameters studied will be of great value in appraising the desirability of nutrition intervention programs in general.

## POPULATION

### Research on Prostaglandins in Relation to Human Reproduction

Research Contractor	Makerere University
Principal Investigator	Kampala, Uganda
Date of Initiation	June 1971
Project Number	CSD-3300

#### Purpose

Prostaglandins have been shown to be effective in the induction of labor, termination of pregnancy, and for inducing menstruation. Studies on the use of prostaglandins on a once-a-month or missed menses basis are very promising, however, additional research will be required to establish this new technology on a sound basis. Particularly important will be establishing the practicability of this new method in terms of safety and acceptability and developing the best formulations and routes of administration in carefully controlled clinical trials.

The objective of this project is to conduct research essential to further test and develop prostaglandins as a once-a-month means of fertility control and for pregnancy termination. The program focuses on clinical trials for efficacy and side effects evaluation. New formulations and routes of administration will be tested. Assay of prostaglandins will be performed as required to conduct and control the clinical efficacy and side effects studies.

## POPULATION

### Studies on the Synthesis of Prostaglandins

Research Contractor	University of Wisconsin
Principal Investigator	Dr. Charles J. Sih Dr. Robert B. Morin Dr. Robert A. Ellison
Date of Initiation	June 1971
Project Number	GSD-2965

#### Purpose

Prostaglandins are the most promising recent development in the search for new means of fertility control. However, research and ultimately availability for family planning programs is seriously hindered by their high cost and scarcity because present synthetic techniques rely on total synthesis involving many steps to produce these complex biologically active materials. This program's principal objective is to alleviate the scarcity of prostaglandins. The researchers will employ micro-organisms to make difficult chemical synthetic steps and to produce key chemical intermediates that can subsequently be used in the final synthesis of prostaglandins.

### World Fertility Survey

Research Contractor	International Statistical Institute
Principal Investigator	Dr. P. J. Bjerve Dr. E. Lunenberg
Date of Initiation	June 1972
Project Number	GSD-3606

#### Purpose

There is a general lack throughout the world of nationally representative, internationally comparable scientific knowledge concerning fertility and family planning behavior. The International Statistical Institute has received support for a five-year program, entitled World Fertility Survey, to be carried out in conjunction with the World Population Year, and whose purpose is to assess the current state of world knowledge concerning fertility & family planning and to promote, through technical assistance, selective subsidization, and voluntary country cooperation, individual country sample surveys of fertility & planning in some thirty to forty key LDCs. Such a program will be a major step forward in institutionalizing fertility research and providing policymakers with the basis for more effective population policies and programs.

## POPULATION

### Applied Research on Fertility Regulation

Research Contractor	University of Minnesota
Principal Investigator	Dr. John J. Sciarra
Date of Initiation	June 1972
Project Number	CSD-3608

#### Purpose

To actively pursue a number of promising but currently neglected leads of goal directed research to develop new means of fertility control, the Universities Group for Contraceptive Research has been established. This program will actively involve a panel of experts to solicit, evaluate, and assist in the development and monitoring of a series of studies which require modest funding both within the U.S. and in less developed countries. These studies will include work to develop improved means of male and female sterilization, studies of once-a-month means of fertility control, and evaluation of locally effective male and female methods including condoms and vaginal contraceptives.

### Simplified Techniques of Fertility Control

Research Contractor	Johns Hopkins University
Principal Investigator	Dr. Theodore M. King
Date of Initiation	June 1972
Project Number	CSD-3627

#### Purpose

The objective of this research program is to establish a clinical unit for the development and evaluation of simplified fertility control techniques suitable for use in less developed countries. A secondary objective is to determine the undesirable side effects of drugs and techniques currently used in LDC fertility control programs and to seek ways of eliminating or minimizing these undesirable side effects. It is expected that this unit will allow the development and testing of new means of fertility control with regard to efficacy, simplicity, safety and patient acceptability of fertility control techniques. It will also serve as a facility for training LDC participants in the most up to date techniques of fertility control.

## POPULATION

### International Fertility Research Program

Research Contractor	University of North Carolina
Principal Investigator	Dr. Elton Kessel
Date of Initiation	June 1971
Project Number	CSD-2979

#### Purpose

The objective of this program is to accelerate the availability of new breakthroughs in fertility control technology. The program will facilitate rapid evaluation of high quality data obtained from clinical trials of new means of fertility control on a comparative basis under use conditions in a spectrum of countries and cultures. Objectivity and comparability will be insured by use of statistical and epidemiological techniques employing standard data collection formats and central analysis of data. There are now numerous experimental techniques on the brink of clinical usage which have the potential of markedly advancing fertility control technology with regard to the use, reliability and acceptability of these new techniques being developed. Particularly the newer I.U.D.s made with metals, improved sterilization techniques, prostaglandins and some of the steroidal contraceptives urgently require comparative clinical testing. In addition, the project will support special studies to bring promising methods to the field trial stage. The success of certain methods will be followed by selected in-depth studies. The most important consequence of this project will be the shortening of time between the development of a new fertility control technology and its use in family planning by demonstrating the safety and effectiveness of newer methods in actual use conditions.

## POPULATION

### Surgical and Engineering Research on Means of Fertility Control

Research Contractor  
Principal Investigator  
Date of Initiation  
Project Number

Battelle Memorial Institute  
Dr. Denis J. Prager  
June 1971  
CSD-3152

#### Purpose

This project engages the combined talents of engineers, physical and biological scientists, material specialists and clinicians to: (a) develop new and improved techniques and equipment for termination of early pregnancy, (b) conduct research on simplified and more reversible means of male sterilization, and (c) to initiate studies in experimental animals regarding female sterilization. The program is designed to insure maximum utilization of direct feedback from clinic and field personnel so that methods will evolve that are safe, simple, effective and acceptable.

## POPULATION

### Gross-Cultural Research in Fertility Behaviour

Research Contractor	American Institute for Research
Principal Investigators	Dr. Henry P. David Dr. H. L. Frideman
Date of Initiation	June 1971
Project Number	GSD-3155

#### Purpose

Abortion has been a significant means of family limitation for much of human history. Today it is estimated that there are 30 million pregnancy terminations through abortion annually throughout the world, making abortion perhaps the most employed means by which women control their fertility.

The objective of this project is to build on an already established but still evolving informal network of cooperating research facilities in various parts of the world for the purpose of establishing an International Reference Center for Abortion Research (IRCAR). This Center will have the capability to analyze data, prepare country reports, disseminate information and answer inquiries. In addition, the Center will conduct a limited number of field studies into behavioral factors associated with acceptance of new pregnancy termination methods.

In the development of IRCAR, an international advisory committee will be established to guide the operations of IRCAR. This committee will include representatives from the UN, WHO, AID, subject area experts from the LDCs, and representatives of other relevant organizations. In providing for this international advisory committee, it is AID's intent that the activities of IRCAR should eventually be taken over by an international agency such as UN or WHO.

## POPULATION

### A Study of Side Effects and Mechanisms of Action of Prostaglandins

Research Contractor  
Principal Investigator  
Date of Initiation  
Project Number

Washington University  
Dr. Arpod I. Csapo  
June 1971  
CSD-3160

#### Purpose

Prostaglandins are a promising means of fertility control which have the potential for self-administration on a once-a-month basis. In addition, use of prostaglandins could overcome certain motivational problems because they are effective post-conception. This project will explore this means of fertility control by conducting carefully controlled clinical trials to examine the efficacy, acceptability and side effects of prostaglandins, focusing upon the simplest and most effective method of therapeutic administration. Furthermore, new assay techniques will be developed, and insight into the fundamental mechanism of action of prostaglandins will be pursued.

## EDUCATION

### Case Studies of Low-Cost Instructional Technologies

Research Contractor  
Principal Investigator  
Date of Initiation  
Contract Number

Leland Stanford, Jr. University  
Dr. Wilbur Schramm  
June 15, 1971  
CSD-3284

#### Purpose

This research is especially significant because of its demonstrable relevance to the Agency's key problem areas in education. It is designed to produce a comprehensive study and analysis of the potential of instructional technologies, with particular reference to radio-cassettes, printed and illustrative materials and TV, and ways in which these media may be combined to complement and reinforce each other. This will be done by the development and analysis of a map of the uses of TV and other technologies, a survey of existing literature on the uses of educational technology in the LDCs, and by field study primarily in one country but later perhaps in one or two more.

The project will provide guidance and information for the technology problem area, and will help the LDCs in their exploration of all appropriate means to realize financial economies in informing and educating their people. The project also has significance to our efforts to utilize those educational modes which may be usefully employed with people who are not reached through the formal school system.

**PROGRAM PLANNING AND ECONOMIC STUDIES**

**Distribution of Gains, Wealth and Income for  
Economic and Political Development**

Research Contractor  
Principal Investigator

Rice University  
J. Land, R. Soligo, M. Krzyzaniak,  
F. von der Mehden and C. McClure

Date of Initiation  
Contract Number

June 15, 1971  
CSD-3302

**Purpose**

The purpose of this project is to develop better understanding of the relationship between income distribution and development. The research will explore both the role of income distribution in determining the development of a country and the way such development affects the distribution of income. Since the distribution of income and wealth is a political and social as well as an economic phenomenon it will be explored in a multi-disciplinary fashion, using a broad social science framework. Senior economists and political scientists will research the following topics: (a) Income distribution, the structure of demand and growth; (b) Income distribution and government policy; and (c) Income distribution, development planning, and special interest groups.

The research is directed to a problem area of major significance to A.I.D., and also to other bilateral and multi-lateral donors as well as to the governments of the LDCs: how rapid economic development can be made more compatible with broader sharing of the benefits of development.

## SCIENCE AND TECHNOLOGY

### The Design, Siting, and Construction of Locally-Planned Structures to Better Withstand Earthquakes and Storms

Research Contractor  
Principal Investigator  
Date of Initiation  
Contract Number

National Bureau of Standards  
Dr. E. O. Pfrang  
May 1, 1971  
PASA-RA-CE 9-71

#### Purpose

The purpose of this project is to mobilize and critically examine existing information on the effects of seismic and wind storm stresses on structures and previous engineering attempts to reduce these effects by structural modifications and site choices. Besides examining existing information the project is identifying those approaches that may be especially applicable under developing country conditions. These include the identification of significant structural, technological innovations and research gaps. These approaches and others which may surface during the process will be analyzed within the context of socio-economic and behavioral factors which may have impeded application of technological adaptations in developing countries.

The National Bureau of Standards will be the focal point for this preliminary analysis and evaluation, drawing upon the Department of Housing and Urban Development and the U.S. Geological Survey, and other governmental and private experts.

SCIENCE AND TECHNOLOGY

Ecological Studies in Aedes Aegypti in East  
Africa Preliminary to Genetic Control

Research Contractor  
Principal Investigator

University of Notre Dame  
Dr. George B. Craig  
Dr. Karamjit S. Rai  
June 15, 1971  
GSD-3159

Date of Initiation  
Contract Number

Purpose

This research is conceived as a model for the biological control of mosquitoes, with Aedes aegypti as the target species because so much of its genetics, physiology and bionomics are known, mass production is simple, and a variety of mechanisms for modifying its genetic composition have been demonstrated. This combination not yet available for other mosquitoes. Development of an effective genetic technique would provide a non-chemical alternative or supplement for controlling Aedes aegypti, currently a pervasive and significant disease vector responsible for transmitting Yellow Fever, Dengue and Asian Hemorrhagic Fever in epidemic proportions throughout large areas of the developing world.

A three-year research project involving field studies and concurrent laboratory experimentation will be carried out in East Africa by the staff of the University of Notre Dame's Vector Biology Laboratory, to determine whether genetic control of Aedes aegypti is feasible. Field studies of the ecology of natural populations will be undertaken, with emphasis on population dynamics and reproductive biology. Special attention will be given to the solution of certain technical requirements for genetic control involving mass production and release of mosquitoes which are to be competitive with natural populations. Concurrently, genetics of East African populations will be studied in the laboratory in order to discover which among several currently available genetic mechanisms would be most useful for control.

SMALL RESEARCH PROJECTS PROGRAM

Laboratory Improvement for Development of  
Malaria Vaccine from Irradiated Sporozoites

Research Contractor	New York University
Principal Investigator	Dr. Harry Most
Date of Initiation	May 1972
Project Number	CSD-3640

Purpose

This proposal is intended to improve laboratory facilities to supply irradiated malaria sporozoites for a group of U.S. institutions which, using their own research funds, can undertake a variety of experimental leads toward development of a human malaria vaccine.

Preliminary Field Evaluation of  
Biodegradable Analogues of DDT

Research Contractor	University of Illinois
Principal Investigator	Dr. Robert L. Metcalf
Date of Initiation	June 1972
Project Number	CSD-3681

Purpose

The University of Illinois has synthesized several new biologically active analogues of DDT that exhibit biodegradable properties. Under the present project large batch quantities of the compounds will be synthesized at the University laboratory and then field tested.

SMALL RESEARCH PROJECTS PROGRAM

Effects of Environmental Enrichment on  
Subsequent Development of Malnourished Children

Research Contractor	Columbia University
Principal Investigator	Dr. Myron Wirick
Date of Initiation	June 1972
Project Number	CSD-3679

Purpose

This study will examine the effects of the enriched environment in the adopting homes on the mental and physical development of children now 8 to 14 years of age who have histories and documented measurements of severe malnutrition during the first two years of life.

Comparative Analysis of Utilization  
of Research Reactors

Research Contractor	University of California
Principal Investigator	Dr. Vincent P. Guinn
Date of Initiation	June 1972
Project Number	CSD-3639

Purpose

A survey will be made in seven countries in Asia and Latin America of the problems that have limited the effective exploitation of the potential of research reactors that have been financed in part by the U.S. The study will examine actual and potential contributions of these reactors to the nations involved and identify practical steps that can be taken to capitalize more effectively on these reactor investments.

SMALL RESEARCH PROJECTS PROGRAM

Evaluation of Analytical Services Relating  
Communication Technology to Development

Research Contractor  
Principal Investigator  
Date of Initiation  
Project Number

American Technical Assistance Corp.  
Dr. Albert A. Brown  
June 1972  
CSD-3376

**Purpose**

The basic purpose is to provide a mechanism for translating the implications of completed communication and education strategy studies into AID's policy, sector, and project planning. The work will consist of 1) analyzing the policy and program applications of the strategy studies, and 2) working with a wide range of AID personnel in exploring the action implications of the new communication technologies and educational methodologies for specific AID programs.