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TA/PPU

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DEPARTMENT OF STATE  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D.C. 20523

PD-ADD-251

July 26, 1976 10p.

TO: TA/AGR, Dr. Leon Hesser  
FROM: AA/TA, <sup>cf</sup> Curtis Farrar  
SUBJECT: PID/Agricultural Mechanization.

I have approved the PID on Agricultural Mechanization, subject to the addition of the interrelationships between human fertility and agricultural mechanization as an additional subject of study. It is a very ambitious project and I imagine may have to be scaled down a bit as you develop the specific proposal or proposals.

Please take into account the possibility that IRRI may not be entirely unbiased on the subject, in determining their role in the project.

cc: TA/PPU  
Dr. Baird

DATE: April 29, 1976

TO: AA/TA, Mr. Curtis Farrow

FROM: TA/PPU, John Gunning

PROBLEM: Your Approval is Requested of the Project Identification Document (P.I.D.) for Agricultural Mechanization

Proposed Project Begins: FY 78 Proposing Office: TA/AGR

A. TA/PPU Review.

1. Does PID Adequately Describe and Justify Project?

Yes.

Funding Adequate?--If T.Q. or FY 77, How Compares to FY 77 C.P. FY 78 funding.

3. Are Plans for PP Development, Approval and Project Initiation Realistic?

B. This PID has been in TA/PPU; staff work is incomplete because of: TA/PPU work pressure; Tech. Office work pressure. Recommend you return the PID for further work prior to your final decision.

C. TA/PPU recommends the following action:

Approval.

- a) Approval subject to <sup>3</sup> funding for 3 years, submission of environmental, women, energy, population statements to included in PP.
- b) Negative environmental threshold determination.

Return for further work prior to AA/TA decision.

Disapproval.

D. AA/TA Action.

Approved.

Approved subject to inclusion of relationship between human fertility and mechanization as a subject of inquiry

Disapproved.

Curtis Farrow  
Signature

7/24/76  
Date

ENVIRONMENTAL THRESHOLD DETERMINATION

TO: AA/TA, Mr. Curtis Farrar

THRU: TA/PPU *[Signature]*

FROM: TA/AG, Leon Hesser *[Signature]*

SUBJECT: Environmental Threshold Determination

Project Title: Agricultural Mechanization

Project # : 1026

Specific Activity (if applicable) \_\_\_\_\_

REFERENCE: Initial Environmental Examination (IEE) contained in  
PID Attachment dated 4/23/76

On the basis of the initial environmental examination referenced above and attached to this memorandum I recommend that you make the following determination:

XXX 1. The proposed agency action is not a major Federal action which will have a significant effect on the human environment.

         2. The proposed agency action is a major Federal action which will have a significant effect on the human environment, and:

         a. An Environmental Assessment is required; or

         b. An Environmental Impact Statement is required.

The cost of and schedule for this requirement is fully described in the referenced document.

         3. Our environmental analysis is not complete. We will submit the analysis no later than \_\_\_\_\_ with our recommendation for an environmental threshold decision.

Approved *[Signature]*

Disapproved \_\_\_\_\_

Date 7/26/76

PID; Agricultural Mechanization, TA/AG/ESP

Initial Environmental Examination\*

The activities of this project fall in the area described in par. 216.2(c) "Analyses, studies, academic or investigative research, workshops and meetings." These classes of activities will not normally require the filing of an Environmental Impact Statement or the preparation of an Environmental Assessment.

Under these guidelines, this activity clearly qualifies for a Negative Determination of the time when a Threshold Decision is determined.

\* Developed in conformance with information on pp. 26913 - 26919, Federal Register, Vol. 41, No. 127-Wednesday, June 30, 1976.



## AGRICULTURAL MECHANIZATION

### I. Summary of Problem

There is general recognition that the mechanization of agriculture has been a continuous process in economic development and that the speed and direction of this process can be altered by public policies and programs. AID has been increasingly concerned in recent years in developing programs which would encourage the mechanization of agriculture in such a way as to benefit the rural poor. This has proven to be a difficult task primarily because of the lack of solid data and agreement on (1) the impact of mechanization on employment and food production and (2) the effects of specific government actions on the type of mechanization used by the agricultural sector. The proposed project investigates an important set of the agricultural mechanization questions. It is concerned primarily with the impact of mechanical technology in food grain production and processing systems in Asia.

The specific objectives of the project are:

1. to estimate, at a micro level, the potential and actual impact of various mechanical devices and alternative mechanization systems used in food grain production and processing on:
  - a. employment patterns
    - (1) family vs. hired labor
    - (2) seasonality of employment
    - (3) on and off-farm employment
    - (4) women vs. men
  - b. the efficiency of input use
    - (1) water
    - (2) fertilizer
    - (3) pesticides
    - (4) herbicides
    - (5) seeds
    - (6) capital
    - (7) labor
    - (8) buffalo
  - c. the reduction of post-harvest losses
  - d. the intensity of land utilization
    - (1) single crop intensity for both upland and lowland food grains
    - (2) multiple cropping systems (time frame)

2. to evaluate, at a macro level, the potential impact of alternative mechanization systems used in food grain production and processing in selected Asian countries on:
  - a. total on and off-farm employment
  - b. total production of rice and other crops
  - c. income and land distribution patterns
3. to develop methodologies for assessing possible employment production-(production) tradeoffs associated with the introduction of mechanical devices used in food grain production and processing and for assessing the tradeoffs in terms of the meat production losses as animals are replaced by machines.
4. to assess the impact of various government policies and programs on the type of mechanical devices adopted by farmers and processors and on the rate of adoption. Of major importance are:
  - a. price policies for
    - (1) food grains
    - (2) major inputs
  - b. water allocation policies
  - c. credit programs for manufacturing and purchase of machinery
  - d. import policies affecting the price of equipment, major components of domestically produced equipment, and availability of spare parts
  - e. government extension and training programs to encourage the use of mechanical devices
5. to estimate the impact of alternative programs to increase farm power, both animal and mechanical, on the welfare of small farmers, farm laborers, and the rural poor in general.
6. to increase host country capacity to evaluate programs and policies affecting the introduction of mechanical devices for rice production and processing. This objective is to be accomplished through:
  - a. the development of special, short-term post graduate training seminars
  - b. providing opportunities for host country researchers to exchange research results and information through short seminar programs

- c. assuring that host country personnel are actively involved in a major way in the design and implementation of research activities associated with this project

7. Developing an information network to promote the exchange of information on appropriate technology for mechanizing agriculture.

In more general terms, the goals, purposes, outputs, and inputs are described briefly in the attached logical framework.

There are several reasons for focusing the project on food grain production and processing. First, food grains are the major crops grown extensively by small farmers, especially rice. Second, the results of research probably can be generalized to other crops grown by small farmers. Third, AID needs to be able to better assess the effects of its program to expand the small farm machinery program at IRRI to other countries. Fourth, the existing field data on the mechanization of food grain production and on processing particularly for rice, appears to be more detailed and readily available than for other crops.

The project is primarily a research project. The major outputs will be reports and seminars. Nonetheless, to the extent that the project can be carried out in close cooperation with agricultural planners in one or more Asian countries, there will be immediate utilization of the results obtained from the research in developing appropriate technology strategies.

## II. Financial Requirements

The estimated total cost of the proposed research is \$750,000 over a three year period. These costs include salaries of senior staff, support, overhead, and research support. Financial details are presented in Table 1.

Part of the work would be carried out in the U.S. but most of it would be undertaken in several Asian countries. Most likely countries include: Thailand, Philippines, Pakistan, and Indonesia.

Table 1: Budget for Mechanization Study

	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>Total</u>
	<u>(\$000)</u>	<u>(\$000)</u>	<u>(\$000)</u>	<u>(\$000)</u>
<b>I. Personnel</b>				
A. Senior Staff	50	100	100	250
B. Support Staff	50	50	50	150
C. Overhead	50	75	75	200
<b>II. Research Support</b>				
A. Travel	10	10	10	30
B. Computer Time	10	10	10	30
C. Publication	5	5	5	15
D. Seminar Activities	5	10	10	25
E. Per Diem	5	5	5	15
F. Contingencies	15	10	10	35
	<u>\$200</u>	<u>\$275</u>	<u>\$275</u>	<u>\$750</u>

III. Development of the Project

The project would be developed by TA/AGR/ESP with the cooperation of other divisions of TA/AGR and PPC. Preliminary discussions have been undertaken with IRRI and the A/D/C. Both groups have expressed interest in participating in such a study.

IRRI and A/D/C have suggested that a regional seminar be held to identify major research needs and to determine where such research would have the greatest impact. Such a seminar could be organized by August or September 1976 and the project prepared by early 1977. Personnel from TA/AGR and PPC should participate in such a seminar and following the seminar begin to develop a project paper in cooperation with IRRI, A/D/C and other interested groups in Asia.

PROJECT DESIGN SUMMARY  
GENERAL FRAMEWORK

Life of Project: \_\_\_\_\_  
 From FY: \_\_\_\_\_ to FY: \_\_\_\_\_  
 Total U.S. Dollars: \_\_\_\_\_  
 Date Prepared: \_\_\_\_\_

Project Title & Number: \_\_\_\_\_

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: The broader objective to which this project contributes:</p> <p>To increase employment and income opportunities for the rural poor in LDCs.</p>	<p>Measures of Goal Achievement:</p> <ol style="list-style-type: none"> <li>1. Increased use of employment and income creating technology in LDCs.</li> <li>2. Reduced underemployment of rural poor.</li> <li>3. Increased local production of agricultural inputs and local processing of agricultural outputs.</li> </ol>	<ol style="list-style-type: none"> <li>1. Sample surveys to estimate local changes in employment and income opportunities and patterns</li> <li>2. Review of import and export data for farm inputs and outputs to determine if domestic production and processing of agricultural goods has changed</li> <li>3. Survey of FAO estimates of changes in unemployment and underemployment in the agricultural sectors of LDCs.</li> </ol>	<p>Assumptions for achieving goal targets:</p> <ol style="list-style-type: none"> <li>1. Governments are able to promote appropriate technology to increase rural employment opportunities.</li> <li>2. Increased ability to estimate the impacts of capital-intensive and labor-intensive technologies will affect government decisions to encourage use of specific technologies.</li> </ol>
<p>Project Purpose:</p> <ol style="list-style-type: none"> <li>1. To assess the impact of mechanical technology in food grain production on the welfare of the rural poor.</li> <li>2. To determine the effects of government programs and policies on the type of mechanical technology utilized by the agricultural sector.</li> </ol>	<p>Conditions that will indicate purpose has been achieved: End of project status.</p> <ol style="list-style-type: none"> <li>1. Greater availability of data on the effects of farm mechanization on employment, food production, and income distributions.</li> <li>2. Increased attention being given by agricultural planners to the development and use of appropriate agricultural technology.</li> <li>3. Improved ability to evaluate the potential effects of alternative technological machines designed to increase food production.</li> </ol>	<ol style="list-style-type: none"> <li>1. Changes in laws and policies affecting domestic production and use of farm equipment.</li> <li>2. Review of project reports and their distribution.</li> <li>3. Changes in the type and number of studies being carried out on appropriate agricultural technology.</li> </ol>	<p>Assumptions for achieving purposes:</p> <ol style="list-style-type: none"> <li>1. Government agencies in LDCs and international research groups willing to cooperate by supplying data and personnel for the study</li> <li>2. Much of the basic field data required for the work is already available in several countries.</li> </ol>
<p>Outputs:</p> <ol style="list-style-type: none"> <li>1. Reports, articles, and seminars which identify (a) how different technologies affect employment and production of rice and (b) how government policies affect the use of various technologies.</li> <li>2. Use of methodologies for assessing the effects of mechanical technologies used in the agricultural sector planning of rice producing countries.</li> </ol>	<p>Magnitude of Outputs:</p> <ol style="list-style-type: none"> <li>1. At least two major reports and one major seminar.</li> <li>2. Information and methodologies developed by the project used in at least one major rice producing country to develop policies to promote the use of appropriate technology.</li> </ol>	<ol style="list-style-type: none"> <li>1. Review and evaluation of project reports.</li> <li>2. Analysis of Agricultural planning systems in selected rice producing countries.</li> </ol>	<p>Assumptions for achieving outputs:</p> <ol style="list-style-type: none"> <li>1. Researchers with extensive field experience in rice producing countries are available to undertake the studies.</li> <li>2. Work will be carried out in cooperation with at least one agricultural planning unit.</li> </ol>
<p>Inputs:</p> <ol style="list-style-type: none"> <li>1. Specialists in the analysis of appropriate agricultural technologies.</li> <li>2. Secretarial and data analysis support</li> <li>3. Support for LDC technicians</li> <li>4. Travel funds</li> </ol>	<p>Implementation Target (Type and Quantity):</p> <ol style="list-style-type: none"> <li>1. Specialists: 6 man years</li> <li>2. Support staff: 6 man years</li> <li>3. Items 1 &amp; 2 above include LDC technicians</li> <li>4. Support funds shown in Table 1</li> </ol>	<ol style="list-style-type: none"> <li>1. PAR</li> <li>2. On-site inspection</li> </ol>	<p>Assumptions for providing inputs:</p> <ol style="list-style-type: none"> <li>1. LDC agencies and international research and development organizations willing to provide support facilities and in-country costs</li> </ol>

May 20, 1977

MEMORANDUM FOR: Research and Development Committee Members  
FROM: TA/PPU, Robert C. Simpson  
SUBJECT: Research and Development Committee Meeting  
June 2, 1977

19p.

The Agency is entering the busiest period of the fiscal year when FY 1979 reviews must be accomplished simultaneously with implementation of the FY 1977 program. We are acutely aware of the double burden placed upon the members of the R & DC who must participate in TAB reviews as well as those of their own bureaus.

During the next four weeks you are being asked to participate in eleven reviews chaired by Mr. Farrar in addition to a regular R & DC meeting scheduled for May 24. Despite this workload it is imperative that TAB continue to process its FY 1977 program during this period. There simply is not enough time prior to September 30 to have a hiatus.

Attached to this memorandum are seven project papers for FY 1977 projects. Several of them are research proposals for which the July meeting of the RAC is the last opportunity which permits FY 1977 contract action. We would prefer not to call still another meeting during this busy period and request your optional comments and/or clearance regarding these PPs. Please notify Mrs. Edna Shields, TA/PPU, 235-9011, if there are any specific proposals for which you request that a meeting be convened. We have tentatively reserved a conference room for such a contingency on June 2, 1977, at 2:00 p.m. Please notify Mrs. Shields no later than May 27, if you wish a meeting and which of the proposals you wish to be placed on the agenda. We will assume your concurrence with the PPs if Mrs. Shields has not heard from you by June 2.

The proposals are as follows:

1. Small-Scale Fisheries, TA/AGR - two year 211(d) grant extension to the University of Rhode Island, Small Scale Fisheries Cluster, (RDA 27). Please note the cover memorandum which explains that the proposal is being divided into two components, a 211(d) extension plus a new project for which a PP will be developed.
2. International Aquaculture Development, TA/AGR - six month 211(d) grant extension to Auburn University, Aquaculture Cluster, (RDA 27). Although the grant project statement calls for a two year extension, TAB believes that AID's relationship with Auburn is maturing and should be put into a form other than that of a 211(d) grant during the proposed six month extension.
3. Aflatoxin Reduction in Maize, TA/AGR, Research, Post Harvest Food Losses Cluster. (RDA 28).

4. Small Farmer Credit, TA/AGR - Adaptation/Application, Agriculture Policy Impact Analysis Cluster, (RDA 1).
- ✓ 5. Effects of Mechanizing Grain-Producing Small Farms Upon Food Output, TA/AGR - Research, Appropriate Technology Cluster, (RDA 1).
6. Development of Model for Demonstration, TA/H - Research, Health Planning Cluster, (RDA 12).  
(N.B. Mr. Farrar, AA/TA has not yet reviewed a PID or PP. However, TAB is soliciting R & DC comments).
7. Alternative Malaria Control Methods, TA/H - Research, Malaria Cluster, (RDA 13).

Attachments: a/s

(See attached list for distribution)

# Memorandum

TO : LA/OR, Mr. William Feldman

DATE: May 26, 1977

FROM : LA/OR/RO, John Ballis

SUBJECT: Effects of Mechanizing Grain-Producing Small Farms upon Food Output, Income and Employment

Thorough study of the impact of mechanization should produce invaluable information. We were very much impressed by the thoroughness of the IRRI study "Changes in Rice Farming in Selected Areas of Asia". If this proposed project enables IRRI to pursue with the same thoroughness, a study of mechanization as another element of HYV technology, we would have an even more valuable reference. The reputation of ADC for quality research is also very well known. Consequently the combination of resources raises a high level of interest in the proposal.

Consequently we concur with this proposal and anticipate an improved understanding of the implications of mechanization of small farms to result from this study. At the same time we anticipate that the direct application of this study may be a modest fraction of this work due to the markedly different place of rice cultivation in L.A. agriculture.

While supportive of this project, there are statements and aspects of the project design which raise some technical questions. I believe these can be adequately dealt with in the course of our informal working dialogue with TA/AGR/ESP.



5010-110

*Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*

## memorandum

DATE: May 27, 1977

REPLY TO  
ATTN OF: NE/TECH/SP-RD, James J. Dalton *MC*

SUBJECT: Ten TAB Project Proposals Received for Regional Bureau Review on May 23 and May 25, 1977

TO: TA/PPU, Mr. Robert C. Simpson

A total of ten (10) projects, some extensions and some new, were received from your office on May 23 and May 25, 1977. They were accompanied by a message stating that ". . .if comments are not received by COB, May 31, it will be assumed that you recommend submitting proposals to the RAC . . ." The memo then states that if the regional Bureaus have problems with the contents, they should call for a R&DC meeting to be held June 2, 1977.

While seeking to comply with the terrible staff workload generated by the sudden dumping of ten complex matters on our desks, I wish to protest this way of doing business. It turns the whole review role of the regional Bureaus into the most superficial process. It is just about all that regional Bureaus can do to handle one to two PIDs and PPs per week emanating from TAB. When the pace is kicked up to ten in one bunch, prudent regional Bureau management would seem to demand a cessation of activity. That, however, is only my opinion; and I don't think that either you nor ourselves have even the time--at the moment--to debate the procedural/policy issues posed by this episode.

So, with the help of Russ Olson and Emily Leonard of NE Tech Support, we have plowed through as many of the proposals as we can. Our views follow:

#### Agriculture

1. The Control of Vertebrate Pests - Extension for \$1,424,000 on a project already costing \$2,625,000.

Dr. Olson states: Food crop losses to pests continue to be very large despite very significant progress in research, particularly on rice rats. This project would extend the research and "shift emphasis to adaptation of control to other rodent species, assessment of damage to other crops and development of new research techniques for specific damage problems caused by other rodent or vertebrate pest species." The project would also put much greater emphasis on development of technology for control of the noxious quelea bird. There are important objectives, and the results of this research should have an important and favorable impact on food supplies in all regions. We should support.

Action: The Near East Bureau votes in favor of this extension.



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

2. Small-Scale Fisheries Grant - Rhode Island University

This proposes extension of the 211 (d) grant for another two years (\$500,000) and the development of a GTS contract which would appear to cost another \$1,227,000.

While Dr. Olson tends to favor at least extending the two-year 211 (d) component, he makes the point ". . . We do not have the staff time or technical competence to make a judgement regarding the second component of the URI proposal . . ." I have reviewed the details of the proposal in the light of current Agency policies on 211 (d) renewals. I also have tried to understand what the Agency might be buying through a GTS contract.

Unless we can be given more time to study this, and some chance to discuss the matter in detail, I believe the Near East Bureau must be counted as not favoring this proposal.

Action: The Near East Bureau votes against this proposal.

3. Aflatoxin Reduction in Maize

This is a new project with the University of Missouri for three years of research at a cost of \$415,000.

Dr. Olson states: The topic is one of considerable importance world-wide. Aflatoxin poisoning is a hazard to humans in those areas where maize is an important part of the diet. Whereas in the past the problem was considered a post-harvest problem, it is now recognized that it may be possible to deal effectively with the problem through plant breeding programs. This project is designed to search over many geographic areas for maize strains that have genetic factors which reduce or eliminate synthesis of Aflatoxin. I recommend we support the project proposal.

Action: The Near East Bureau votes in favor of this project.

4. International Aquaculture Development Grant - Auburn University

This proposes a short-term, six-month, extension of a 211 (d) grant at a cost of \$180,000.

Dr. Olson regards this proposed extension as a reasonable request, allowing time for TAB/AG and the University of Auburn to develop proposals for a new project incorporating some of the gains of past activities.

Action: The Near East Bureau votes in favor of this extension.

5. Small-Farmer Credit

Review not completed as of May 27, 1977, COB.

Action: The Near East Bureau reserves vote.

6. Control of Tsetse Fly  
Papers not received from TAB. No review work started.

Action: Near East Bureau reserves vote.

7. Effects of Mechanizing Grain-Producing Small Farms  
Review not completed as of May 27, 1977.

Action: Near East Bureau reserves vote.

8. Physiology and Ecology of Ticks  
Review not completed as of May 27, 1977.

Action: Near East Bureau reserves vote.

#### Health

1. Modeling for Health Planning

A one-year project for \$100,000 with GE-Tempo in order to develop three computer models to be used for sensitization orientation and teaching purposes for LDC health and economic planners.

Ms. Leonard observes: ". . .I love it. Only question I have is, is it under-costed? Seems like a big project for \$100,000 . . ."

Action: The Near East Bureau votes in favor of this proposal.

2. Alternative Malaria Control Methods (Integrated Genetic/Biological Mosquito Control)

A new three-year project with the Agriculture Research Service, USDA, Gainesville, Florida, at a cost of \$780,000.

Ms. Leonard observes: ". . .This looks reasonable to me. The only reservation would be the exclusion in the discussion of the rest of the world. The concentration is on Latin America. What about replication possibilities elsewhere? . . ."

Action: The Near East Bureau votes in favor of this proposal.

#### cc:

AA/NE:AWhite  
NE/TECH:DSteinberg  
NE/TECH:JAlden  
NE/TECH:ELeonard  
NE/TECH:ROlson  
NE/TECH:JSmith  
NE/TECH:JDalton

AFR/DP:FMoore  
ASIA/DP:RMeehan  
LA/DR:WFeldman  
PPC/DPRE:EHogan  
PHA/POP:CHemmer  
SER/MP:ASchoepfer

## MEMORANDUM

DATE: May 31, 1977

REPLY TO  
ATTN OF: NE/TECH/SP-RD, James J. Dalton *JD*

SUBJECT: Sequel to "Ten Project Proposals for Regional Bureau Review on May 23 and May 25, 1977

REF: Dalton-Simpson Memo of May 27, 1977

TO: TA/PPU, Robert Simpson

The Near East Bureau now has views to provide on three of the four agricultural projects on which it reserved votes in the memo of May 27.

These follow:

1. Research on the Physiology and Ecology of Ticks

This is a new project with the International Center for Insect Physiology and Ecology in Kenya, for a sum of \$750,000.

Dr. Olson observes:

"...Ticks and tick-borne diseases are major limiting factors in livestock production, particularly in the tropics. This project would be carried out under a contract with the ICIPE in Nairobi. ICIPE is one of the international research centers which AID does not support in its core program. The fact that they are competent to carry out research of value to AID seems justification for contracting with them for such research. I think we should support..."

Action: The Near East Bureau votes in favor of this proposal.

2. Small-Farmer Credit

The views of the NE/TECH Agriculture Division are attached, Annex A.

Action: The Near East Bureau votes against this proposal.

✓ 3. <sup>Agricultural Mechanization</sup> Effects of Mechanizing Grain-Producing Small Farms Upon Food Output, Income and Employment

The views of NE/TECH Agriculture Division are attached, Annex B.

Action: The Near East Bureau votes against this proposal.



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

4. Control of Tsetse Fly

Papers received on May 31. Now under study.

Action: The Near East Bureau reserves vote.

Attachments: Annex A  
Annex B

CC: AA/NE:AWWhite  
NE/TECH:DSteinberg  
NE/TECH/HND:JAlden  
ELeonard  
NE/TECH/AD:ROlson  
NE/TECH/HRST:JSmith  
NE/TECH/SP-RD:JJDalton  
AFR/DP:FMoore  
ASIA/DP:FMeehan  
LA/DR:WFeldman  
PPC/DPRE:EHogan  
PHA/POP/PPD:CHemmer  
SER/MP:ASchoepfer

## Annex B

### Effects of Mechanizing Grain-Producing Small Farms Upon Food Output, Income and Employment

#### General Comments

While we can whole-heartedly agree with the need for priority attention to the subject of mechanization for small farms and thus support the general thrust of the project, we would prefer to have had it organized and carried out differently.

1. Why limit the study to tropical Asia, and for the most part to the tropical humid and sub-humid areas. Why not <sup>include</sup> Korea where a temperate climate could be included and where they have been keeping good farm-records for several years and there exists a wide-range of mechanization in use.

2. In fact, why limit the study to Asia. A more complete set of various agri-ecological conditions, which may influence the choice and effects of mechanization, could be obtained by broadening the scope to include other regions. Otherwise, perhaps it should be deemed a regional project and funded from such sources.

3. Also, while grain producing farms are to be studied, will this really include many different major grains or will rice be overwhelmingly predominate?

4. It also appears the study is mostly to concentrate on small-scale mechanization as opposed to larger-sized equipment and power-units. If this is so, it should be better reflected in the title.

5. On what basis was IRRI chosen and why will the study focus primarily on the effects of equipment they have developed. One would have thought they would have wanted to analyze some of the effects <sup>the way</sup> before they widely promoted its use. Why is AID now funding what should have been done <sup>by them</sup> with earlier funds.

6. There has in fact been considerable research done on mechanization on small farms and by no means all of it on only large-scaled components. FAO held a world-wide seminar on mechanization, employment and production in January 1975. They have also assisted with mechanization policy studies in several countries including Pakistan. Many of the other bilateral donors have done a lot of work in this area, particularly in Africa. *How have these been done?*

### Specific Comments

#### 1. Policy and Research Focus (top of page 9).

Here it is stated, "The research proposed in this project focuses on the economic and social costs and benefits . . ." Does this mean no measurement or evaluation of effects on farmers' incomes (the earlier referred to 'financial analysis') will be carried-out? If so, this is not only contrary to what has been implied earlier-on in the document but also a serious deficiency to which we would have objections.

#### 2. Research Design (page 10)

The case is made for the essentiality of primarily (original) farm-level data; that secondary data, available from farm surveys, is not sufficient. This is true only to a point. The approach to be followed in this study will limit the analysis to the use of cross-sectional data as opposed to time-series which may be available from past surveys. Time-series data would much better reveal the dynamic impacts of mechanization on a farm, in a community or country than cross-sectional analysis.

#### 3. Project Design and Method (page 14 - procedure in selecting a sample of Farms in the study area).

It is not clear whether any pre-sampling will be done to be sure that the set of farms selected will provide the needed array of variations in size, type of mechanization, technology used, etc. that are to be studied. This

is highly recommended.

4. Farm Budgeting Analysis (page 19).

If the synthetic process of farm budgeting is to be used for estimating conditions that will not be observed empirically (to estimate future conditions as well as unobserved), of which considerable <sup>ones</sup> seem to be anticipated. Perhaps some of the large sampling should be dropped in favor of a post-analysis surveys to verify model results. Otherwise the synthetic results will remain suspect.

5. Also it is not clear, despite the term 'farm budget' analysis, whether a total-farm analysis will be made as an enterprize budget analysis. We agree that a total-farm analysis is essential if one hopes to reflect the overall impact of mechanization in employment, incomes and total food output. <sup>the flow of</sup> ~~sub-optimization~~ analysis can lead to sub-optimization, as well as lead to distortions regarding the true mechanization impact.

UNITED STATES GOVERNMENT

# Memorandum

4 RS  
ES

TO : TA/PPU, Mr. Robert C. Simpson

DATE: June 2, 1977

FROM : AFR/DR/ARD, Woodrow W. Leake

SUBJECT: R&DC Meeting June 2, 1977

We concur with each of the proposals, per your memo of May 20, and provide some comments as listed herein:

1. Small Scale Fisheries (comments to follow).
2. International Aquaculture Development Grant, Auburn University (see comments attached by Mr. Doral Watts).

3. Aflatoxin Reduction in Maize

While we have no objection, we are unaware of its importance in Africa.

4. Small Farmer Credit (see comments attached by Mr. Stanley Krause).
5. Effects of Mechanizing Grain-Producing Small Farms upon Food Outputs, Income and Employment (comments to follow).

cc: AFR/DP, Mr. Frank Moore



RS  
ES

UNITED STATES GOVERNMENT

# Memorandum

TO : TA/PPU, Mr. Robert C. Simpson

DATE: June 2, 1977

FROM : LA/DR, William M. Feldman

SUBJECT: R&D Committee Meeting, June 2, 1977

REF: Your memorandum of May 20 to R&D Committee Members

We provided comments to Edna Shields by phone on June 1 on how the LA Bureau stands on each of the projects.

Using the same project numbers as the referenced memorandum, we approved Nos. 4, 5, and 7; we disapproved No. 6; and we questioned the tactics recommended in Nos. 1, 2, and 3.

We would like TAB responses to the issues raised in the attached comments.



5010-110

*Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*

RS  
C.S.

June 3, 1977

MEMORANDUM FOR: TA/PPU, Mr. Robert Simpson  
FROM : PPC/DPRE, Edward Hogan  
SUBJECT : Research and Development Committee Meeting June 2, 1977

PPC has the following comments on PPs circulated by TAB for clearance by June 2, 1977

1. TA/H Research, Dev. of Model for Demonstration. PPC does not clear this project and objects strongly to this proposal. A.I.D. currently has a substantial contract with GE-TEMPO which has been in effect for several years. Recently PHA/POP requested an extension of the project with a substantial increase in funding. This proposal was examined by the current A.I.D. Administrator and disapproved. He did approve a modest extension to the end of this fiscal year to complete ongoing work. The project will receive an intensive evaluation before A.I.D. decides whether it wishes to continue a contractual relation with GE TEMPO. In view of this we believe it highly inappropriate for A.I.D. to be considering entering into another contractual relation with GE-TEMPO. In view of this I believe it is not necessary to address substantive matters though we will be prepared to do so in the future if the project is resubmitted for consideration.
2. 211(d) University of Rhode Island. A review of the 211(d) proposal submitted by URI indicates that work performed under the previous 211(d) grants has been generally satisfactory and that the University has been involved in providing useful assistance to several less developed countries. Certainly no one should under rate the importance from a production and income distribution standpoint of assisting the development of small-scale fisheries. However, one would be more comfortable if there was some concrete evidence of the benefits derived from this activity in terms of increased production and incomes of poor majority fishermen. Demonstration of a direct or indirect relationship of 211(d) activities to the major policy imperative of A.I.D. is not a simple task but surely we can do better than we have on this matter.

We would question whether providing budgetary support to URI International Center for Marine Resource Development ought to be continued. There are two issues to be addressed. Should A.I.D. continue to provide budgetary support? Should A.I.D. do this through a 211(d) grant if the answer to the first issue is yes? The proposal submitted by URI appears to clearly indicate that the ICMRD cannot be sustained as a really viable institution capable of responding to less developed countries' needs for development assistance without a substantial A.I.D. subsidy. The requirement for A.I.D. budgetary support is infinite. Should A.I.D. continue to provide this type of recurrent cost support for URI when A.I.D. is not prepared to provide it to our principal clients, the less developed countries? This issue, of course, is broader than

the 211(d) but we believe it is of sufficient importance to be brought to the new Administrator's attention. If an affirmative judgment is made with respect to providing budgetary support to the ICMRD, it does not follow that the 211(d) grant is the proper vehicle for providing this type of assistance. It would appear more straightforward to contract with ICMRD to provide so many days of services to work on research and other activities as requested by A.I.D.

We would not be prepared to undertake a substantive review of this project which might result in our clearing the URI 211(d) project until the issues cited above are resolved.

3. 211(d) grant extension for Auburn. The comments made on the URI 211(d) project apply to this request for extension. In addition, there appears to be a probable duplication of effort between part of the Auburn proposal and the proposed Milkfish Project proposal. (We will be commenting separately to you on that project proposal).

4. Small Farmer Credit. PPC does not object to this project going to the RAC. We would note, however, that we continue to have reservations with respect to undertaking new research activities in the field of agriculture credit.

5. Aflatoxin Reduction in Maize. PPC does not concur in forwarding the Aflatoxin Reduction in Maize project to the RAC. We do not believe it is appropriate for funding under the A.I.D. program. This is a world-wide problem which affects both developed and less developed countries. We therefore conclude that A.I.D. funds which are appropriated to provide assistance to less developed countries should not be used to fund this project. We suggest that as the corn growing areas of Missouri are probably at least as warm and humid as the average of other corn growing areas throughout the world that the University seek funding from its State Legislation. We would also point out that we see no relationship between this proposed project and A.I.D. policy with respect to assistance to the poor majority. The quality of the research proposed is irrelevant.

✓ 6. Effects of Mechanization Grain-Producing Small Farms Upon Food Output. Based on a review of this project by Mr. McClelland PPC concurs in going forward with the Effects of Mechanizing Grain-Producing Small Farms Upon Food Output, Income and Employment.

7. Alternative Malaria Control Methods. PPC approves going forward with the Alternative Malaria Control Methods project subject to a demonstration that alternative financing could not be obtained from USDA. In brief, the question is why should A.I.D. pick up an activity which USDA has been financing. We would also note that, while we recognize a variety of reasons why the elimination or reduction of incidence of malaria is important, we do not recognize as one of the reasons the fact that malaria reduces fecundity.

**Effects of Mechanizing Grain-Producing Small Farms  
Upon Food Output, Income and Employment (New) -  
International Rice Research Institute (IRRI).  
Duration of project, three years; estimated cost  
\$635,000**

Mechanization of farming in developing countries has potentially profound implications that affect the well-being of rural and urban inhabitants alike. The impacts upon the poor and destitute subsistence farmer and the landless rural laborer can be devastating. Jobs may be lost, income may be reduced, and land may transfer to those who are able to afford more. On the other hand, mechanization can result in greater farm productivity, greater employment off the farm, reduced production costs and improved terms of trade for the farmer. While the possibilities for significant improvement in the welfare of the poor exist, little concrete information exists on small farmer mechanization problems.

Some of the questions which remain are: Why don't more small farmers utilize appropriate mechanical power? What will happen to farm output and farm labor use if small farmers do adopt more modern power units? What demands upon the environment, including fuel requirements, can be expected with mechanization? Will incomes increase if small-scale mechanization programs are carried out and, if so, is it the poor who will benefit? What type of equipment is most profitable for the typical small operator? How do other technological advances relate to mechanization on the small farm?

The proposed project seeks to address these type of questions. In its focus upon the small farmer and the small-scale equipment which is being developed by the International Rice Research Institute (IRRI) expressly for this use, it covers an area given too little attention to date. The project is an effort involving AID, IRRI, The Agricultural Development Council, LDC research institutes, and the farmers who will participate in country studies.

The R&DC reviewed and approved this proposal with one dissenting vote from the Near East Bureau.

Summary of RAC Recommendations - July 14, 1977

Effects of Mechanizing Grain-Producing Small Farms Upon Food Output, Income and Employment (New) - International Rice Research Institute (IRRI). Duration of project, 3 years; estimated cost, \$635,000. \*Swanson, Anderson Thorbecke, Wittnebert. +115,000 to A/D/C

Recommendation: That the research design development portion of the proposal be approved. RAC will consider and make a recommendation on the remaining parts of the proposal after it receives a report of the research design, including both the IRRI and ADC components.

Note: RAC concluded that the output from this project would be highly useful in improving the quality of decisions on subsidies, tariffs and other social and economic problems that are related to mechanization. The specifics of the research design will be developed at an international workshop involving professionals from several developing countries. RAC members suggested some analytical approaches that could be considered at the workshop. The International Rice Research Institute was thought to be uniquely qualified to do the research.

\*RAC review Subcommittee; chairman underscored

UNITED STATES GOVERNMENT

# Memorandum

TO : TA/PPU, Robert Simpson

DATE: August 4, 1977

FROM :  TA/RES, Miloslav Rechcigl

SUBJECT: Clearance of Research Project PIO/Ts From the July 14-15, 1977 RAC Meeting.

This Office has reviewed the following PIO/Ts approved at the July 14-15, 1977 RAC meeting for conformance with RAC recommendations and the research design as presented in the project paper. Specific comments to be brought to the attention of PPU are listed below.

"Improvement of Pearl Millet" - Kansas State University  
Comments: None

"Sterility Method for Tsetse Fly Control" - USDA  
Comments: The funding level in the PIO/T is approximately \$200,000 higher than the funding requested in the PP reviewed and approved by RAC. No justification is found in the PIO/T although the project manager has informed us that costs have significantly increased in the areas of insect rearing and barrier construction.

"Control of Vertebrate Pests" - Department of Interior - DWRC  
Comments: The funding requested in the PIO/T is approximately \$60,000 less than indicated in the budget in the PP.

"Socio-Economic Analysis of Impact of Water Projects on Schistosomiasis"  
- Resources for the Future  
Comments: None

"Aflatoxin Reduction in Maize" - University of Missouri  
Comments: None

"Benchmark Soils" - University of Puerto Rico  
Comments: None

"Effects of Mechanizing Grain Producing Small Farms Upon Food-Output, Income, and Employment" - IRRI and ADC  
Comments: This PIO/T was apparently prepared prior to RAC meeting and therefore does not reflect RAC recommendation on this project, specifically, "the approval of that part of the proposal dealing with development of the research design. RAC



will consider and make a recommendation on the remaining parts of proposal after it receives a report of the research design, including both the IRRI and ADC components".

We have not yet received the PIO/Ts for "Alternative Malaria Controls" or "Research and Implementation of Milkfish Propagation".

Our clearance of these projects is based solely upon scientific considerations and does not indicate the Administrators approval to go ahead with contracting and funding of the projects.

DEPARTMENT... STATE AGENCY FOR INTERNATIONAL DEVELOPMENT  PROJECT IMPLEMENTATION ORDER/TECHNICAL SERVICES	1. Cooperating Country TA/Bureau	Page 1 of 5 Pages
	2. PIO/T No. 931-1026.01-3177627	3. <input checked="" type="checkbox"/> Original or Appendment No. _____
	4. Project/Activity No. and Title 931-1026.01  Effects of Mechanization on Small Farms <span style="float: right;">32p.</span>	

<b>DISTRIBUTION</b>	5. Appropriation Symbol 72-11x1023		6.A. Allotment Symbol and Charge 402-31-099-00-22-71		6.B. Funds Allotted to: <input checked="" type="checkbox"/> A.I.D./W <input type="checkbox"/> Mission		
	7. Obligation Status <input checked="" type="checkbox"/> Administrative Reservation <input type="checkbox"/> Implementing Document				8. Funding Period (Mo., Day, Yr.) From 9/20/77 to 9/19/80		
	9.A. Services to Start (Mo., Day, Yr.) Between 9/20/77 and 9/30/77				9.B. Completion date of Services (Mo., Day, Yr.) 9/19/80		
	10.A. Type of Action <input checked="" type="checkbox"/> A.I.D. Contract <input type="checkbox"/> Cooperating Country Contract <input type="checkbox"/> Participating Agency Service Agreement <input type="checkbox"/> Other						
	10.B. Authorized Agent AID/W with IRRI						
	Estimated Financing						
	\$1.00=						
	11. Maximum A.I.D. Financing		A. Dollars	(1) Previous Total	(2) Increase	(3) Decrease	(4) Total to Date
					\$438,700		\$438,700
	12. Cooperating Country Contributions		A. Counterpart	FUNDS RESERVED BY <i>JMM</i> POSTED <i>9/8/77</i> SER/AM/CSD			
		B. Other					

13. Mission References

14. Instructions to Authorized Agent

The Contract Office is authorized to prepare a three year contract with the International Rice Research Institute (IRRI) at Los Banos, Philippines to carry out the work listed on pages 13 to 17 of the attached Research Project Statement. Budget details are shown on page 23 of the same attachment.

"Article # \_\_\_\_\_ In each instance of voucher the (SF 1034) submission made by the contractor for payment hereunder, the following identification data will appear on the face of the voucher: (Continued on page 5)

15. Clearances - Show Office Symbol, Signature and Date for all Necessary Clearances.

A. The specifications in the scope of work are technically adequate TA/AGR/ESP, J. Day <i>JDB</i> Date: 7/25/77	B. Funds for the services requested are available TA/PPU, M. Mozynski <i>MEM</i> Date: 9/2
TA/AGR/ESP, W. Merrill <i>WCM</i> Date: 7/25/77	D. TA/PPU, C. Molfetto <i>CM</i> Date: 8/5/77
C. The scope of work lies within the purview of the initiating and approved Agency Programs TA/AGR, L. Hesser <i>LH</i> Date: 7/25/77	TA/RES, M. Rechcigl <i>MR</i> Date: 8/29/77
E. TA/AGR/ESP, K. Brundage <i>KPB</i> Date: 7/25/77	F. ASIA/TD, C. Martin <i>CM</i> Date: 7/25/77
TA/AGR, D. Clark <i>DC</i> Date: 7/25/77	

16. For the cooperating country: The terms and conditions set forth herein are hereby agreed to

17. For the Agency for International Development

18. Date of Signature

Signature and date:	Signature:	Date:
Title:	Title:	

AID 1350-1X (19-20)	Cooperating Country Thailand, Indonesia Philippines, Pakistan	PIO/T No. 931-1026.01-31-627	Page 2 of 5 Pages
PIO/T	Project/Activity No. and title Effects of Mechanization on Small Farms 931-1026		

**SCOPE OF WORK**

**19. Scope of Technical Services**

**A. Objective for which the Technical Services are to be Used** To provide a better understanding of the effect of farm mechanization on small farmers and to improve, capacity of Asian Scientists and institutions to do farm mechanization research.

**B. Description**

See Attachment pages 13-17

**C. Technicians**

(1) (a) Number	(b) Specialized Field	(c) Grade and/or Salary	(d) Duration of Assignment (Man-Months)
1	Project Manager	8,000	36
3	Research Assistants	9,000	108

Similar teams in three countries besides the Philippines

**(2) Duty Post and Duration of Technicians' Services**

Philippines and other selected Countries

**(3) Language requirements**

Of country assigned

**(4) Access to Classified Information**

None

**(5) Dependents**     Will     Will Not    Be Permitted to Accompany Technician

**D. Financing of Technical Services**

(1) By AID - \$ 438,700

(2) By Cooperating Country -

AID 1380-1X  
(8-70)  
PIO/T

Cooperating Country I.onesia, Thailand  
Philippines, Pakistan

PIO/T No.  
931-1026.01-3177627

Page 3 of 5 Pages

Project/Activity No. and Title

**Effects of Mechanization on Small Farms**

20. Equipment and Supplies (Related to the services described in Block 19 and to be procured outside the Cooperating Country by the supplier of these services)

A. (1) Quantity (2) Description

(3) Estimated Cost

(4) Special instructions

B. Financing of Equipment and Supplies

(1) By AID - \$

(2) By Cooperating Country -

21. Special Provisions

A. This PIO/T is subject to AID (contracting) (PASA implementation) regulations.

**Local hire and support cost authorized**

B. Except as specifically authorized by AID, or when local hire is authorized under the terms of a contract with a U. S. Supplier, services authorized under this PIO/T must be obtained from U.S. sources.

C. Except as specifically authorized by AID/W, the purchase of commodities authorized under this PIO/T will be limited to the U.S. under Geographic Code 000.

D. Other (specify): **"Special Provisions**

Prior to making any visits to LDCs, the Contractor will review his plans with TA/AGR. He will keep AID Missions in countries to be visited fully informed of proposed visits and to participate if they desire, and will inform the Missions of the outcomes of consultations. He will make his own appointments and logistics arrangements directly. Upon completion of any project funded travel, a copy of the trip report will be provided to the TA/AGR Project Manager. The report format will be established jointly by the Contractor and the Project Manager."

AID 1350-1X (8-70)  PIO/T	Cooperating Country <u>Indonesia, Thailand</u>	PIO/T No.	Page 4 of 5 Pages
	<u>Philippines, Pakistan</u>	<u>931-1026.01-3177627</u>	
Project/Activity No. and Title		<u>Effects of Mechanization on Small Farms 931-1026</u>	

22. Reports by Contractor or Participating Agency (Indicate type, content and format of reports required, including language to be used if other than English, frequency or timing of reports, and any special requirements)

"Contractor shall submit three copies of all reports listed as being a product of the contract (administrative, progress, final and technical reports containing R&D findings) to the Documentation Coordinator, TA/PPU/EUI, Technical Assistance Agency for International Development, Washington, D.C. 20523, or his designee. Such reports shall include a title page showing the title of the report, project title as set forth in this contract (or grant) and the contract number. One copy of each report shall be clearly typed or printed on white paper so that it may be photographed to produce a microfilm master. Technical reports shall be accompanied by an author-prepared abstract."

Six copies of progress reports shall be submitted on a semi-annual basis (commencing from effective date of contract) to the Project Manager TAB/AGR/ESP, Agency for International Development Washington, D.C. 20523.

23. Background Information (Additional information useful to Authorized Agent and Prospective Contractors or Participating Agency; if necessary cross reference Block 19.C(4) above.)

Available from TA/AGR

24. Relationship of Contractor or Participating Agency to Cooperating Country and to AID

A. Relationships and Responsibilities

Director IRRI

B. Cooperating Country Liaison Official

C. AID Liaison Officials

TA/AGR, Director Leon F. Hesser and/or Dr. J. Day TA/AGR/ESP

CONTINUATION SHEET

FORM SYMBOL

TITLE OF FORM

DEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT

Worksheet  Quence

PAGE 5 OF 5 PAGES

1. Cooperating County TAB

2.a. Code No. 931-1026.01-3177627

2.b. Effective Date

2.c.  Original OR Amendment No: \_\_\_\_\_

3. Project/Activity No. and Title

Effects of Mechanization on Small Farms

Indicate block numbers.

Use this form to complete the information required in any block of a PIO or PA/PR form.

14

Contract: AID/\_\_\_\_\_  
Project 931- 1026.01  
Project Office TAB/AGR

A companion activity will be undertaken by the Agricultural Development Council in New York to involve Asian Scientists in the study of these problems. . Coordination will be maintained between the two Agencies.

This activity was approved by RAC on July 15, 1977, subject to the following conditions (a) expenditures not to exceed \$40,000 are authorized only for Phase I research design activities, and (b) expenditures for activities beyond Phase I will not be authorized until RAC has reviewed and approved the proposed research methodology. If the methodology to be carried out does not meet with RAC's approval project funds will be deobligated and the project terminated at the end of Phase I. The final project proposal containing the detailed research methodology shall be submitted to RAC for its approval no later than March 31, 1978.

Funding in this PIO/T is for a 24 month period if approval of Phase II is provided by RAC upon review of Phase I, The final year of funding will be provided at a later date, depending on the availability of funds to AID

**PROJECT STATEMENT**

**A. PROJECT SUMMARY**

**1. Statistics:**

**Project Title:**

**Effects of Mechanization Upon Small  
Grain Farm Production, Income, and  
Employment**

**New or Extension:**

**New**

**Duration:**

**Three Years -- September 1, 1977 to  
August 31, 1980**

**Total Estimated Cost:**

<b>FY 1977</b>	<b>\$330.8</b>
<b>FY 1978</b>	<b>\$222.9</b>
<b>FY 1979</b>	<b>\$216.9</b>

**Total**            **\$768.6**

**Principal Investigator:**

**International Rice Research Institute  
(IRRI), Agricultural Development  
Council, Inc., (A/D/C), and subcon-  
tractors to be selected by IRRI.**

**Project Manager:**

**William C. Merrill  
Economics and Sector  
Planning Division  
TA/AGR/ESP**

## 2. Abstract

Since 1965 AID has promoted the development and use of small scale farm machinery for grain production in Asia. In recent years there has been increased interest in the economic and social effects of such machinery on small farm households. The basic question is, "Does the development and promotion of small scale farm machinery truly benefit small farmers?" This project will not provide the definitive answer to this question but it will begin the process of building an increased awareness in the Asian region of the importance of the question and an increased capacity to carry out research related to the question.

Under this project coordinated case studies of the effects of farm mechanization will be carried out in four Asian countries under the direction of the International Rice Research Institute IRRI and several small independent research activities will be carried out in other Asian countries under the direction of the Agricultural Development Council (A/D/C). The coordinated case studies directed by IRRI are the major component of this project. Under this component it is proposed that a sample of small farms characterized by varying agricultural practices and levels of mechanization be selected and surveyed at various times in the crop production cycle. Farm-level data will be gathered on use and cost of inputs, yields, incomes and other variables required to better understand how the use of small scale farm machinery affects small farmers. Particular attention will be placed on the timing, amount and composition of the labor input vis-a-vis family and hired labor. The data will be analyzed to determine whether significant differences in employment, yields and other relevant variables exist among the various mechanization-technology combinations found in a particular study area. The results from these case studies, will provide micro-level data on input characteristics of several farm operations and insights for analysis of mechanization on other cropping systems in different areas or countries. Since the research project will focus on four countries with differing geographic climatic and socio-economic conditions these externalities will be greater than those from a single country study.

The small, independent research activities directed by A/D/C will provide information on the effects of mechanization which will supplement and complement that developed by the IRRI directed component of the project. The A/D/C directed research will provide scholars not included in the IRRI directed component an opportunity

to carry out small studies on the effects of agricultural mechanization and to exchange ideas, information, and results of their work with IRRI researchers.

The A/D/C component of the project will be managed in such a way as to encourage (1) research on the effects of mechanization in countries not included in the IRRI component and (2) the exchange of information and results of this research with other interested scholars in the Asian area. The exchange of information will take place, in part, through participation in regional seminars on agricultural mechanization. Some of the seminar activities will be funded by this project. Funding for additional seminar and workshop activities will be requested at a later date if necessary but, in general, would be provided by other organizations or through other AID programs.

## B. EXPANDED NARRATIVE STATEMENT

### 1. General Background

Since 1965, the International Rice Research Institute has had a program for the development and extension of small farm machinery which has been funded in part by AID. Total AID funding of these activities to date amounts to approximately \$2,200,000. Under the IRRI program prototype models are designed and field tested. Successful models are then made available to local manufacturers. IRRI provides these manufacturers technical assistance and engineering testing services for machinery of IRRI design or modifications of IRRI designs. Most of this work until recently has been conducted in the Philippines. In 1975, however, the IRRI program was broadened to include "industrial outreach" activities in Pakistan and Thailand. It is anticipated that similar work will be initiated in Indonesia in the near future.

In the early 1970's AID began to direct greater attention to the impact of its programs on small farmers. As part of this process it became increasingly interested in the effects that programs such as the IRRI small farm machinery program might have on small farmers. A thorough review of the literature on the effects of farm mechanization was undertaken by the Agency in late 1974 and a careful review of the IRRI program was completed in 1975. Following the 1975 reviews it was decided that, in light of the industrial outreach program, it would be appropriate and timely to initiate more in-depth research on the effects of agricultural mechanization once initiated outside of the Philippines.

Funds were requested for such research in 1976 but staff time did not permit the development of a project proposal or request for such proposal at that time. In early 1977, IRRI submitted an unsolicited proposal to undertake such research in coordination with its industrial outreach project. A/D/C had previously indicated its interest in such research but felt that its style of operation and staff situation would not be consistent with accepting primary responsibility for a large scale, coordinated research effort. This project proposal is a revision of the proposal submitted by IRRI and links that proposal to the approach suggested by the A/D/C for encouraging small research projects on the effects of agricultural mechanization in Asia.

## 2. Research Purpose and Expected Products

Purpose: This project is designed to achieve two objectives. The first is to provide a better understanding of the effects which farm mechanization has had on small farmers. Emphasis will be given to determining output, income, and employment effects of small scale (IRRI-type) equipment on small grain farms, particularly rice farms. The second objective is to encourage more applied research on the effects of farm mechanization and improve the capacity of Asian scientists and institutions to undertake such research. A large proportion of the total funding for this project is devoted to achieving the second objective. The rationale for undertaking IRRI directed research activities in four countries and the proposed A/D/C research grant, in large part, stems from the importance of achieving the second objective. The first objective is a research objective. The second, in large part, an institution (or capacity) building objective.

Expected Products: (1) improved capacity of Asian scientists to use the techniques of agricultural economics and rural sociology to assess new technologies, conduct farm level studies, and to analyze policies; (2) recommendations useful to small grain farmers regarding appropriate mechanization practices based on economic, and technical studies in regions of four Asian countries; (3) analysis of alternative policies and programs for assisting small farmers to improve income and employment opportunities and the extension of this information to relevant government and parastatal agencies; (4) analysis of the optimum resource combinations and the resulting impacts of mechanization on 'typical' farms in four Asian countries; (5) additional knowledge of the factors underlying the adoption of improved practices,

new technologies and mechanization and projections of adoption rates based on this knowledge; (6) regional estimates of the effects on farm income, employment, and production of adoption of mechanization in grain production and (7) methodologies for assessing the impacts of mechanization on small farms.

Relevant Policy Questions: The information developed by this project will be relevant to program and policy questions such as:

- (1) whether or not to include a mechanization component in government agricultural projects,
- (2) the use of subsidized small equipment government operated "power/implement" pools for custom-hire work,
- (3) the use of subsidized credit for equipment purchase,
- (4) removing or improving tariffs on imported machinery, parts, and fuel,
- (5) subsidy programs for domestic producers of equipment,
- (6) commodity price and input cost subsidies which may alter the relative profitability of small-scale mechanization
- (7) land tenure arrangements which may affect size of holdings and thus effect the profitability of mechanization.

It is recognized that the priorities assigned to policy questions of this type will vary between countries. The research designs for the countries may differ somewhat as a result.

### 3. Relevance and Significance of the Proposed Project

#### a. The Development Problem

Agricultural mechanization touches on three vital issues which are important not only to AID and the "New Directions" mandate but, to basic development questions: i.e., employment creation, food production and equitable income distributions. For example, employment creation continues to be a most vexing problem for LDCs for it is apparent that employment growth within LDC manufacturing sectors has not been sufficient to absorb the increases in the labor force nor are the prospects for doing so likely to improve in the near future. Therefore the agricultural and rural sectors in LDCs, particularly those with low land/labor ratios, must generate added employment if these increases are to be absorbed in productive activity.

On the other hand, food production and productivity per worker must increase to meet the food demands stemming from population growth and the increasing urban populations. Increases in food production are a vital element of a rural income-generating mechanism that will allow self-sustaining growth. New agricultural technologies, particularly cost decreasing innovations, can be important in this strategy.

In the process of food production, initial factor endowments and the returns to those factors will determine the amount as well as the direction of income flows. It is important to determine the changes in direction and amount of flows due to new technologies and mechanization in particular.

While farm mechanization is viewed as a vital part of agricultural development, the type of mechanization, i.e., size and power and type of machine, may have a profound influence on the demand for labor, output and distribution of income. It has been argued that mechanization will result in increased output and employment by increasing the cultivated area, permitting multiple cropping, and improving cultivation practices and yields, yet, little empirical evidence exists to support this conventional wisdom.

Unfortunately such statements provide little useful information to policy makers since each type of machinery can interact differently with cropping systems and operations, resulting in different and possibly negative employment and output effects.

While the problems of assessing the effects of new technology are not simple, strong interest in these effects is expressed by LDCs and is a necessary input into AID decision making. AID is increasingly concerned about the development and use of appropriate technology given the factor endowments and the needed increases in food output. It is clear that the assessment of the effects of agricultural mechanization can be helpful to many development practitioners. The proposed research project will provide information about appropriate technology on farm sizes which make up close to 90% or more of farms in the region, viz., 0-12 hectares.

#### b. Policy Issues and the Research Focus

By nearly any measure, the amount of useable energy (man, animal, and machine) available for agricultural use in LDCs is low. One of the most important decisions facing a low income country is that of evaluating the most economically and socially desirable process of agricultural mechanization. In evaluating the process, one must consider the type of machine used, the rate of introduction, and the operations affected. For individual countries,

the lack of adequate technical expertise and farm level data makes the formulation of policy and assessment of impacts speculative at best.

Some economists point to the paradox of mechanization in labor abundant economies while other economists and most engineers equate farm mechanization with modernization; and modernization, in turn with high productivity of labor and land. The latter group seems to foster the concept of a mechanization ladder. The first group prescribes a "go slow" policy for mechanization while the second encourages rapid adoption. To some extent these groups may be talking past each other as a result of initial biases, but these divergent prescriptions may also result from different perspectives on the temporal dimensions of mechanization. Over the long run, mechanization appears to be the only viable means of significantly increasing agricultural power. As the availability and quality of land drops per capita, the food energy for men and animals will become increasingly expensive. Thus, mechanization could reduce the demand for animal feeds and increase availability of land for food production. On the other hand most studies have shown that mechanization in its early stages has little effect on crop yields. There appears to be wide agreement that the long term effect of farm machinery on agricultural employment is likely to be substantially greater than the short term changes.

The proposed project will focus on the economic costs and benefits of mechanization on small farms; viz., those associated with short and intermediate term changes in production, income, and employment.

c. Possible Side-effects of the Proposed Research

Environmental aspects of this project have been considered. The project activities are limited to an economic study of the effects of mechanizing small farms. Projects of this type normally do not require the filing of an Environmental Impact Statement (22CFR 216.2(b)). This activity is not deemed a major Federal Action (Section 1500.6, CEQ Guidelines) since the project will have no significant effects which adversely affect such aspects of the human environment as air, water, land, flora or socio-economic conditions. Therefore, it is recommended that the Threshold Decision be deemed negative, constituting a Negative Determination since the project will not result in activities affecting environment.

This project will analyze the input requirements particularly the labor used under alternative levels of mechanization. This should permit a clearer understanding of mechanization impacts on population growth, energy requirements and the role of women. For example, if mechanization reduces the drudgery of field work it may increase female labor participation as women assume other jobs. If these jobs are incompatible with the care of children at home there could be implications for fertility. Also, if the skill levels required in agriculture are increased it may motivate farmers to provide more education for their children and increase the cost of children. Therefore, the analysis of family vs. hired labor are or should yield insight into the role of women and population growth implications of mechanization. On the other hand, the analysis of input needs should also provide information on energy requirements of alternatives mechanization levels.

#### 4. Relation to Existing Knowledge

A review of the literature on farm mechanization reveals several complications involved in measuring employment, output and income impacts. First, each individual operation required for crop production can be performed with many alternative techniques. Land preparation, water control, planting, harvesting and threshing are individual operations within the farm production function. Mechanization can impact on all, one or several of these operations. Thus, in the research design proposed, the mechanical changes are disaggregated into specific changes in individual operations.

Secondly, although studies of single mechanization options (tractor hire schemes for example) are relatively easy to carry out, they are of more limited value to policy makers than those concerned with assessing the impact of mechanization options which may affect several production operations. Research in the short and medium term should emphasize the trade-offs inherent in mechanization options. The array of alternatives is wide and an all inclusive sample would be very expensive and difficult to collect. This research project will attempt to investigate only a limited range of mechanization alternatives associated with several farming operations. It is recognized that sorting out the impacts is complicated by the fact that the type of mechanization employed in one operation is seldom independent of that used in other operations. Small power tillers for example, may have little impact on production unless a pumpset is used to increase water availability. Further, it is difficult to sort out the impact of a newly mechanized operation and new technology inputs like fertilizer. Mechanization may enable more precise timing of operations and application of chemical inputs so that double cropping may take place. Thus, the study has to look not only at separate operations and the array of mechanical techniques but

also at the level of technology and the feedbacks between mechanization and other farming practices. The existing literature provides very little insight into the complexities of these relationships.

Existing data available from farm surveys provide limited information for policy analysis of mechanization. Such surveys frequently provide information on size of farms, man/land ratios, implements in use etc., but seldom show changes in output, income distribution and employment associated with changes in inputs including farm machinery. The estimates of employment requirements for particular operations vary widely from country to country. Differences in soil, weather and cultural practices account for some of the variation, but in other cases the differences are hard to explain given similar cultivation practices. Thus the collection of new farm level data is necessary to provide the information needed for this project.

During the past four years, AID has funded five small studies of the effects of new technology on small farmers.

- (1) Antonio Gayoso, The Impact of Changing Technologies Mechanization and Employment: A Preliminary Review Economic Analysis Division, Bureau of Program and Policy Coordination, U.S. Agency for International Development, Washington, D.C., 1974
- (2) William C. Merrill, The Impact on Agricultural Mechanization on Employment and Food Production, Occasional Paper No. 1, Economics and Sector Planning Division, Office of Agriculture, Technical Assistance Bureau, U.S. Agency for International Development, Washington, D.C., September 1975
- (3) A. L. Becker, W. R. Butcher, C. F. Feise, and C. A. Ulinski, Evaluation of Factors Affecting the Rate of Adoption of IRRI Small Farm Equipment, Department of Agricultural Economics, Washington State University, Pullman, Washington, November, 1975.
- (4) John Balis, Appropriate Technology for Agricultural Development, Appropriate Technology Committee, U. S. Agency for International Development, Washington, D. C., June, 1976.

- (5) Wayne A. Schutjer and Marlin G. Van Der Veen, Economic Constraints on Agricultural Technology in Developing Nations, Occasional Paper No. 5, Economics and Sector Planning Division, Office of Agriculture Technical Assistance Bureau, U.S. Agency for International Development, Washington, D.C., forthcoming, 1977.

Each of these studies represented three to six man-months of research based on existing literature and data. The conclusions of these studies were quite similar. They confirm:

- (1) That little systematic research has been carried out on the impacts of mechanization on small farmers.
- (2) That much of the existing research fails to separate out the interactions between mechanization and the adoption of other technologies and practices.
- (3) That there is very little evidence to support the contention that mechanization substantially increases yields.
- (4) That mechanization which replaces animal power usually reduces rural employment.
- (5) That tractorization may result in a gradual increase in the size of land holdings and the displacement of tenants or farm workers.
- (6) That government policies and programs to promote mechanization through subsidized interest rates, favorable import arrangements, or increased credit availability can cause a significant increase in the rate of mechanization and are likely to benefit large landholders more than others.
- (7) That the mechanization of agriculture is a continuous and inevitable process in economic development but one whose speed and direction can be altered by public policies and programs.
- (8) That agricultural mechanization should be viewed as a part of modern agricultural production systems.

Combined with new biological and chemical technologies mechanization may enable more precise timing of operations and application of chemical inputs so that the total biological, chemical, and mechanical package results in an increase in output per acre year with little, if any, reduction in total cost.

Many of the studies upon which these general conclusions are based are careful analyses of specific types of mechanization in selected types of mechanization in selected regions in most of the countries included in this project. The focus of these studies, however, generally was not on small scale, IRRI-type, farm machinery. A large proportion of the research on this topic has been on medium and larger size tractors, associated equipment, and larger scale modern grain harvesting equipment. These studies will provide background and complementary information for the proposed research. Very little, if any, duplication between the proposed and past research is anticipated. IRRI has, however, carried out several small, case study surveys of the impact of small scale equipment in the Philippines. This work will provide a starting point for the proposed study in the Philippines, and illustrations of the type of information which could be collected relatively quickly in the other countries working with IRRI.

#### 5. Relation to Other AID Projects

There are no AID projects currently underway or proposed on the effects of different types of mechanization on small farms in other areas of the world. The AID Working Group on Appropriate Technology has, however, established a private corporation, Appropriate Technology International, intended to develop and promote appropriate technologies for developing countries. A.T. International may at a later date undertake projects related to the proposed project. TA/AGR/ESP is represented on the AID Working Group on A.T. and, therefore will be able to assure close coordination between the proposed project and any related work sponsored by A.T. International.

The proposed project is directly related to IRRI's industrial outreach program which is funded by AID (AID Contract csd-1208). This project will be managed by IRRI and AID so as to supplement and complement on-going industrial outreach program. It will provide useful information with which to evaluate the industrial outreach program and for re-focusing the program, if necessary, in the future. The IRRI industrial outreach network in Pakistan, Thailand, Indonesia (proposed), and the Philippines will be used to provide information on where IRRI-type equipment is being used and, where appropriate, institutional bases for the research activities.

The A/D/C - Research and Training Network (RTN) program will be particularly helpful in the dissemination of the results of the proposed project, to policy-makers and other researchers.

Current work supported by AID/TA/AGR at Michigan State University, Purdue University, and Cornell University (Poor Rural Households, Technical Change and Income Distribution in LDCs) is related to the proposed project, but differs in the degree of detail being given to the mechanization issue. The Poor Rural Households ... project will not attempt to define specific farm level packages of mechanization and then evaluate their impacts in relation to other technological advancements as does this proposal. Thus, the proposed activity focusses upon the question of the role that adoption of mechanization plays in increasing small farm income, in changing farm labor requirements, and in bringing about change in farm production.

## 6. Research Project Design and Methodology (IRRI Component)

### a. Research Design Summary

The research design for this project will be finalized and approved prior to and during the initial start-up Phase of the project period. Nevertheless, the following discussion outlines what is presently anticipated and serves as the basis for estimating project costs. It is recognized that the needs, capabilities, and interests of each country are likely to differ and must be reflected in the final project design.

### b. Preliminary Description and Justification of Project Design

Primary farm survey data supplemented by experiential data derived from agronomic and engineering studies will be utilized in this project. Cross-sectional survey data will be obtained from random samples of farms in selected regions of each of four countries viz., Pakistan, Indonesia, Thailand, and the Philippines. Farmers will be interviewed to determine the nature of their farming operation. Engineering feasibility and cost data will come from IRRI as will agronomic and other production oriented data.

The entire set of information utilized will serve as the basis for describing the production, resource use, costs and income status of typical farms in each region. From these data typical-farm programming models will be constructed and analysis carried out to identify efficient production levels, use of resources, levels of mechanization, labor utilization, costs and returns. Sensitivity analysis will be carried out to determine the impacts at the farm

level of variations in commodity prices resource constraints input prices, and other parameters which may be sensitive to government policies and programs. The effects of alternative levels of mechanization will be shown by comparison between farms where alternative sources of power and implements are the primary difference.

Aggregation of the "typical" results will be carried out to show regional implications of changes in relevant policies and programs. To the extent possible, regional estimates will in turn be aggregated to reveal the general nature of impacts at the national level. Rough estimates of adoption rates for mechanization will be approximated using information derived from the cross-sectoral surveys as well as other sources

c. Project Activities

Project Phases: This project will be carried out in four phases. Phase I will require approximately four months. (October 1977 - January 1978). During this phase (1) sub-contracts will be negotiated with institutions in Indonesia, Thailand, Pakistan, and the Philippines, and (2) the research design for each country will be finalized and approved. Phase II will entail completion of the field survey questionnaires to be used and the selection of the sample farms for intensive study during Phase II. It is anticipated that Phase II will require approximately six months. Phase III is the data collection phase. It will require approximately one year. Phase IV is the data analysis phase which will end with the preparation of final reports at the end of year three. Workshops will be scheduled at appropriate times during each phase to coordinate the activities in each country and assure the maximum comparability of results.

Phase I October 1, 1977-January 31, 1978

The proposed primary contractor is the International Rice Research Institute (IRRI). During Phase I the research design and methodology for each country will be finalized, and sub-contractors for country studies will be selected.

During early meetings between AID and IRRI staff members the procedures to be followed for reaching project objectives will be finalized. Details to be agreed upon include the different types and levels of mechanization to be examined, the farm size units to be considered, the "mix" of other traditional/modern cultural practices to be included, the basis for stratification of sample data, the probable variation in

sample data, the specific sampling procedures and size required in order for the study to produce statistically reliable results and the methods of analysis to be followed in evaluating the data.

Following agreement on the study design and methodology, IRRI will identify sub-contractors to carry out three studies, one in Pakistan, one in Thailand, one in Indonesia, and will conduct a study themselves in the Philippines. Each sub-contractor will be selected on the basis of capacity to carry out the work and institutional commitment to the research. AID/TA/AGR will have final approval of the sub-contractors. While final selection of sub-contractors has not yet been made IRRI has had preliminary discussions with several institutions. The following is a synopsis of their findings:

Indonesia - Three institutions offer possibilities to assist with the project. They are the Central Research Institute for Agriculture, the Agriculture Institute (an agricultural university) both at Bogor, and the Institute of Technology, Bondung. The Agricultural Engineering Department, Ministry of Agriculture is also very much interested in mechanization studies:

Pakistan - Dr. H. Slamul Haque, Director General of the Agricultural Research Council (ARC) and R. M. Tono Quraishi, Director of Economic Research for ARC are interested in mechanization utilization research. Dr. Quraishi has experience with this type of research at the Sind University and will welcome the opportunity for additional study

Dr. M. L. Quraeshi, Director Pakistan Institute of Development Economics (PIDE) and members of his staff also indicated an interest in mechanization use studies. Dr. Abdul Salam appeared the most interested in conducting such research. Dr. Quraeshi indicated interest in coordinating a Pakistani effort in this area

Dr. Amir Khan IRRI/Pakistan talked with Dr. Bashir Ahmed, Joint Chief Economist - Planning and Development Department, Government of the Punjab; and staff of the Economics Department - Layallpur University. Both offices were interested in participating in mechanization use research. All Pakistani contacts indicated facilities for analysis and assessment of data and availability of survey staff. PIDE appeared to be the most capable and interested in coordinating project activity in Pakistan.

Thailand - In Thailand, interest and capability to assist with mechanization use studies were found in the Ministry of Agriculture, Agricultural Economics Division: Kasitsart University Faculty of Economics and Business Administration and at the Asian Institute of Technology (AIT). Dr. Nguen Susurak, Agricultural Marketing Chief and Dr. Nurong Chaprakab, Chief of Planning

Branch are interested staff members in the Ministry of Agriculture. At Kasitsart University, Dr. C. Boonma, Director of Agribusiness and Management Programs also indicated interest. Both the ministry and university voiced preference for a secondary role and not that of coordination. The AIT in addition to having good facilities and capabilities, was interested in contracting to coordinate project activities in Thailand. Also through their graduate training program, they see an opportunity to conduct surveys in neighboring countries with their students who are nationals of those countries.

Dr. Peter Cowell, Agricultural Engineering Chief at AIT is the principal contact for mechanization use studies.

Phase II - February 1, 1978 - July 31, 1978

Phase II begins with the selection of the study region.

Criteria for selection should include:

- (a) a high degree of specialization in grain farming;
- (b) low variation in those factors which can not be controlled in the model specification such as climate;
- (c) widespread use of mechanical, biological, and chemical technologies, and modern practices;
- (d) a high level of existing available knowledge, data, or information about farmers and farming in the area in order to facilitate specification of research hypotheses development as well as sampling design and questionnaire construction;
- (e) a high degree of cooperativeness of farmers in responding to questions, as exhibited by any previous surveys;
- (f) accessibility to facilitate senior staff participation in field work and to facilitate numeration.

Also in Phase II the questionnaire will be developed, translated into the local language and tested. Testing should be carried out on a wide range of farms using different combinations of technology and practices and of different sizes and cropping patterns. After completion of field tests, a workshop will be held in March, 1978 by the research collaborators to construct the final questionnaire and to design sampling procedures for the survey.

Phase III - August 1, 1978 - August 31, 1979

During Phase III basic data will be collected describing farming operations and the economic and institutional environment in which sample farmers exist. As indicated above, these data pertain to farm size, enterprise combinations, access to and use of resources including land, labor, non-farm produced inputs, capital, water, machinery and work animals, cultural practices, input costs and output prices. These data will be used to delineate farming systems prevalent in the regions of interest and the timing and level of inputs utilized. Upon completion of the survey, initial analysis will be undertaken to stratify the sample by farming characteristics. The basis of the stratifications cannot be specified a priori, but it will include relationships such as size of holding, use of mechanical, biological, and chemical technology employed, other cultural practices, and enterprise combinations. Whole-farm calendars of operations and budgets will be the fundamental framework for preparing typical farm accounts. Among the strata will be the traditional farm operation not characterized by mechanization or use of other modern practices.

Following completion of field work the data will be processed for verification and storage for later analysis (i.e. Phase IV). Preliminary examination of the data will be carried out to identify missing segments or gaps, and complementary experimental data added to the data file.

At the end of Phase III a workshop will be carried out in order for the country research teams to share experiences and knowledge gained, and to review programming for Phase IV.

Phase IV - September 1, 1979 - September 30, 1980

Once data has been collected and made ready for analysis Phase IV begins. In this Phase the activities to be carried out involve, first, the design of programming models which adequately characterize typical farming operations within each region studied. It is expected that for each region there will be several typical farming systems, each one reflecting different levels of mechanization and other cultural and resource base differences. For each type of system there will be a economic programming model designed to simulate basic production and resource use behavior of that type of farm. More than likely these models will be based upon linear programming activity analysis, however the "lumpy" nature of mechanization inputs may mean another approach such as integer programming will be a more realistic tool of analysis. In any event, the appropriate modelling technique to be utilized will be decided upon later by the researchers involved in consultation with AID/TA/AGR staff.

Analysis of the impacts of mechanization upon farm production, income,

and resource use, and the interactions which are likely to show up between mechanization and other cultural practices will be carried out by first testing initial solutions of the programming models against actual farm behavior, evaluating solutions to isolate the impacts of interest, and then carrying out parametric studies of the models. The latter activity (i.e., parametric studies) will permit the researcher to evaluate the impacts upon efficient farm operations of alternative policies and programs which affect such things as farm output prices, input costs, input-output technical relationships, and resource constraints.

Finally, attempts will be made to generalize the results of the typical farm studies to their regional and to the extent possible, national implications. Future research needs will be identified, the methodology followed will be evaluated, a final workshop will be carried out and project completion reports will be prepared and distributed.

d. Independent Research Activities: A/D/C Component

The proposed \$115,000 research grant to the A/D/C is intended to encourage and facilitate small, independent studies on the effects of agricultural mechanization in Asia. These studies will not be coordinated with those carried out by IRRI but opportunities will be provided for persons working under A/D/C grants to meet with the IRRI directed researchers to compare results and exchange information and data. The A/D/C research grants will be used primarily to fund research by Asian Scholars who are working with A/D/C associates on full time appointments in Asia. The A/D/C will assign one of its associates as the project manager for the A/D/C mechanization research grants component. The project manager responsibilities will be:

- (1) to keep other A/D/C associates informed of the research grants program,
- (2) to assist in the final selection of small research activities to receive grant support,
- (3) to keep in touch with the coordinated research projects directed by IRRI, and
- (4) to assure that, where appropriate, researchers funded by A/D/C grants participate in the seminar and workshop activities carried out under the IRRI directed component of this proposal.

The basic philosophy of the Agricultural Development Council and style of operation in Asia precludes the identification and specification, at this

time, of the research activities to be grant funded. The A/D/C's primary objectives are to facilitate the training of Asian scholars and the exchange of information on the problems of agricultural development. The A/D/C component of this project is designed to be consistent with the broad A/D/C objectives while at the same time encouraging research on the economic and social effects of agricultural mechanization in Asia. The A/D/C, through its associates, will assist in the design and will monitor (or assist in) the implementation of the research. Grants will be made only when there is reasonable assurance that the proposed research is feasible and the work will meet the high professional standards of the A/D/C. The principle criteria specified by AID selection of activities to be grant funded is that the research must be concerned with the economic and/or social effects of small scale mechanization on small grain farmers in Asia.

#### 7. Contribution to Institution Building

Institution building is one of the principal objectives of this project. This will be achieved in two ways under the IRRI directed component. First, by facilitating close working relationships between IRRI personnel and national institutions concerned about the effects of agricultural mechanization. This, in a sense, is building capacity through "on-the-job" training and experience. Second, by hopefully establishing long term professional relationships with scientists in neighboring countries who are undertaking similar work and contributing to international recognition of the interests and capabilities of the institutions selected to participate in the project.

The A/D/C directed research grants will also improve national capacity to undertake research on agricultural mechanization. Again the mechanism is to providing opportunities (1) to undertake research in this area, and (2) to exchange information data, and research results with other Asian scientists through seminar and workshop activities.

To a large extent, this project attempts to build individual and institutional capacity primarily through investments in human capital. Only a small percentage of the funds will be invested in physical capital such as automobiles, calculators, and books.

#### 8. Facilitate Utilization of Research Results

This project has been developed with the assistance of TA/AGR's Food Crop Production Division which manages an AID-funded project carried out by IRRI to develop small scale agricultural machinery (AID Contract csd-1208). That project focuses on engineering/technical constraints and problems in

the design of machine prototypes to be manufactured in the LDCs. This project focuses on the impacts of adopting similar machinery types and other mechanization forms by small farmers and thus will be of direct value to the evaluation and redesign of future IRRI programs to promote agricultural mechanization. In addition, results will be of interest to four audiences: farmers, LDC machinery manufacturers, LDC government policy and program planners, and the international community of development practitioners and scholars. The results will be released to farmers and manufacturers through IRRI's Industrial Liaison groups. These groups provide technical advisory services to manufacturers of farm machinery and through them to farmers. In addition, IRRI has excellent relationships with the Ministry of Agriculture in each of the countries. Publications summarizing the results of this study will be made available to the Extension Services of these Ministries. Similarly agricultural sector planners will receive publications. IRRI will also publish the results in one of their regular research publication series for distribution to the international community.

#### 9. Researcher Competence and Resources

IRRI has had twelve years of experience in working on agricultural mechanization programs in the Philippines. Since 1970 it has undertaken several small studies on the effects of IRRI designed machines. As part of its industrial outreach program it has established contacts with institutions interested in agricultural mechanization throughout Asia. IRRI has an international reputation for high quality research and the strongest agricultural economics division of any of the international research institutions.

The A/D/C also has an international reputation of excellence in any job which it elects to undertake. Its staff is widely known and respected in Asia and has developed close working relationships with Asian universities and scholars in both government and private institutions. Although the A/D/C staff does not have long term experience in research related to agricultural mechanization, it has had substantial experience in the design and implementation of small research activities.

Both the A/D/C and IRRI have a capacity to rapidly respond to any problems which may arise in carrying out the proposed research. This is in part because both already have staff members in most of the countries involved in this project and, in part, because this project is highly complementary to their existing programs.

Project funding consists of two components:

(1) A research grant of \$115,000 (includes 15% for overhead) to the Agricultural Development Council to undertake independent research in selected countries.

(2) A centrally funded research contract between the Agency for International Development (TA/AGR/ESP) and the International Rice Research Institute. Funding of this contract for the three years of operations will be \$653,600. Major budgetary items will be for research programs in three countries as shown in the work plan, a project coordination and research program in the Philippines at IRRI and funding for consultants to advise and assist in the planning and implementation of data assembly and in analysis.

Budget Components

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u>	<u>3</u>	
		( <u>\$000</u> )		
Three Country Projects	\$147.9	\$132.9	\$126.9	\$407.7
Philippine Project	53.9	64.5	62.5	180.9
Consultants*	14.0	25.5	25.5	65.0
<b>Total</b>	<u>\$215.8</u>	<u>\$222.9</u>	<u>\$214.9</u>	<u>\$653.6</u>
ADC Grant	115.0	--	--	115.0
	<u>\$330.8</u>	<u>\$222.9</u>	<u>\$216.9</u>	<u>\$768.6</u>

\* Includes salary, per diem and travel :

A. IRRI - Individual Country Research Component

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> ( <u>\$000</u> )	<u>3</u>	
Salaries <u>1/</u>	\$15.0	\$15.0	\$15.0	\$45.0
Fringe Benefits <u>2/</u>	5.3	5.3	5.3	15.9
Overhead <u>3/</u>	3.0	3.0	3.0	9.0
Domestic Travel & Survey Costs	10.0	10.0	10.0	30.0
Vehicle (including Operating Cost) <u>4/</u>	8.0	2.0	2.0	12.0
Materials & Supplies	3.0	4.0	2.0	9.0
International Travel (workshop & conferences)	4.0	4.0	4.0	12.0
Contingency	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>3.0</u>
Total	\$49.3	\$44.3	\$42.3	\$135.9
<u>For three countries</u>	<u>\$147.9</u>	<u>\$132.9</u>	<u>\$126.9</u>	<u>\$407.7</u>

1/ Includes salary supplement for one Senior Research Associate and salaries for four Research Assistants and one Secretary.

2/ Fringe benefits calculated as 35 percent of base salaries.

3/ Overhead for country projects calculated at 15 percent of base salaries.

4/ Locally procured vehicle. Estimated cost is \$6,000..

B. IRRI - Philippine Component

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> (\$000)	<u>3</u>	
Salaries <sup>1/</sup>	\$16.0	\$17.0	\$17.0	\$50.0
Benefits <sup>2/</sup>	5.6	6.0	6.0	17.6
Overhead <sup>3/</sup>	3.3	3.5	3.5	10.3
Travel and Transportation <sup>4/</sup>	15.0	15.0	10.0	40.0
Materials & Supplies <sup>5/</sup>	6.0	8.0	10.0	24.0
Workshops & Conferences <sup>6/</sup>	8.0	15.0	16.0	39.0
Total	\$53.9	\$64.5	\$62.5	\$180.9

<sup>1/</sup> Includes salary component for IRRI project manager plus support for three Research Assistants.

<sup>2/</sup> Fringe benefits are calculated as 35 percent of project employee salaries.

<sup>3/</sup> Overhead is calculated as 15 percent of project salaries and benefits.

<sup>4/</sup> Includes domestic travel for country research and international travel for project coordination.

<sup>5/</sup> Includes computer analysis of data and publications.

<sup>6/</sup> Includes local support costs of workshops and conferences plus travel costs for researches not directly associated with the IRRI component

C. IRRI - Consultants

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> (\$000)	<u>3</u>	
Consultant's fee	\$7.5	\$15.0	\$15.0	\$37.5
Per diem	1.5	3.0	3.0	7.5
Travel	5.0	7.5	7.5	20.0
<b>Total</b>	<b>\$14.0</b>	<b>\$25.5</b>	<b>\$25.5</b>	<b>\$65.0</b>

Summary -- Line Item Budget

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> (\$000)	<u>3</u>	
Salaries	\$61.0	\$62.0	\$62.0	\$185.0
Consultants	7.5	15.0	15.0	37.5
Fringe Benefits	21.5	21.9	21.9	65.3
Overhead	12.3	12.5	12.5	37.3
Travel & Transportation	63.5	67.5	67.5	193.5
Vehicles*	24.0	6.0	6.0	36.0
Materials & Supplies	15.0	20.0	16.0	51.0
Workshops & Conferences	8.0	15.0	16.0	39.0
Contingency	3.0	3.0	3.0	9.0
<b>Total</b>	<b>\$215.8</b>	<b>\$222.9</b>	<b>\$219.9</b>	<b>\$653.6</b>
Grant to Agricultural Development Council				<u>\$115.0</u>
<b>Grand Total</b>				<b>768.6</b>

\* Included operating expenses for country research projects

It is recognized that some budget adjustments may be required for the IRRI directed component once specific sub-contractors have been identified and scopes of work finalized.

11. Work Plan and Contract Budget

The general work plan for the project is outlined in Section 6 and the estimated project budget presented in Section 10. The proposed project timetable is as follows:

Phase I

- (1) July 15, 1977 RAC Approval
- (2) September 30, 1977 Contracts signed with IRRI and A/D/C
- (3) November 30, 1977 IRRI sub-contractors selected and initial planning workshop held
- (4) January 31, 1978 Research design finalized

Phase II

- (5) March 31, 1978 Planning workshop held to finalize field survey questionnaires and design sampling procedures
- (6) September 30, 1978 Field testing of questionnaires completed
- (7) September 30, 1978 Survey of existing data and studies on agricultural mechanization completed
- (8) September 30, 1978 Workshop to compare results of initial field survey work and exchange information on existing research.

Phase III

- (9) August 1, 1978 Field data collection initiated
- (10) August 31, 1979 Field survey work completed
- (11) November 30, 1979 Workshop held to compare initial results of field surveys and coordinate Phase IV activities
- (12) January 1, 1980 Field data processed and verified
- (13) June 30, 1980 Programming analysis of typical farms completed
- (14) July 30, 1980 Final workshop held to compare results of typical farm analyses.

(15) September 30, 1980 Final policy analysis work completed and final reports prepared.

It is recognized that there will be some overlap in the timing of the activities associated with each phase of the research. The four workshops held during each phase of the project are the principal means of coordinating the research activities in the four countries and exchanging results. Nevertheless, it is anticipated that research results will be exchanged throughout the project through publications and travels of individual researchers to other countries. Where appropriate, researchers funded under A/D/C grants will be invited to participate in the workshops and to evaluate research designs and implementation procedures.

It is not possible to make a concise allocation of funds to the two principal project objectives outlined in Section 2. TA/AGR/ESP assigns both objectives approximately equal weight. Nevertheless, most of the funds are allocated to achieving the research objective and the institution building objective is to be achieved as a by-product of the research activities

## 12. Management Considerations

No unusual management problems are expected to arise in connection with this project. TA/AGR has worked closely with both the A/D/C and IRRI on past projects. Both institutions have shown high technical capacity, efficient administration and excellent cooperation with AID's technical and contract staffs.

It is estimated that the project will require approximately 2 person months per year of TA/AGR/ESP staff time. Consultants will be utilized when necessary for major evaluations of the project.

No person will, on the grounds of sex, race, color or national origin be excluded from participation in, be denied the benefits of, or be subject to discrimination under this project. Women, who are qualified and available, will be employed as research assistants, as consultants and evaluators, and in administrative positions.

## 13. Internal and External Reviews

The project will be evaluated on a regular schedule of reviews as well as by continuing supervisions by the AID project manager. For the life of the project full-scale evaluations will be scheduled for:

Ten months after project initiation  
Twenty-two months after project initiation  
Thirty six months after project initiation

The project evaluation team will be composed of:

1-Project Manager, TA/AGR/ESP

2-Representatives of A/D/C and IRRI

3-Dr. William J. Chancellor, Agr. Eng. Dept,  
University of California, Davis (tentative)

4-Additional Members selected by AID (optional)

14. Proposing Office General Appraisal

TA/AGR/ESP, assigns this project high priority. This is, in part, due to the worldwide importance of the topic and, in part, because of potential effects of the IRRI program to develop and promote small scale farm implements in Asia. Both IRRI and the A/D/C also assign high priority to the proposed research and would like to begin work on the project as early as possible.

TA/AGR/ESP has discussed alternative research designs with several experienced researchers. There is general agreement that the proposed research is feasible but considerable differences in opinion exist as to the specific research design most appropriate to achieve project objectives. The essence of what is being proposed is to first define typical farms using different technology mixes and different types of mechanization in four countries. Then to analyze the effects of mechanization based on in-depth field surveys of the typical farms' operations using for example, linear programming as one of the principal analytical methodologies.

It is recognized that research results with greater statistical reliability could be obtained by utilizing the proposed funds for research in only one or two countries. This approach, however, would limit the achievement of the institutional building capacity objective to fewer countries and would provide less information on differences between countries.

If the entire project could not be funded, TA/AGR/ESP would give highest priority to the IRRI directed component of the project. Further reductions in funding would require reducing the number of countries included in the IRRI component.

Because of the number of host country institutions that will be involved in implementing this project and the possibilities of raising false expectations TA/AGR/ESP is reluctant to involve these institutions in detailed discussions of the project's design until RAC has reviewed the project. Never-

theless, TA/AGR/ESP is of the opinion that the final project design can not be finalized until Phase I is completed.

Of the various recommendations which RAC could make on this project, the one preferred by TA/AGR/ESP would be:

- (1) RAC provide recommendations for improving the research design.
- (2) RAC approve the project subject to (a) a RAC member (or designated consultant) participating in preliminary discussions with IRRI sub-contractors and the finalization of the project design during Phase I of the project, and (b) review of the final research design at the first RAC meeting following completion of Phase I. The RAC participant in Phase I would have authority to recommend (a) termination of the project at the end of Phase I, (b) delay of initiation of Phase II, or (c) initiation of Phase II activities with suggested changes in project design to be reviewed by RAC prior to final approval.

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William C. Merrill  
Project Manager

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Leon F. Hesser  
Director, TA/AGR

AID 180-1X  
(7-71)  
  
PIO/T

DEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT  
  
PROJECT IMPLEMENTATION  
ORDER/TECHNICAL  
SERVICES

1. Cooperating Country  
TA Bureau  
Page 1 of 5 Pages  
2. PIO/T No.  
931-1026.02-3177628  
3.  Original or  
Amendment No. \_\_\_\_\_  
4. Project/Activity No. and Title  
931-1026.02  
Effects of Mechanization on Small Farms 35p

DISTRIBUTION

5. Appropriation Symbol  
72-11x1023

6.A. Allotment Symbol and Charge  
402-31-099-00-22-71

6.B. Funds Allotted to:  
 A.I.D./W  Mission

7. Obligation Status  
 Administrative Reservation  Implementing Document

8. Funding Period (Mo., Day, Yr.)  
From 9/20/77 to 9/19/80

9.A. Services to Start (Mo., Day, Yr.)  
Between 9/20/77 and 9/30/77

9.B. Completion date of Services  
(Mo., Day, Yr.) 9/19/80

10.A. Type of Action  
 A.I.D. Contract  Cooperating  
Country Contract  Participating Agency  
Service Agreement  Other

10.B. Authorized Agent  
AID/W

Estimated Financing		(1)	(2)	(3)	(4)
		Previous Total	Increase	Decrease	Total to Date
\$1.00=					
11. Maximum A.I.D. Financing	A. Dollars		\$115,000		\$115,000
	B. U.S.-Owned Local Currency				
12. Cooperating Country Contributions	A. Counterpart				
	B. Other				

13. Mission References

14. Instructions to Authorized Agent

The Contract Office is authorized to execute a three year grant to the Agricultural Development Council (A/D/C) in New York City, New York to carry out the work outlined on pages 17 and 18 of the attached Research Project Statement. Budget figures are shown on page 23 of the same attachment. The work to be performed under this grant shall be complementary to that of the International Rice Research Institute in a companion contract. Coordination between the two Agencies will be maintained with IRRI taking the lead and responsibility for final report.

Attached is detailed line item budget projection. Continued p. 5.

15. Clearances - Show Office Symbol, Signature and Date for all Necessary Clearances.

A. The specifications in the scope of work are technically adequate TA/AGR/ESP, JDay <i>JDay</i> Date 7/25/77 TA/AGR/ESP, WMerrill <i>Wm</i> Date 7/25/77		B. Funds for the services requested are available TA/PPU, MZozynski <i>MZozynski</i> Date 9/2	
C. The scope of work lies within the purview of the initiating and approved Agency Programs TA/AGR, LHesser <i>LHesser</i> Date 7/25/77		D. TA/PPU, JDurnan <i>JDurnan</i> Date 8/5/77 TA/RES, MRehcigl <i>MRehcigl</i> Date 8/29/77	
E. TA/AGR, KBrundage <i>KBrundage</i> Date 7/25/77 TA/AGR, DClark <i>DClark</i> Date 7/25/77		F. ASIA/TD, CMartin <i>CMartin</i> Date 7/25/77	

16. For the cooperating country: The terms and conditions set forth herein are hereby agreed to

Signature and date:  
  
Title:

17. For the Agency for International Development

Signature: *Kenneth A Milow*  
Title: TA/PPU, Chief Program Div.

18. Date of Signature  
9/6/77

PIO/T

Project/Activ. No. Title

Effects of Mechanization on Small Farms 931-1026

SCOPE OF WORK

19. Scope of Technical Services

A. Objective for which the Technical Services are to be Used To provide a better understanding of the effects of farm mechanization on small farmers and to improve capacity of Asian Scientist and institutions to do farm mechanization research.

B. Description

See attachment pages 17 & 18

C. Technicians

(1) (a) Number	(b) Specialized Field	(c) Grade and/or Salary	(d) Duration of Assignment (Man-Months)
1	Project Managers	10,000	36
6	Research Assistants	12,000	216

(2) Duty Post and Duration of Technicians' Services

Selected Asian Countries

(3) Language requirements

Of country assigned

(4) Access to Classified Information

None

(5) Dependents

Will

Will Not

Be Permitted to Accompany Technician

D. Financing of Technical Services

(1) By AID - \$ 115,000

(2) By Cooperating Country -



AID 1980-1X (8-78) PIO/T	Cooperating Country <b>Asian Region</b>	PIO/T No. <b>931-1026.2-31.228</b>	Page 4 of 5 Pages
	Project/Activity No. and Title <b>Effects of Mechanization on Small Farms 931- 1026</b>		

22. Reports by Contractor or Participating Agency (Indicate type, content and format of reports required, including language to be used if other than English, frequency or timing of reports, and any special requirements)

"Contractor shall submit three copies of all reports listed as being a product of the contract (administrative, progress, final and technical reports containing R&D findings) to the Documentation Coordinator, TA/PPU/EUI, Technical Assistance Agency for International Development, Washington, D.C. 20523, or his designee. Such reports shall include a title page showing the title of the report, project title as set forth in this contract (or grant) and the contract number. One copy of each report shall be clearly typed or printed on white paper so that it may be photographed to produce a microfilm master. Technical reports shall be accompanied by an author-prepared abstract."

Six copies of progress reports shall be submitted on a semi-annual basis (commencing from effective date of contract) to the Project Manager TAB/AGR/ESP, Agency for International Development, Washington, D.C. 20523.

23. Background Information (Additional information useful to Authorized Agent and Prospective Contractors or Participating Agency; if necessary cross reference Block 19.C(4) above.)

Available form TA/AGR

24. Relationship of Contractor or Participating Agency to Cooperating Country and to AID

A. Relationships and Responsibilities

Director, A/D/C

B. Cooperating Country Liaison Official

C. AID Liaison Officials

TA/AGR, Director Leon F. Hesser and/or Dr. J. Dav. TA/AGR/ESP

CONTINUATION  
SHEETDEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT Worksheet  InvoicePAGE 5 OF 5 PAGES

FORM SYMBOL

TITLE OF FORM

1. Cooperating County

TAB

2.a. Code No.

931-1026.02-3177628

2.b. Effective Date

2.c.

 Original OR Amendment No:

3. Project/Activity No. and Title

Indicate block

Use this form to complete the information required in any block of a PIO or PA/PR form.

14

"Article # Voucher Identification. In each instance of voucher (SF1034) submission made by the contractor for payment hereunder, the following identification data will appear on the face of the voucher:

Contract: AIA/  
 Project 931-1026.02  
 Project Office TAB/AGR "

A companion study will be undertaken by the International Rice Research Institute in the Philippines to involve Asian Scientists in the study of these problems. Coordination will be maintained between the two Agencies.

This activity was approved by RAC on July 15, 1977, subject to the following conditions (a) expenditures not to exceed \$10,000 are authorized only for Phase I research design activities, and (b) expenditures for activities beyond Phase I will not be authorized until RAC has reviewed and approved the proposed research methodology. If the methodology to be carried out does not meet with RAC's approval project funds will be deobligated and the project terminated at the end of Phase I. The final project proposal containing the detailed research methodology shall be submitted to RAC for its approval no later than March 31, 1978.

**TABLE I MECHANIZATION BUDGET COMPONENTS**

**D. A/D/C Research Component**

<u>Item</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>Total</u>
Small Grants	\$20	\$60	\$5	\$85
International Travel	4	4	2	10
Materials and Supplies	2	2	1	5
Overhead	<u>4</u>	<u>10</u>	<u>1</u>	<u>15</u>
Total	\$30	\$76	\$9	\$115

PROJECT STATEMENT

A. PROJECT SUMMARY

1. Statistics:

Project Title: Effects of Mechanization Upon Small Grain Farm Production, Income, and Employment

New or Extension: New

Duration: Three Years -- September 1, 1977 to August 31, 1980

Total Estimated Cost:	FY 1977	\$320.8
	FY 1978	\$222.9
	FY 1979	<u>\$216.9</u>
	Total	\$768.6

Principal Investigator International Rice Research Institute (IRRI), Agricultural Development Council, Inc., (A/D/C), and subcontractors to be selected by IRRI.

Project Manager: William C. Merrill  
Economics and Sector  
Planning Division

## 2. Abstract

Since 1965 AID has promoted the development and use of small scale farm machinery for grain production in Asia. In recent years there has been increased interest in the economic and social effects of such machinery on small farm households. The basic question is, "Does the development and promotion of small scale farm machinery truly benefit small farmers?" This project will not provide the definitive answer to this question but it will begin the process of building an increased awareness in the Asian region of the importance of the question and an increased capacity to carry out research related to the question.

Under this project coordinated case studies of the effects of farm mechanization will be carried out in four Asian countries under the direction of the International Rice Research Institute IRRI and several small independent research activities will be carried out in other Asian countries under the direction of the Agricultural Development Council (A/D/C). The coordinated case studies directed by IRRI are the major component of this project. Under this component it is proposed that a sample of small farms characterized by varying agricultural practices and levels of mechanization be selected and surveyed at various times in the crop production cycle. Farm-level data will be gathered on use and cost of inputs, yields, incomes and other variables required to better understand how the use of small scale farm machinery affects small farmers. Particular attention will be placed on the timing, amount and composition of the labor input vis-a-vis family and hired labor. The data will be analyzed to determine whether significant differences in employment, yields and other relevant variables exist among the various mechanization-technology combinations found in a particular study area. The results from these case studies, will provide micro-level data on input characteristics of several farm operations and insights for analysis of mechanization on other cropping systems in different areas or countries. Since the research project will focus on four countries with differing geographic climatic and socio-economic conditions these externalities will be greater than those from a single country study.

The small, independent research activities directed by A/D/C will provide information on the effects of mechanization which will supplement and complement that developed by the IRRI directed component of the project. The A/D/C directed research will provide scholars not included in the IRRI directed component an opportunity

to carry out small studies on the effects of agricultural mechanization and to exchange ideas, information, and results of their work with IRRI researchers.

The A/D/C component of the project will be managed in such a way as to encourage (1) research on the effects of mechanization in countries not included in the IRRI component and (2) the exchange of information and results of this research with other interested scholars in the Asian area. The exchange of information will take place, in part, through participation in regional seminars on agricultural mechanization. Some of the seminar activities will be funded by this project. Funding for additional seminar and workshop activities will be requested at a later date if necessary but, in general, would be provided by other organizations or through other AID programs.

## B. EXPANDED NARRATIVE STATEMENT

### 1. General Background

Since 1965, the International Rice Research Institute has had a program for the development and extension of small farm machinery which has been funded in part by AID. Total AID funding of these activities to date amounts to approximately \$2,200,000. Under the IRRI program prototype models are designed and field tested. Successful models are then made available to local manufacturers. IRRI provides these manufacturers technical assistance and engineering testing services for machinery of IRRI design or modifications of IRRI designs. Most of this work until recently has been conducted in the Philippines. In 1975, however, the IRRI program was broadened to include "industrial outreach" activities in Pakistan and Thailand. It is anticipated that similar work will be initiated in Indonesia in the near future.

In the early 1970's AID began to direct greater attention to the impact of its programs on small farmers. As part of this process it became increasingly interested in the effects that programs such as the IRRI small farm machinery program might have on small farmers. A thorough review of the literature on the effects of farm mechanization was undertaken by the Agency in late 1974 and a careful review of the IRRI program was completed in 1975. Following the 1975 reviews it was decided that, in light of the industrial outreach program, it would be appropriate and timely to initiate more in-depth research on the effects of agricultural mechanization once initiated outside of the Philippines.

Funds were requested for such research in 1976 but staff time did not permit the development of a project proposal or request for such proposal at that time. In early 1977, IRRI submitted an unsolicited proposal to undertake such research in coordination with its industrial outreach project, A/D/C had previously indicated its interest in such research but felt that its style of operation and staff situation would not be consistent with accepting primary responsibility for a large scale, coordinated research effort. This project proposal is a revision of the proposal submitted by IRRI and links that proposal to the approach suggested by the A/D/C for encouraging small research projects on the effects of agricultural mechanization in Asia.

## 2. Research Purpose and Expected Products

Purpose: This project is designed to achieve two objectives. The first is to provide a better understanding of the effects which farm mechanization has had on small farmers. Emphasis will be given to determining output, income, and employment effects of small scale (IRRI-type) equipment on small grain farms, particularly rice farms. The second objective is to encourage more applied research on the effects of farm mechanization and improve the capacity of Asian scientists and institutions to undertake such research. A large proportion of the total funding for this project is devoted to achieving the second objective. The rationale for undertaking IRRI directed research activities in four countries and the proposed A/D/C research grant, in large part, stems from the importance of achieving the second objective. The first objective is a research objective. The second, in large part, an institution (or capacity) building objective.

Expected Products: (1) improved capacity of Asian scientists to use the techniques of agricultural economics and rural sociology to assess new technologies, conduct farm level studies, and to analyze policies; (2) recommendations useful to small grain farmers regarding appropriate mechanization practices based on economic, and technical studies in regions of four Asian countries; (3) analysis of alternative policies and programs for assisting small farmers to improve income and employment opportunities and the extension of this information to relevant government and parastatal agencies; (4) analysis of the optimum resource combinations and the resulting impacts of mechanization on 'typical' farms in four Asian countries; (5) additional knowledge of the factors underlying the adoption of improved practices,

new technologies and mechanization and projections of adoption rates based on this knowledge; (6) regional estimates of the effects on farm income, employment, and production of adoption of mechanization in grain production and (7) methodologies for assessing the impacts of mechanization on small farms.

Relevant Policy Questions: The information developed by this project will be relevant to program and policy questions such as:

- (1) whether or not to include a mechanization component in government agricultural projects,
- (2) the use of subsidized small equipment government operated "power/implement" pools for custom-hire work,
- (3) the use of subsidized credit for equipment purchase,
- (4) removing or improving tariffs on imported machinery, parts, and fuel,
- (5) subsidy programs for domestic producers of equipment,
- (6) commodity price and input cost subsidies which may alter the relative profitability of small-scale mechanization
- (7) land tenure arrangements which may affect size of holdings and thus effect the profitability of mechanization.

It is recognized that the priorities assigned to policy questions of this type will vary between countries. The research designs for the countries may differ somewhat as a result.

### 3. Relevance and Significance of the Proposed Project

#### a. The Development Problem

Agricultural mechanization touches on three vital issues which are important not only to AID and the "New Directions" mandate but, to basic development questions: i.e., employment creation, food production and equitable income distributions. For example, employment creation continues to be a most vexing problem for LDCs for it is apparent that employment growth within LDC manufacturing sectors has not been sufficient to absorb the increases in the labor force nor are the prospects for doing so likely to improve in the near future. Therefore the agricultural and rural sectors in LDCs, particularly those with low land/labor ratios, must generate added employment if these increases are to be absorbed in productive activity.

On the other hand, food production and productivity per worker must increase to meet the food demands stemming from population growth and the increasing urban populations. Increases in food production are a vital element of a rural income-generating mechanism that will allow self-sustaining growth. New agricultural technologies, particularly cost decreasing innovations, can be important in this strategy.

In the process of food production, initial factor endowments and the returns to those factors will determine the amount as well as the direction of income flows. It is important to determine the changes in direction and amount of flows due to new technologies and mechanization in particular.

While farm mechanization is viewed as a vital part of agricultural development, the type of mechanization, i.e., size and power and type of machine, may have a profound influence on the demand for labor, output and distribution of income. It has been argued that mechanization will result in increased output and employment by increasing the cultivated area, permitting multiple cropping, and improving cultivation practices and yields, yet, little empirical evidence exists to support this conventional wisdom.

Unfortunately such statements provide little useful information to policy makers since each type of machinery can interact differently with cropping systems and operations, resulting in different and possibly negative employment and output effects.

While the problems of assessing the effects of new technology are not simple, strong interest in these effects is expressed by LDCs and is a necessary input into AID decision making. AID is increasingly concerned about the development and use of appropriate technology given the factor endowments and the needed increases in food output. It is clear that the assessment of the effects of agricultural mechanization can be helpful to many development practitioners. The proposed research project will provide information about appropriate technology on farm sizes which make up close to 90% or more of farms in the region, viz., 0-12 hectares.

#### b. Policy Issues and the Research Focus

By nearly any measure, the amount of useable energy (man, animal, and machine) available for agricultural use in LDCs is low. One of the most important decisions facing a low income country is that of evaluating the most economically and socially desirable process of agricultural mechanization. In evaluating the process, one must consider the type of machine used, the rate of introduction, and the operations affected. For individual countries,

the lack of adequate technical expertise and farm level data makes the formulation of policy and assessment of impacts speculative at best.

Some economists point to the paradox of mechanization in labor abundant economies while other economists and most engineers equate farm mechanization with modernization; and modernization, in turn with high productivity of labor and land. The latter group seems to foster the concept of a mechanization ladder. The first group prescribes a "go slow" policy for mechanization while the second encourages rapid adoption. To some extent these groups may be talking past each other as a result of initial biases, but these divergent prescriptions may also result from different perspectives on the temporal dimensions of mechanization. Over the long run, mechanization appears to be the only viable means of significantly increasing agricultural power. As the availability and quality of land drops per capita, the food energy for men and animals will become increasingly expensive. Thus, mechanization could reduce the demand for animal feeds and increase availability of land for food production. On the other hand most studies have shown that mechanization in its early stages has little effect on crop yields. There appears to be wide agreement that the long term effect of farm machinery on agricultural employment is likely to be substantially greater than the short term changes.

The proposed project will focus on the economic costs and benefits of mechanization on small farms; viz., those associated with short and intermediate term changes in production, income, and employment.

c. Possible Side-effects of the Proposed Research

Environmental aspects of this project have been considered. The project activities are limited to an economic study of the effects of mechanizing small farms. Projects of this type normally do not require the filing of an Environmental Impact Statement (22CFR 216.2(b)). This activity is not deemed a major Federal Action (Section 1500.6, CEQ Guidelines) since the project will have no significant effects which adversely affect such aspects of the human environment as air, water, land, flora or socio-economic conditions. Therefore, it is recommended that the Threshold Decision be deemed negative, constituting a Negative Determination since the project will not result in activities affecting environment.

This project will analyze the input requirements particularly the labor used under alternative levels of mechanization. This should permit a clearer understanding of mechanization impacts on population growth, energy requirements and the role of women. For example, if mechanization reduces the drudgery of field work it may increase female labor participation as women assume other jobs. If these jobs are incompatible with the care of children at home there could be implications for fertility. Also, if the skill levels required in agriculture are increased it may motivate farmers to provide more education for their children and increase the cost of children. Therefore, the analysis of family vs. hired labor are or should yield insight into the role of women and population growth implications of mechanization. On the other hand, the analysis of input needs should also provide information on energy requirements of alternatives mechanization levels.

#### 4. Relation to Existing Knowledge

A review of the literature on farm mechanization reveals several complications involved in measuring employment, output and income impacts. First, each individual operation required for crop production can be performed with many alternative techniques. Land preparation, water control, planting, harvesting and threshing are individual operations within the farm production function. Mechanization can impact on all, one or several of these operations. Thus, in the research design proposed, the mechanical changes are disaggregated into specific changes in individual operations.

Secondly, although studies of single mechanization options (tractor hire schemes for example) are relatively easy to carry out, they are of more limited value to policy makers than those concerned with assessing the impact of mechanization options which may affect several production operations. Research in the short and medium term should emphasize the trade-offs inherent in mechanization options. The array of alternatives is wide and an all inclusive sample would be very expensive and difficult to collect. This research project will attempt to investigate only a limited range of mechanization alternatives associated with several farming operations. It is recognized that sorting out the impacts is complicated by the fact that the type of mechanization employed in one operation is seldom independent of that used in other operations. Small power tillers for example, may have little impact on production unless a pumpset is used to increase water availability. Further, it is difficult to sort out the impact of a newly mechanized operation and new technology inputs like fertilizer. Mechanization may enable more precise timing of operations and application of chemical inputs so that double cropping may take place. Thus, the study has to look not only at separate operations and the array of mechanical techniques but

also at the level of technology and the feedbacks between mechanization and other farming practices. The existing literature provides very little insight into the complexities of these relationships.

Existing data available from farm surveys provide limited information for policy analysis of mechanization. Such surveys frequently provide information on size of farms, man/land ratios, implements in use etc., but seldom show changes in output, income distribution and employment associated with changes in inputs including farm machinery. The estimates of employment requirements for particular operations vary widely from country to country. Differences in soil, weather and cultural practices account for some of the variation, but in other cases the differences are hard to explain given similar cultivation practices. Thus the collection of new farm level data is necessary to provide the information needed for this project.

During the past four years, AID has funded five small studies of the effects of new technology on small farmers.

These are:

- (1) Antonio Gayoso, The Impact of Changing Technologies Mechanization and Employment: A Preliminary Review Economic Analysis Division, Bureau of Program and Policy Coordination, U.S. Agency for International Development, Washington, D.C., 1974
- (2) William C. Merrill, The Impact on Agricultural Mechanization on Employment and Food Production, Occasional Paper No. 1, Economics and Sector Planning Division, Office of Agriculture, Technical Assistance Bureau, U.S. Agency for International Development, Washington, D.C., September 1975
- (3) A. L. Becker, W. R. Butcher, C. F. Feise, and C. A. Ulinski, Evaluation of Factors Affecting the Rate of Adoption of IRRI Small Farm Equipment, Department of Agricultural Economics, Washington State University, Pullman, Washington, November, 1975.
- (4) John Balis, Appropriate Technology for Agricultural Development, Appropriate Technology Committee, U. S. Agency for International Development, Washington, D. C., June, 1976.

- (5) Wayne A. Schutjer and Marlin G. Van Der Veen, Economic Constraints on Agricultural Technology in Developing Nations, Occasional Paper No. 5, Economics and Sector Planning Division, Office of Agriculture Technical Assistance Bureau, U.S. Agency for International Development, Washington, D.C., forthcoming, 1977.

Each of these studies represented three to six man-months of research based on existing literature and data. The conclusions of these studies were quite similar. They confirm:

- (1) That little systematic research has been carried out on the impacts of mechanization on small farmers.
- (2) That much of the existing research fails to separate out the interactions between mechanization and the adoption of other technologies and practices.
- (3) That there is very little evidence to support the contention that mechanization substantially increases yields.
- (4) That mechanization which replaces animal power usually reduces rural employment.
- (5) That tractorization may result in a gradual increase in the size of land holdings and the displacement of tenants or farm workers.
- (6) That government policies and programs to promote mechanization through subsidized interest rates, favorable import arrangements, or increased credit availability can cause a significant increase in the rate of mechanization and are likely to benefit large landholders more than others.
- (7) That the mechanization of agriculture is a continuous and inevitable process in economic development but one whose speed and direction can be altered by public policies and programs.
- (8) That agricultural mechanization should be viewed as a part of modern agricultural production systems.

Combined with new biological and chemical technologies mechanization may enable more precise timing of operations and application of chemical inputs so that the total biological, chemical, and mechanical package results in an increase in output per acre year with little, if any, reduction in total employment

Many of the studies upon which these general conclusions are based are careful analyses of specific types of mechanization in selected types of mechanization in selected regions in most of the countries included in this project. The focus of these studies, however, generally was not on small scale, IRRI-type, farm machinery. A large proportion of the research on this topic has been on medium and larger size tractors, associated equipment, and larger scale modern grain harvesting equipment. These studies will provide background and complementary information for the proposed research. Very little, if any, duplication between the proposed and past research is anticipated. IRRI has, however, carried out several small, case study surveys of the impact of small scale equipment in the Philippines. This work will provide a starting point for the proposed study in the Philippines, and illustrations of the type of information which could be collected relatively quickly in the other countries working with IRRI.

##### 5. Relation to Other AID Projects

There are no AID projects currently underway or proposed on the effects of different types of mechanization on small farms in other areas of the world. The AID Working Group on Appropriate Technology has, however, established a private corporation, Appropriate Technology International, intended to develop and promote appropriate technologies for developing countries. A.T. International may at a later date undertake projects related to the proposed project. TA/AGR/ESP is represented on the AID Working Group on A.T. and, therefore will be able to assure close coordination between the proposed project and any related work sponsored by A.T. International.

The proposed project is directly related to IRRI's industrial outreach program which is funded by AID (AID Contract csd-1208). This project will be managed by IRRI and AID so as to supplement and complement on-going industrial outreach program. It will provide useful information with which to evaluate the industrial outreach program and for re-focusing the program, if necessary, in the future. The IRRI industrial outreach network in Pakistan, Thailand, Indonesia (proposed), and the Philippines will be used to provide information on where IRRI-type equipment is being used and, where appropriate, institutional bases for the research activities.

The A/D/C - Research and Training Network (RTN) program will be particularly helpful in the dissemination of the results of the proposed project, to policy-makers and other researchers.

Current work supported by AID/TA/AGR at Michigan State University, Purdue University, and Cornell University (Poor Rural Households, Technical Change and Income Distribution in LDCs) is related to the proposed project, but differs in the degree of detail being given to the mechanization issue. The Poor Rural Households ... project will not attempt to define specific farm level packages of mechanization and then evaluate their impacts in relation to other technological advancements as does this proposal. Thus, the proposed activity focusses upon the question of the role that adoption of mechanization plays in increasing small farm income, in changing farm labor requirements, and in bringing about change in farm production.

6. Research Project Design and Methodology (IRRI Component)

a. Research Design Summary

The research design for this project will be finalized and approved prior to and during the initial start-up Phase of the project period. Nevertheless, the following discussion outlines what is presently anticipated and serves as the basis for estimating project costs. It is recognized that the needs, capabilities, and interests of each country are likely to differ and must be reflected in the final project design.

b. Preliminary Description and Justification of Project Design

Primary farm survey data supplemented by experiential data derived from agronomic and engineering studies will be utilized in this project. Cross-sectional survey data will be obtained from random samples of farms in selected regions of each of four countries viz., Pakistan, Indonesia, Thailand, and the Philippines. Farmers will be interviewed to determine the nature of their farming operation. Engineering feasibility and cost data will come from IRRI as will agronomic and other production oriented data.

The entire set of information utilized will serve as the basis for describing the production, resource use, costs and income status of typical farms in each region. From these data typical-farm programming models will be constructed and analysis carried out to identify efficient production levels, use of resources, levels of mechanization, labor utilization, costs and returns. Sensitivity analysis will be carried out to determine the impacts at the farm

level of variations in commodity prices resource constraints input prices, and other parameters which may be sensitive to government policies and programs. The effects of alternative levels of mechanization will be shown by comparison between farms where alternative sources of power and implements are the primary difference.

Aggregation of the "typical" results will be carried out to show regional implications of changes in relevant policies and programs. To the extent possible, regional estimates will in turn be aggregated to reveal the general nature of impacts at the national level. Rough estimates of adoption rates for mechanization will be approximated using information derived from the cross-sectoral surveys as well as other sources.

### c. Project Activities

Project Phases: This project will be carried out in four phases. Phase I will require approximately four months. (October 1977 - January 1978). During this phase (1) sub-contracts will be negotiated with institutions in Indonesia, Thailand, Pakistan, and the Philippines, and (2) the research design for each country will be finalized and approved. Phase II will entail completion of the field survey questionnaires to be used and the selection of the sample farms for intensive study during Phase II. It is anticipated that Phase II will require approximately six months. Phase III is the data collection phase. It will require approximately one year. Phase IV is the data analysis phase which will end with the preparation of final reports at the end of year three. Workshops will be scheduled at appropriate times during each phase to coordinate the activities in each country and assure the maximum comparability of results.

Phase I October 1, 1977-January 31, 1978

The proposed primary contractor is the International Rice Research Institute (IRRI). During Phase I the research design and methodology for each country will be finalized, and sub-contractors for country studies will be selected.

During early meetings between AID and IRRI staff members the procedures to be followed for reaching project objectives will be finalized. Details to be agreed upon include the different types and levels of mechanization to be examined, the farm size units to be considered, the "mix" of other traditional/modern cultural practices to be included, the basis for stratification of sample data, the probable variation in

sample data, the specific sampling procedures and size required in order for the study to produce statistically reliable results and the methods of analysis to be followed in evaluating the data.

Following agreement on the study design and methodology, IRRI will identify sub-contractors to carry out three studies, one in Pakistan, one in Thailand, one in Indonesia, and will conduct a study themselves in the Philippines. Each sub-contractor will be selected on the basis of capacity to carry out the work and institutional commitment to the research. AID/TA/AGR will have final approval of the sub-contractors. While final selection of sub-contractors has not yet been made IRRI has had preliminary discussions with several institutions. The following is a synopsis of their findings:

Indonesia - Three institutions offer possibilities to assist with the project. They are the Central Research Institute for Agriculture, the Agriculture Institute (an agricultural university) both at Bogor, and the Institute of Technology, Bondung. The Agricultural Engineering Department, Ministry of Agriculture is also very much interested in mechanization studies.

Pakistan - Dr. H. Slamul Haque, Director General of the Agricultural Research Council (ARC) and R. M. Tono Quraishi, Director of Economic Research for ARC are interested in mechanization utilization research. Dr. Quraishi has experience with this type of research at the Sind University and will welcome the opportunity for additional study.

Dr. M. L. Quraeshi, Director Pakistan Institute of Development Economics (PIDE) and members of his staff also indicated an interest in mechanization use studies. Dr. Abdul Salam appeared the most interested in conducting such research. Dr. Quraeshi indicated interest in coordinating a Pakistani effort in this area.

Dr. Amir Khan IRRI/Pakistan talked with Dr. Bashir Ahmed, Joint Chief Economist - Planning and Development Department, Government of the Punjab; and staff of the Economics Department - Layallpur University. Both offices were interested in participating in mechanization use research. All Pakistani contacts indicated facilities for analysis and assessment of data and availability of survey staff. PIDE appeared to be the most capable and interested in coordinating project activity in Pakistan.

Thailand - In Thailand, interest and capability to assist with mechanization use studies were found in the Ministry of Agriculture, Agricultural Economics Division; Kasitsart University Faculty of Economics and Business Administration and at the Asian Institute of Technology (AIT). Dr. Nguen Susurak, Agricultural Marketing Chief and Dr. Nurong Chaprakab, Chief of Planning

Branch are interested staff members in the Ministry of Agriculture. At Kasitwatt University, Dr. C. Koonma, Director of Agribusiness and Management Programs also indicated interest. Both the ministry and university voiced preference for a secondary role and not that of coordination. The AIT in addition to having good facilities and capabilities, was interested in contracting to coordinate project activities in Thailand. Also through their graduate training program, they see an opportunity to conduct surveys in neighboring countries with their students who are nationals of those countries.

Dr. Peter Cowell, Agricultural Engineering Chief at AIT is the principal contact for mechanization use studies.

Phase II - February 1, 1978 - July 31, 1978

Phase II begins with the selection of the study region.

Criteria for selection should include:

- (a) a high degree of specialization in grain farming;
- (b) low variation in those factors which can not be controlled in the model specification such as climate;
- (c) widespread use of mechanical, biological, and chemical technologies, and modern practices;
- (d) a high level of existing available knowledge, data, or information about farmers and farming in the area in order to facilitate specification of research hypotheses development as well as sampling design and questionnaire construction;
- (e) a high degree of cooperativeness of farmers in responding to questions, as exhibited by any previous surveys;
- (f) accessibility to facilitate senior staff participation in field work and to facilitate numeration.

Also in Phase II the questionnaire will be developed, translated into the local language and tested. Testing should be carried out on a wide range of farms using different combinations of technology and practices and of different sizes and cropping patterns. After completion of field tests, a workshop will be held in March, 1978 by the research collaborators to construct the final questionnaire and to design sampling procedures for the survey.

Phase III - August 1, 1978 - August 31, 1979

During Phase III basic data will be collected describing farming operations and the economic and institutional environment in which sample farmers exist. As indicated above, these data pertain to farm size, enterprise combinations, access to and use of resources including land, labor, non-farm produced inputs, capital, water, machinery and work animals, cultural practices, input costs and output prices. These data will be used to delineate farming systems prevalent in the regions of interest and the timing and level of inputs utilized. Upon completion of the survey, initial analysis will be undertaken to stratify the sample by farming characteristics. The basis of the stratifications cannot be specified a priori, but it will include relationships such as size of holding, use of mechanical, biological, and chemical technology employed, other cultural practices, and enterprise combinations. Whole-farm calendars of operations and budgets will be the fundamental framework for preparing typical farm accounts. Among the strata will be the traditional farm operation not characterized by mechanization or use of other modern practices.

Following completion of field work the data will be processed for verification and storage for later analysis (i.e. Phase IV). Preliminary examination of the data will be carried out to identify missing segments or gaps, and complementary experimental data added to the data file.

At the end of Phase III a workshop will be carried out in order for the country research teams to share experiences and knowledge gained, and to review programming for Phase IV.

Phase IV - September 1, 1979 - September 30, 1980

Once data has been collected and made ready for analysis Phase IV begins. In this Phase the activities to be carried out involve, first, the design of programming models which adequately characterize typical farming operations within each region studied. It is expected that for each region there will be several typical farming systems, each one reflecting different levels of mechanization and other cultural and resource base differences. For each type of system there will be a economic programming model designed to simulate basic production and resource use behavior of that type of farm. More than likely these models will be based upon linear programming activity analysis, however the "lumpy" nature of mechanization inputs may mean another approach such as integer programming will be a more realistic tool of analysis. In any event, the appropriate modelling technique to be utilized will be decided upon later by the researchers involved in consultation with AID/TA/AGR staff.

Analysis of the impacts of mechanization upon farm production, income,

and resource use, and the interactions which are likely to show up between mechanization and other cultural practices will be carried out by first testing initial solutions of the programming models against actual farm behavior, evaluating solutions to isolate the impacts of interest, and then carrying out parametric studies of the models. The latter activity (i.e., parametric studies) will permit the researcher to evaluate the impacts upon efficient farm operations of alternative policies and programs which affect such things as farm output prices, input costs, input-output technical relationships, and resource constraints.

Finally, attempts will be made to generalize the results of the typical farm studies to their regional and to the extent possible, national implications. Future research needs will be identified, the methodology followed will be evaluated, a final workshop will be carried out and project completion reports will be prepared and distributed.

d. Independent Research Activities: A/D/C Component

The proposed \$115,000 research grant to the A/D/C is intended to encourage and facilitate small, independent studies on the effects of agricultural mechanization in Asia. These studies will not be coordinated with those carried out by IRRI but opportunities will be provided for persons working under A/D/C grants to meet with the IRRI directed researchers to compare results and exchange information and data. The A/D/C research grants will be used primarily to fund research by Asian Scholars who are working with A/D/C associates on full time appointments in Asia. The A/D/C will assign one of its associates as the project manager for the A/D/C mechanization research grants component. The project manager responsibilities will be:

- (1) to keep other A/D/C associates informed of the research grants program,
- (2) to assist in the final selection of small research activities to receive grant support,
- (3) to keep in touch with the coordinated research projects directed by IRRI, and
- (4) to assure that, where appropriate, researchers funded by A/D/C grants participate in the seminar and workshop activities carried out under the IRRI directed component of this proposal.

The basic philosophy of the Agricultural Development Council and style of operation in Asia precludes the identification and specification, at this

time, of the research activities to be grant funded. The A/D/C's primary objectives are to facilitate the training of Asian scholars and the exchange of information on the problems of agricultural development. The A/D/C component of this project is designed to be consistent with the broad A/D/C objectives while at the same time encouraging research on the economic and social effects of agricultural mechanization in Asia. The A/D/C, through its associates, will assist in the design and will monitor (or assist in) the implementation of the research. Grants will be made only when there is reasonable assurance that the proposed research is feasible and the work will meet the high professional standards of the A/D/C. The principle criteria specified by AID selection of activities to be grant funded is that the research must be concerned with the economic and/or social effects of small scale mechanization on small grain farmers in Asia.

#### 7. Contribution to Institution Building

Institution building is one of the principal objectives of this project. This will be achieved in two ways under the IRRI directed component. First, by facilitating close working relationships between IRRI personnel and national institutions concerned about the effects of agricultural mechanization. This, in a sense, is building capacity through "on-the-job" training and experience. Second, by hopefully establishing long term professional relationships with scientists in neighboring countries who are undertaking similar work and contributing to international recognition of the interests and capabilities of the institutions selected to participate in the project.

The A/D/C directed research grants will also improve national capacity to undertake research on agricultural mechanization. Again the mechanism is to providing opportunities (1) to undertake research in this area, and (2) to exchange information data, and research results with other Asian scientists through seminar and workshop activities.

To a large extent, this project attempts to build individual and institutional capacity primarily through investments in human capital. Only a small percentage of the funds will be invested in physical capital such as automobiles, calculators, and books.

#### 8. Facilitate Utilization of Research Results

This project has been developed with the assistance of TA/AGR's Food Crop Production Division which manages an AID-funded project carried out by IRRI to develop small scale agricultural machinery (AID Contract csd-1208). That project focuses on engineering/technical constraints and problems in

the design of machine prototypes to be manufactured in the LDCs. This project focuses on the impacts of adopting similar machinery types and other mechanization forms by small farmers and thus will be of direct value to the evaluation and redesign of future IRRI programs to promote agricultural mechanization. In addition, results will be of interest to four audiences: farmers, LDC machinery manufacturers, LDC government policy and program planners, and the international community of development practitioners and scholars. The results will be released to farmers and manufacturers through IRRI's Industrial Liason groups. These groups provide technical advisory services to manufacturers of farm machinery and through them to farmers. In addition, IRRI has excellent relationships with the Ministry of Agriculture in each of the countries. Publications summarizing the results of this study will be made available to the Extension Services of these Ministries. Similarly agricultural sector planners will receive publications. IRRI will also publish the results in one of their regular research publication series for distribution to the international community.

#### 9. Researcher Competence and Resources

IRRI has had twelve years of experience in working on agricultural mechanization programs in the Philippines. Since 1970 it has undertaken several small studies on the effects of IRRI designed machines. As part of its industrial outreach program it has established contacts with institutions interested in agricultural mechanization throughout Asia. IRRI has an international reputation for high quality research and the strongest agricultural economics division of any of the international research institutions.

The A/D/C also has an international reputation of excellence in any job which it elects to undertake. Its staff is widely known and respected in Asia and has developed close working relationships with Asian universities and scholars in both government and private institutions. Although the A/D/C staff does not have long term experience in research related to agricultural mechanization, it has had substantial experience in the design and implementation of small research activities.

Both the A/D/C and IRRI have a capacity to rapidly respond to any problems which may arise in carrying out the proposed research. This is in part because both already have staff members in most of the countries involved in this project and, in part, because this project is highly complementary to their existing programs.

Project funding consists of two components:

(1) A research grant of \$115,000 (includes 15% for overhead) to the Agricultural Development Council to undertake independent research in selected countries.

(2) A centrally funded research contract between the Agency for International Development (TA/AGK/ESP) and the International Rice Research Institute. Funding of this contract for the three years of operations will be \$653,600. Major budgetary items will be for research programs in three countries as shown in the work plan; a project coordination and research program in the Philippines at IRRI and funding for consultants to advise and assist in the planning and implementation of data assembly and in analysis.

Budget Components

<u>Item</u>	<u>Year</u>			<u>To</u>
	<u>1</u>	<u>2</u> ( <u>\$000</u> )	<u>3</u>	
Three Country Projects	\$147.9	\$132.9	\$126.9	\$407.7
Philippine Project	53.9	64.5	62.5	180.9
Consultants*	14.0	25.5	25.5	65.0
<b>Total</b>	<u>\$215.8</u>	<u>\$222.9</u>	<u>\$214.9</u>	<u>\$653.6</u>
ADC Grant	<u>115.0</u>	<u>--</u>	<u>--</u>	<u>115.0</u>
	<u>\$330.8</u>	<u>\$222.9</u>	<u>\$216.9</u>	<u>\$768.6</u>

\* Includes salary, per diem and travel

A. IRRI - Individual Country Research Component

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> ( <u>\$000</u> )	<u>3</u>	
Salaries <sup>1/</sup>	\$15.0	\$15.0	\$15.0	\$45.0
Fringe Benefits <sup>2/</sup>	5.3	5.3	5.3	15.9
Overhead <sup>3/</sup>	3.0	3.0	3.0	9.0
Domestic Travel & Survey Costs	10.0	10.0	10.0	30.0
Vehicle (including Operating Cost) <sup>4/</sup>	8.0	2.0	2.0	12.0
Materials & Supplies	3.0	4.0	2.0	9.0
International Travel (workshop & conferences)	4.0	4.0	4.0	12.0
Contingency	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>3.0</u>
<b>Total</b>	<b>\$49.3</b>	<b>\$44.3</b>	<b>\$42.3</b>	<b>\$135.9</b>
<u>For three countries</u>	<u>\$147.9</u>	<u>\$132.9</u>	<u>\$126.9</u>	<u>\$407.7</u>

<sup>1/</sup> Includes salary supplement for one Senior Research Associate and salaries for four Research Assistants and one Secretary.

<sup>2/</sup> Fringe benefits calculated as 35 percent of base salaries.

<sup>3/</sup> Overhead for country projects calculated at 15 percent of base salaries.

<sup>4/</sup> Locally procured vehicle. Estimated cost is \$6,000.

IRRI - Philippine Component

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> ( <u>\$000</u> )	<u>3</u>	
Salaries <sup>1/</sup>	\$16.0	\$17.0	\$17.0	\$50.0
Benefits <sup>2/</sup>	5.6	6.0	6.0	17.6
Overhead <sup>3/</sup>	3.3	3.5	3.5	10.3
Travel and Transportation <sup>4/</sup>	15.0	15.0	10.0	40.0
Materials & Supplies <sup>5/</sup>	6.0	8.0	10.0	24.0
Workshops & Conferences <sup>6/</sup>	<u>8.0</u>	<u>15.0</u>	<u>16.0</u>	<u>39.</u>
<b>Total</b>	<b>\$53.9</b>	<b>\$64.5</b>	<b>\$62.5</b>	<b>\$180.9</b>

1/ Includes salary component for IRRI project manager plus support for three Research Assistants.

2/ Fringe benefits are calculated as 35 percent of project employee salaries.

3/ Overhead is calculated as 15 percent of project salaries and benefits.

4/ Includes domestic travel for country research and international travel for project coordination.

5/ Includes computer analysis of data and publications.

6/ Includes local support costs of workshops and conferences plus travel costs for reseaches not directly associated with the IRRI component

C. IRRI - Consultants

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> (\$000)	<u>3</u>	
Consultant's fee	\$7.5	\$15.0	\$15.0	\$37.5
Per diem	1.5	3.0	3.0	7.5
Travel	5.0	7.5	7.5	20.0
<b>Total</b>	<b>\$14.0</b>	<b>\$25.5</b>	<b>\$25.5</b>	<b>\$65.0</b>

Summary -- Line Item Budget

<u>Item</u>	<u>Year</u>			<u>Total</u>
	<u>1</u>	<u>2</u> (\$000)	<u>3</u>	
Salaries	\$61.0	\$62.0	\$62.0	\$185.0
Consultants	7.5	15.0	15.0	37.5
Fringe Benefits	21.5	21.9	21.9	65.3
Overhead	12.3	12.5	12.5	37.3
Travel & Transportation	63.5	67.5	67.5	193.5
Vehicles*	24.0	6.0	6.0	36.0
Materials & Supplies	15.0	20.0	16.0	51.0
Workshops & Conferences	8.0	15.0	16.0	39.0
Contingency	3.0	3.0	3.0	9.0
<b>Total</b>	<b>\$215.8</b>	<b>\$22.9</b>	<b>\$214.9</b>	<b>\$653.6</b>
Grant to Agricultural Development Council				<b>\$115.0</b>
<b>Grand Total</b>				<b>768.6</b>

\* Included operating expenses for country research projects.

It is recognized that some budget adjustments may be required for the IRRI directed component once specific sub-contractors have been identified and scopes of work finalized.

## 11. Work Plan and Contract Budget

The general work plan for the project is outlined in Section 6 and the estimated project budget presented in Section 10. The proposed project timetable is as follows:

### Phase I

- (1) July 15, 1977 RAC Approval
- (2) September 30, 1977 Contracts signed with IRRI and A/D/C
- (3) November 30, 1977 IRRI sub-contractors selected and initial planning workshop held
- (4) January 31, 1978 Research design finalized

### Phase II

- (5) March 31, 1978 Planning workshop held to finalize field survey questionnaires and design sampling procedures
- (6) September 30, 1978 Field testing of questionnaires completed
- (7) September 30, 1978 Survey of existing data and studies on agricultural mechanization completed
- (8) September 30, 1978 Workshop to compare results of initial field survey work and exchange information on existing research.

### Phase III

- (9) August 1, 1978 Field data collection initiated
- (10) August 31, 1979 Field survey work completed
- (11) November 30, 1979 workshop held to compare initial results of field surveys and coordinate Phase IV activities
- (12) January 1, 1980 Field data processed and verified
- (13) June 30, 1980 Programming analysis of typical farms completed
- (14) July 30, 1980 Final workshop held to compare results of typical farm analyses.

(15) September 30, 1980 Final policy analysis work completed and final reports prepared.

It is recognized that there will be some overlap in the timing of the activities associated with each phase of the research. The four workshops held during each phase of the project are the principal means of coordinating the research activities in the four countries and exchanging results. Nevertheless, it is anticipated that research results will be exchanged throughout the project through publications and travels of individual researchers to other countries. Where appropriate, researchers funded under A/D/C grants will be invited to participate in the workshops and to evaluate research designs and implementation procedures.

It is not possible to make a concise allocation of funds to the two principal project objectives outlined in Section 2. TA/AGR/ESP assigns both objectives approximately equal weight. Nevertheless, most of the funds are allocated to achieving the research objective and the institution building objective is to be achieved as a by-product of the research activities.

#### 12. Management Considerations

No unusual management problems are expected to arise in connection with this project. TA/AGR has worked closely with both the A/D/C and IRRI on past projects. Both institutions have shown high technical capacity, efficient administration and excellent cooperation with AID's technical and contract staffs.

It is estimated that the project will require approximately 2 person months per year of TA/AGR/ESP staff time. Consultants will be utilized when necessary for major evaluations of the project.

No person will, on the grounds of sex, race, color or national origin be excluded from participation in, be denied the benefits of, or be subject to discrimination under this project. Women, who are qualified and available, will be employed as research assistants, as consultants and evaluators, and in administrative positions.

#### 13. Internal and External Reviews

The project will be evaluated on a regular schedule of reviews as well as by continuing supervisions by the AID project manager. For the life of the project full-scale evaluations will be scheduled for:

Ten months after project initiation  
Twenty-two months after project initiation  
Thirty six months after project initiation

The project evaluation team will be composed of:

1-Project Manager, TA/AGR/ESP

2-Representatives of A/D/C and IRRI

3-Dr. William J. Chancellor, Agr. Eng. Dept,  
University of California, Davis (tentative)

4-Additional Members selected by AID (optional)

14. Proposing Office General Appraisal

TA/AGR/ESP, assigns this project high priority. This is, in part, due to the worldwide importance of the topic and, in part, because of potential effects of the IRRI program to develop and promote small scale farm imple-  
ments in Asia. Both IRRI and the A/D/C also assign high priority to the proposed research and would like to begin work on the project as early as possible.

TA/AGR/ESP has discussed alternative research designs with several experienced researchers. There is general agreement that the proposed research is feasible but considerable differences in opinion exist as to the specific research design most appropriate to achieve project objectives. The essence of what is being proposed is to first define typical farms using different technology mixes and different types of mechanization in four countries. Then to analyze the effects of mechanization based on in-depth field surveys of the typical farms' operations using for example, linear programming as one of the principal analytical methodologies.

It is recognized that research results with greater statistical reliability could be obtained by utilizing the proposed funds for research in only one or two countries. This approach, however, would limit the achievement of the institutional building capacity objective to fewer countries and would provide less information on differences between countries.

If the entire project could not be funded, TA/AGR/ESP would give highest priority to the IRRI directed component of the project. Further reductions in funding would require reducing the number of countries included in the IRRI component.

Because of the number of host country institutions that will be involved in implementing this project and the possibilities of raising false expectations TA/AGR/ESP is reluctant to involve these institutions in detailed discussions of the project's design until RAC has reviewed the project. Never-

theless, TA/AGR/ESP is of the opinion that the final project design can not be finalized until Phase I is completed.

Of the various recommendations which RAC could make on this project, the one preferred by TA/AGR/ESP would be:

- (1) RAC provide recommendations for improving the research design.
- (2) RAC approve the project subject to (a) a RAC member (or designated consultant) participating in preliminary discussions with IRK1 sub-contractors and the finalization of the project design during Phase I of the project, and (b) review of the final research design at the first RAC meeting following completion of Phase I. The RAC participant in Phase I would have authority to recommend (a) termination of the project at the end of Phase I, (b) delay of initiation of Phase II, or (c) initiation of Phase II activities with suggested changes in project design to be reviewed by RAC prior to final approval.

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William C. Merrill  
Project Manager

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Leon F. Hesser  
Director, TA/AGR