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ANNUAL REPORT
for
USAID/211d GRANT CSD-2824
to
IOWA STATE
UNIVERSITY

1973 - 74

AUGUST 1, 1974

DATE: August 1, 1974

TO: Miloslav Rechcigl Jr.
Office of Research and Institutional Grants
Bureau for Technical Assistance

FROM: William C. Merrill
Department of Economics
Iowa State University

SUBJECT: Annual Report for USAID/211d
Grant CSD-2824, 1973-74

The annual report for the 211d grant made to the Department of Economics, Iowa State University, is enclosed. The report is submitted in draft form and can be modified in line with your comments and suggestions.

Draft

August 1, 1974

Department of Economics

Iowa State University

Annual Report for 1973-74

for

USAID/211d Grant CSD-2824

**Title: "To Strengthen Iowa State University's Competence in the
Economics of Agricultural Development for the Less Developed
Countries"**

**Grantee: Department of Economics
Iowa State University**

**Program Direction: William C. Merrill, Project Leader
John Timmons, Associate Project Leader**

A. STATISTICAL SUMMARY

Period of Grant: July 1, 1970 to June 30, 1975

Amount of Grant: \$375,000

Period Covered by this Report: July 1, 1973 to June 30, 1974

Expenditures in the Report Period: \$92,865

Cumulative Expenditures: \$206,385

Anticipated for Next Year: \$98,500

B. NARRATIVE SUMMARY

The AID-211d grant to Iowa State University consists of two parts. The initial grant made in June, 1970, was a five-year grant for \$375,000 to increase the capacity of Iowa State University in the economics of agricultural development in less developed countries. The initial grant is referred to as the "basic" 211d grant and most of the discussion in the first part of this annual report is about the basic 211d grant.

The basic 211d grant was amended in February, 1973, to fund part of an agricultural sector study in Thailand under the direction of Dr. Earl O. Heady. The 211d amendment also extended the basic 211d grant until February, 1976. The Thailand sector study amendment to the basic 211d grant was a three-year grant for \$400,000 and required different annual reporting procedures. A complete report of the accomplishments under the Thailand sector study is presented as Appendix E. Only a brief summary of this report is presented in sections of the first part of this annual report.

Funds from the basic 211d grant have been used primarily to support graduate student research on agricultural development. Twelve graduate students received grant assistance during the fiscal year 1974. Six of these students spent at least part of the year working in the country which they were writing about. These countries were Guatemala, Mexico, Guyana, Jordan, and Peru. The output of this work will appear in fiscal year 1975.

Talent sharing with AID continued at approximately the 1973 level. Dr. Randall Hoffmann worked with AID-Panama until January, 1974, when he transferred to the AID-Iowa Universities Mission in Peru. Dr. Lehman Fletcher has been on loan to AID-Washington since August, 1973, as Chief of the Agricultural Division of AID's Technical Assistance Bureau. It is estimated that by the end of the present 211d grant, Iowa State University will have provided AID with over eight man years under talent sharing which is the amount originally anticipated.

In addition, the Department of Economics provided approximately 125 months of staff time to other international development agencies and

programs including those of ILO, FAO, AID, and the Agricultural Development Council. This total includes approximately 35 months of staff time to AID through the Iowa Universities Mission in Peru and 50 months of staff time to AID through the ISU Agricultural Sector Analysis Program in Thailand.

The Department of Economics offered 14 courses in economic development and international economics during the past year. A total of 115 graduate and 357 undergraduate students were enrolled in these courses -- an increase of nearly 9 percent compared to fiscal year 1973. There are presently 74 foreign graduate students from 30 different countries working on advanced degrees in the Department of Economics.

Members of the Department continued their active participation in research, seminars and the training programs of international development agencies. Dr. Erik Thorbecke and Gunars Dambe completed a major study on unemployment in LDC's entitled, Comparative Analysis of Agricultural Development and Employment Performance and Planning. This study will be released by the ILO in late 1974. Dr. William Merrill prepared a report on the prospects of increasing incomes of small farmers in the Guatemalan highlands for the National Planning Council of Guatemala. A manuscript on the role of agriculture in Panama's economic development was prepared by Merrill, Fletcher, Hoffmann and Applegate. This will be published by Iowa State University Press in late 1974. Faculty members participated in the training programs of the ILO and FAO, in seminars sponsored by the Agricultural Development Council, and project reviews conducted by AID-Washington.

A number of special seminars on economic development were sponsored this year by the Department of Economics. These included seminars by Dr. Robert Waugh (Director of the Institute of Agricultural Science and Technology (ICTA) in Guatemala), Dr. John Mellor (Cornell), Dr. Robert Evenson (Yale), Dr. Richard Weisskoff (Yale), Dr. Gordon Smith (Rice), and Dr. Jay Salkin (Duke). Department members presented university seminars on Guatemala and the Middle East and participated in various

university programs related to international development.

Various members of the economics faculty assisted the following university councils, committees, and organizations:

- a. Council on International Programs
- b. Program on Technology and Social Change in Foreign Cultures
- c. Institute on World Affairs
- d. International Studies Advisory Committee
- e. World Food Institute.

These groups are concerned primarily with expanding and improving teaching programs related to international development, increasing faculty participation in development studies and programs, and increasing public awareness of major international problems -- especially the problems related to increasing food production.

C. DETAILED REPORT

I. General Background and Purpose of the Grant

The general objective of the basic USAID/211d grant was to strengthen and expand the capacity of Iowa State University to conduct research and provide training in agricultural economic development with emphasis on the relationship between agriculture and other sectors of the economy. The program is designed to provide additional economists with analytical skills and experience in agricultural sector problems and analysis in developing countries, expand the opportunities of existing and new faculty for research and operational involvement in problems of agricultural and economic development, and enlarge the number of graduate students doing research on economic development.

The program developed at Iowa State University emphasizes theoretical, methodological and empirical projects in sectoral analysis that focus on intersectoral obstacles to increased rates of economic and social development both in the agricultural sector and the overall economy. Intersectoral linkages through employment and income distribution represent high priority elements of the problem - oriented research program.

The general objectives of the Thailand sector study amendment are presented on Page 1 of Appendix E.

II. Objectives of the Grant

A. Objectives Restated

The specific objectives of the 211d grant are:

1. To create a framework within which a significant number of development and agricultural economists interested in the international aspects of their discipline can work cooperatively on certain research problems of urgent importance to the developing countries, thereby increasing the effectiveness of their efforts, and making the most efficient use of scarce research resources; to provide an efficient means for applying the product of this research in a way which will be helpful to the developing countries; and to contribute to the development of professional contacts and collaboration among agricultural economists and development economists interested

in agricultural development in the United States and in the developing countries.

2. To increase the competence of the university in the area of economic development problems, particularly as they relate to the agricultural sector and the relationship between agriculture and other economic sectors, by providing a continuing arrangement for faculty members to conduct research on campus and abroad and to carry on work in developing countries.

3. To enable the university to provide increased training in economic development and agricultural economics at the graduate level for students from the U.S. and the developing countries.

4. To provide members of the university faculty the enriching experience of dealing directly with problems of agricultural development in the less developed countries by arranging for them to serve with AID in capacities which will contribute to the development of their professional skills and to their understanding of how to accelerate agricultural growth in the less developed countries and deal with the practical problems involved in the process.

B. Review of Objectives

The four specific objectives of the grant continue to be considered equally important. Many of the activities relevant to objective one (cooperative research of development and agricultural economists), however, are being carried out at Iowa State with non-211d funds. Actual expenditures of 211d grant funds directed to the achievement of objective two (faculty research) increased somewhat during 1973-74 but remained relatively small. Approximately the same emphasis will be placed on this objective during the 1974-75 period. During the past year, most grant expenditures have been used to support graduate student research (objective three). Several members of the economics faculty (Christian, Fletcher, Heady, Hoffmann, Merrill, Timmons, Van de Wetering) worked with AID in various capacities during the 1973-74 period (objective four). Continued efforts will be made to provide faculty members opportunities to serve with

AID in its efforts to accelerate agricultural growth throughout the world.

III. Accomplishments

The principal criteria used to determine satisfactory accomplishment of objectives of the 211d grant to Iowa State University are:

- a. The amount of interaction between members of the Department of Economics and AID.
- b. The relevance of the Department's research to the agricultural development problems of LDC's.
- c. The degree of participation of staff members in the development programs of LDC's and those of international development organizations in addition to AID.
- d. The extent to which members of the Economics Department are contributing to an increased understanding of the problems of LDC's through on-campus teaching and community programs.

The contents of this report show that much has been accomplished during the FY 1974. While not all of the accomplishments are directly attributable to the 211d grant, this grant has provided a more balanced international development program at Iowa State University and has been especially important in supporting graduate student research relevant to economic development. The major accomplishments directly due to the grant are summarized below. Other activities related to the objectives of the grant are discussed in later sections of this report.

1. The Department of Economics provided approximately twelve man years of staff time to international development agencies through a combination of grants, contracts, and talent sharing programs during FY 1974. Dr. Randall Hoffmann continued his work with AID-Panama until January, 1974, at which time he transferred to the AID-Iowa Universities Mission in Peru. Dr. Lehman Fletcher has been on loan to the Technical Assistance Bureau of AID since October, 1973, under an IPA agreement. Dr. Hylke Van de Wetering has been on loan to the AID-Iowa Universities Mission in Peru since August, 1973. He is working with the sector planning office of the Peruvian Ministry of Agriculture on the development of the next five-year plan for Peru.

The Agricultural Sector Analysis Program in Thailand is a cooperative

program utilizing the resources of the Ministry of Agriculture and Cooperatives (MOAC), Iowa State University, and USOM/Thailand. The Iowa State input to this project is directed by Dr. Earl O. Heady and is funded by AID under a 211d project amendment. A complete report on this project is found in Appendix E. The Thailand project got under way fully during July, 1973. The first full year of this project has been devoted to data collection, building agricultural sector models and training Thai technicians. A detailed account of the accomplishments of this project are presented on Pages 5-15 of Appendix E.

2. Nearly 90 percent of all expenditures of 211d grant funds during fiscal year 1973 were for graduate student research on agricultural development. A brief review of the major projects follows:

a. Gunars Dambe (U.S.A.) is investigating the possibilities of reducing unemployment and underemployment in Colombia through the introduction of more labor intensive technologies in the agricultural sector. This work, in part, is a test of a methodology for agricultural sector analysis in which alternative output and employment possibilities in agriculture can be analyzed within a macro-economic model which assures a consistent set of projections of sector incomes, total employment, and exports. Dambe's thesis will be completed in July, 1974. He has accepted a position with the ILO in Geneva beginning in September, 1974.

b. Şahika Kayir (Turkey) completed her thesis on the impact of industrialization on employment and income distribution in Turkey in April, 1974. During May and June, 1974, Ms. Kayir worked on some special studies on the triangularization of input-output tables with emphasis on the latest input-output tables available for Turkey. Ms. Kayir has accepted a teaching position at Wheaton College near Boston.

c. Michael Applegate (U.S.A.) finished his dissertation on the impact of alternative government policies to redistribute incomes in favor of the rural subsistence sector of Guatemala in September, 1973. Copies of this dissertation have been distributed to the Central Bank and National Planning Council of Guatemala as well as to AID-Guatemala and the sector analysis

division of AID-Washington. Dr. Applegate has accepted a teaching position in economic development at Oklahoma State University.

d. Dan Messerschmidt (U.S.A.) finished his field research with the Banco Central de Guatemala in July, 1973, and spent the remainder of the fiscal year in Ames working on the statistical analysis and monetary policy models for Guatemala. Preliminary results demonstrate clearly the important role that agricultural exports play in the availability of credit. The final results will be prepared during the summer of 1974 and the dissertation should be available by the end of the year. Dan has accepted a teaching position in economic development at Southern Illinois University at Carbondale.

e. Tim David Johnston (U.S.A.) finished his field work with the Ministry of Agriculture in Guatemala and returned to Ames in September, 1973. He is undertaking a detailed linear programming study of impact of rural development programs on the incomes of small farmers in Guatemala's western highlands. His dissertation will be finished in July, 1974. Mr. Johnston has accepted a teaching position at Indiana University Southeast at New Albany.

f. Farrokh Ghobadi (Iran) is studying the employment, income distribution and economic growth consequences of alternative international trade policies for wheat and cotton in Iran. He worked with the Ministry of Agriculture and the Plan Organization in Iran during FY 1973 and has returned to Ames to complete his data analysis and prepare his Ph.D. dissertation.

g. Mohamed El-Hurani (Jordan) began work on a 211d project in March, 1974. He is investigating the possibilities of increasing wheat production in Jordan. Field work will be carried out in late 1974 and early 1975. His dissertation should be completed during FY 1976.

h. Parviz Eshrati (Iran) is working on a dissertation on intermediate agricultural technology and the possibilities of increasing both employment and agricultural production in Iran.

i. Enrique Donnadieu (Mexico) is writing on the impact of government programs and policies on the income distribution, employment and agricultural production of the Yaqui Valley, Sonora, Mexico. This is an area where total agricultural production has increased substantially during the past ten years. Government price and credit policies, however, appear to have prevented small farmers from sharing fully in the benefits of increased production. Enrique returned to Mexico in July and August, 1973, to collect data for his dissertation. Much of the data analysis will be completed in Ames during the summer of 1974. The remainder of the dissertation will be completed as part of his work in the Agricultural Planning Section of the Office of the President in Mexico.

j. Mark Lund's (U.S.A.) dissertation is on the application of alternative intermediate technologies to traditional agriculture. Special attention is being given to the effects of chemical, biological and management technologies on agricultural outputs and labor inputs on small farms. Field research is being carried out in Peru where, since January, Mr. Lund has been working with Dr. Hylke Van de Wetering of the Iowa Mission in close cooperation with the Oficina Sectorial de Planificacion Agropecuaria (OSPA) and the Direccion General de Investigacion (DGI). Mr. Lund is scheduled to return to Ames in the fall of 1974 and should finish his dissertation by July, 1975.

k. Ashton Veramallay (Guyana) is undertaking a study of the income and output effects of a multiple purpose water resource development project in the Berbice area of Guyana. This work is being carried out in cooperation with the Ministry of Works and Communications in Guyana. Mr. Veramallay will work in Guyana during the period June, 1974, to January, 1975, and then return to Ames. His dissertation should be finished by September, 1975.

l. Lu S. Ng (Malaysia) is preparing a generalized consistency model for the Philippines with emphasis on employment and agricultural production. All of the necessary data has been collected and processed. Part

of the work on this project was done while Ng was working with the ILO in Geneva. His dissertation should be finished by September, 1974.

IV. Summary of Past Accomplishments (1970-73)

During the first three years of the 211d grant, members of the economics staff at Iowa State University carried out research and teaching activities in Mexico, Peru, Panama, Uruguay, Guatemala, Indonesia, Tunisia, Colombia, Paraguay, India, and Thailand. These activities were carried out under the auspices of AID, BID, FAO, the World Bank, the Agricultural Development Council, and the Ford Foundation. Much of the staff's work involved agricultural sector analysis. Major sector studies were done for Uruguay, Guatemala, and Panama. The study on Uruguay was published by BID in 1970. Iowa State University Press published the sector study on Guatemala in 1970 and will publish the Panama sector study in late 1974.

An in-service training seminar on agricultural sector analysis was organized and directed for the FAO by Erik Thorbecke and Lehman Fletcher. A national conference on agricultural sector analysis and planning sponsored by AID through the Agricultural Development Council was held at Iowa State University in 1971. Erik Thorbecke presented several papers and short courses on sector analysis at the University of Tunisia, the Food Research Institute at Stanford, and at several international conferences. Other research activities included studies of vegetable marketing in Guatemala, grain marketing in the Philippines and Indonesia, and under-employment in Peru, Colombia, and Guatemala.

Approximately 34 master's theses and Ph.D. dissertations on economic development were completed at Iowa State University during the 1970-73 period. These dissertations were related to development programs and problems in Pakistan, Nigeria, Peru, Indonesia, Argentina, Colombia, Mexico, Guatemala, Greece, Canada, Guyana, Bolivia, Philippines, Saudi Arabia, and Hungary.

Two new courses related to economic development problems were added to the economics teaching program in 1971. One was an undergraduate class

on the economics of agricultural development and the other a graduate course on economic development and growth.

During the 1970-73 period, the Department of Economics provided a total of approximately 30 man years of staff time to international development agencies and programs. Approximately 4.5 man years of staff time were provided to AID through talent sharing arrangements under the 211d grant. Most of the remaining 25.5 man years were provided through the AID-Iowa Universities Mission in Peru and through long-term (one year or more) leaves for staff members working with AID programs, ILO, and the Ford Foundation.

V. Utilization of Institutional Resources in Development

1. During the 1973-74 period, 14 courses in economic development, agricultural development and international economics were offered by the Department of Economics. The total graduate and undergraduate enrollment in these courses was 472 students compared to a total enrollment of 280 students in the development courses offered during the 1970-71 school year (Appendix B). All of these courses are fully funded from non-211d funds.

2. There are a total of 74 foreign graduate students working on advanced degrees in economics and agricultural economics at Iowa State. Approximately 19 percent of these students are from Latin America, 40 percent from Asian countries, and the remaining 41 percent are from Africa, the Middle East, and European countries (Appendix D). The foreign students majoring in economics are supported in a wide variety of ways. Some are on AID, Ford Foundation, or other special scholarships, some work as research assistants or associates on U.S. related research projects and others are employed as teaching assistants and instructors. Although only eight percent of the foreign graduate students in the degree program were supported from 211d funds, approximately 70 percent of the dissertation research related to economic development was supported by the grant. A total of 17 new foreign students began graduate studies in

economics during FY 1974. The composition of foreign graduate students at ISU has changed gradually during the past three years. The percentage of students from Latin America has fallen while the number of students from Middle Eastern countries has increased substantially. The number of students from Peru has declined due to a reduction in scholarship funds from the AID-Iowa Universities program. The number of students from Thailand has remained high as a result of the ISU-211d sector study program in Thailand. Nearly 25 percent of the foreign graduate students in economics are from the Middle East with 10 students from Iran alone.

3. Several special seminars on the Middle East were sponsored this year by the Department of Economics. Dr. Arnold Paulsen assisted several students in the preparation and presentation of a university program on the Middle East and in the development of several department seminars.

4. Geoffrey Shepherd spent most of the year working on an AID marketing program with the Ministry of Agriculture in Paraguay.

5. James Christian spent the year working with the Federal Home Loan Bank System in Washington, D. C., on an AID related program. He has been investigating the impact of housing loans on the national growth and rate of inflation of less developed countries with special attention to Peru, Guatemala, Panama, Venezuela, Tunisia, and Indonesia.

6. Erik Thorbecke was on leave of absence to the International Labor Organization (ILO) in Geneva during the first part of FY 1974. Much of his work with the ILO has been related to the effects of agricultural development policies on underemployment and unemployment in LDC's.

7. William Merrill, Lehman Fletcher, Randall Hoffmann and Michael Applegate prepared a manuscript entitled, Panama's Economic Development: The Role of Agriculture which will be published by Iowa State University Press in late 1974. This book is based on the agricultural sector study prepared for AID-Panama and the National Planning Council of Panama in June, 1973.

8. Hylke Van de Wetering became Chief-of-Party of the AID-Iowa

Universities Mission to Peru where he is devoting full time to an agricultural sector analysis for Peru.

9. Lehman Fletcher and Erik Thorbecke participated in several FAO review projects.

10. Erik Thorbecke and Gunars Dambe completed a set of comparative studies of employment effects of alternative agricultural strategies which are to be published by the FAO in late 1974. Several of these studies were released with FAO approval as occasional papers under the 211d grant program.

11. John Timmons served on several university committees related to international development including: (a) the Council on International Programs; (b) the Institute on World Affairs; (c) the Program Committee on Technology and Social Change in Foreign Cultures; and (d) the Faculty Policy Committee of the World Food Institute.

12. J. T. Scott was appointed as Coordinator of International Agricultural Programs for the College of Agriculture.

13. John Mellor of Cornell University was invited to present a seminar entitled "Agriculture and an Employment Oriented Strategy of Growth." During Dr. Mellor's visit, he participated in several meetings with graduate students interested in economic development to discuss emerging development problems and how they might best use their talents to help solve these problems.

14. A series of seminars on economic development were presented in February and March, 1974. The speakers and topics were:

<u>Speaker</u>	<u>Topic</u>
Dr. Gordon Smith Rice University	Multi-National Corporations and Employment in Brazil
Dr. Robert Evenson Yale University	Productivity Change in India
Dr. Jay Salkin Duke University	Tax Regressivity in Thailand

<u>Speaker</u>	<u>Topic</u>
Dr. Richard Weisskoff Yale University	Income Distribution and Economic Growth in Puerto Rico
Dr. Vladlen Martynor USSR Academy of Sciences	Development of Agriculture in the USSR

15. Dr. Robert Waugh, Director of the Instituto de Ciencia Y Tecnologia Agrícolas (ICTA) in Guatemala, was invited to present several seminars on the Institute's research programs in Guatemala and Central America. During his visit, Dr. Waugh met with members of the World Food Institute and a number of faculty members in other departments of the College of Agriculture.

16. A series of 211d occasional papers on economic development was initiated in November, 1973. A total of six occasional papers, two dissertations and one reprint was released under the 211d program during FY 1974 (Appendix C).

17. C. C. Maji completed a water development and allocation model for West Bengal State, India, incorporating storage water, ground water and rainfall. The basic data, which were collected in India, are now integrated into a previously specified model, and solutions and analysis will be forthcoming in 1974-75.

18. Uri Horowitz completed a dynamic and stochastic water management model which has application to agricultural areas with limited and variable rainfall. The model was listed under snowpack conditions of the U.S. and now is being tested with data from a climatic or moisture equivalent region in Israel for which it is designed.

19. A. Hinojosa developed the first version of a water-allocation, interregional competition model for agricultural production. He has now returned to Mexico to gather data for its quantification.

20. Prasad Nagadevara formulated a first-generation linear programming model of Indian agriculture. The data will be obtained in October from the Directorate of Economics and Statistics of the Indian Ministry of Agriculture. Prasad will return to Iowa State University to complete

the data analysis and preparation of the final study.

21. Jerry Fedeler worked with members of the Thai Ministry of Agriculture on the development of a rice trade model for Southeast Asia.

22. Ken Nicol worked with the FMC Company on the development and solution of a programming model directed towards optimal development of the livestock industry and improving the protein component of diets for the entire country of Iran.

23. Earl O. Heady participated in developmental workshops for (a) the consortium of on-farm water management projects in developing countries, (b) the workshop on tropical soil fertility research at CIAT, (c) the workshop of soil classification and soil fertility response for tropical soils. He served on the policy committee for the university's World Food Institute and as chairman of a planning committee organizing an international symposium on applied models for agricultural development. He also was engaged in the FAO's early planning for the World Food Conference and has been collaborating with the Foreign Agricultural Division of ERS in developing models to estimate world food supplies and developmental incentives. He was a member of the AAEEA's Committee for Agricultural Development during the past year.

24. Raymond Beneke and William Merrill participated in several special meetings of members of the 211d schools to evaluate the accomplishments under the 211d grant and to discuss ways to improve the coordination of the international program activities of the 211d universities.

25. William Merrill participated in an A/D/C workshop on small farmer marketing channels in developing economies, a review of the MSU sector study analysis for Korea, and a seminar on the Southern University Cameroon project.

VI. Other Resources for Grant Related Activities

It is estimated that the Department of Economics supported approximately \$25,000 of graduate student research on economic development problems during the report period. There were five master's theses and Ph.D. dissertations on economic development completed during the 1973-74 school year

(Appendix A).

The total cost of courses taught in economic development was approximately \$50,000. The salary cost of time devoted to advising students interested in economic development, preparing papers on development topics for conferences and seminars, consultation with other faculty members, campus organizations and service groups is estimated at \$10,000. An additional \$8,000 was spent on supplies, administrative services and salaries for the preparation and publication of articles, papers, and books on economic development. (A list of major publications is presented in Appendix C.)

In summary, a total of \$68,000 from the Economic Department's regular budget was used to support teaching, consultation and publications related to international development. An additional \$25,000 from non-211d funds was used to support graduate student research on development problems. Nearly seventy percent of the total graduate student research on economic development at Iowa State University during the report period, however, was financed from 211d funds. Total expenditures of the Iowa Mission to Peru during the report period were approximately \$200,000 bringing the Department's total (non-211d) expenditures on activities directly related to international development to \$293,000 (Table I).

VII. Next Year's Plan of Work and Anticipated Expenditures

Grant funds will be used to support dissertation research of approximately eleven graduate students. This includes continued support for the research to be undertaken by

- a. Enrique Donnadieu (2 months)
- b. Farrokli Ghobadi (12 months)
- c. Mark Lund (12 months)
- d. Lu Siong Ng (2 months)
- e. Ashton Veramallay (12 months)
- f. Parviz Eshrati (12 months)
- g. M. Haitham El-Hurani (12 months)

and new support for

- a. Wayne Yerby (9 months)
- b. Murugasu Kulasingam (10 months)
- c. two other Ph.D. candidates not yet identified.

The work of students now receiving support has been described previously.

Wayne Yerby is an entering graduate student from Virginia State College who worked with Dr. Huey Battle as part of Virginia State's 211d program. Iowa State University will provide half of the assistant-ship support for Mr. Yerby from non-211d funds.

Mr. Murugasu Kulasingam will be developing a forecasting model to determine the impact of changes in government tax policies on tax receipts in Sri Lanka (Ceylon) with emphasis on taxes on agricultural products. This work will be supervised by Dr. Charles Meyer and will be carried out in cooperation with the Central Bank of Sri Lanka.

Expected travel plans during FY 1975 are as follows:

- a. Dr. John Timmons will travel to Guyana to work with Ashton Veramallay later this year -- probably for a one to two-week period in late November.
- b. M. Haitham El-Hurani will travel to Jordan for approximately a nine-month period as soon after September 1, 1974, as country clearance can be obtained.
- c. Dr. Arnold Paulsen will visit Jordan in late November, 1974, for a two to three-week period to work with Mr. El-Hurani. Dr. Paulsen may visit one or more other Middle Eastern countries at this time in relation to the work of other 211d students which is now in process or being planned.
- d. Murugasu Kulasingam will travel to Sri Lanka in late 1974 to undertake his field work with the Central Bank. It is anticipated that he will be in Sri Lanka for approximately nine months.
- e. Dr. Charles Meyer will visit Sri Lanka for a two to three-week period in early 1975 to work with Mr. Kulasingam.

Several research assistants will be hired to work with staff members undertaking research related to the objectives of the 211d grant. This will facilitate faculty research and allow graduate students to become involved in actual development problems prior to beginning work on dissertations.

Increased emphasis will be placed on the grant objective to create a "framework within which a significant number of development and agricultural economists interested in the international aspects of their discipline can work cooperatively." Efforts will be made to further broaden faculty participation in the 211d program by encouraging research on a wider range of development programs and increased faculty awareness of the development problems related to their areas of specialization.

Continued emphasis will be given to publications during FY 1975. A limited number of copies of at least five additional Ph.D. dissertations supported under the 211d grant will be printed for distribution to international development agencies and host country technicians and policy-makers. Several additional studies are being reviewed for publication as occasional papers. The continued emphasis on publication is intended to encourage faculty participation in the 211d program, emphasize the need for policy-oriented research, and acquaint a wider audience with the research being supported by the 211d grant to Iowa State University.

Due to the large number of Iowa State faculty members scheduled to be on leave of absence or on loan to international development agencies, it appears likely that 211d funds may be used to support some special seminar and teaching activities during FY 1975. Specific plans have not yet been completed for these activities.

Talent sharing during the fifth year of the grant is expected to increase slightly during FY 1975. Lehman Fletcher and William Merrill are scheduled to be on loan to AID-TAB-Washington. Fred Mann is expected to continue to work on a part-time basis with AID-Washington. Karl Fox is scheduled to undertake some special studies on sector analysis for AID-Washington.

The number of development courses and graduate and undergraduate enrollments in them is expected to remain at about the 1974 level. Increased attention will be given to special seminars in economic development with emphasis on foreign student participation in them. The university program on technology and social change will be continued.

Projected 211d expenditures under the initial grant for FY 1975 are \$98,500. Approximately 76 percent of the projected expenditures (\$75,000) will be used to support graduate student research (Table I).

Projected expenditures under the Thailand amendment to the 211d grant for FY 1975 are \$124,100 of which \$117,000 or 94 percent will be used for research (Table I).

The Iowa State University grant expires by June, 1976. The present emphasis on graduate student research is expected to continue until that time. After January, 1975, the number of graduate students in the 211d program will be gradually reduced as shown in Figure 1.

Table I
Distribution of 211d Grant Funds and Contributions from Other Funding Sources

Review Period July 1, 1973 to June 30, 1974

Initial Grant					
Activity	211d Expenditures				Non-211d funding
	This period	Cumulative	Projected next year	Projected to end of grant	
Research	\$90,544	\$202,135	\$75,000	\$275,000	\$25,000
Teaching	0	0	10,000	53,500	50,000
Consultation	0	0	500	1,500	10,000
Publication	977	979	3,000	15,000	8,000
Other	1,344	3,271	10,000	30,000	200,000 (Iowa Peru Mission)
TOTAL	\$92,865	\$206,385	\$98,500	\$375,000	\$293,000

Amendment Portion for Thailand Sector Study					
Activity	211d Expenditures				Non-211d funding
	This period	Cumulative	Projected next year	Projected to end of grant	
Research	\$37,250	\$27,250	\$117,000	\$188,750	\$500,000**
Teaching	0	0	2,500	10,000	6,000
Consultation	0	0	0	0	0
Publication	2,500	2,500	4,000	15,000	16,000
Other	600	600	600	20,000	35,000
TOTAL	\$40,350	\$30,350	\$124,100	\$233,750	\$551,000

** Includes \$100,000 appropriated by Thai Government

Table II

Expenditure Report for Institutional Grant AID CSD-2824

Review Period: July 1, 1973 to June 30, 1974

Initial Grant

Item	Expenditures		Projected Expenditures		Total
	This Period	Cumulative	Year 5	Year 6	
Salaries & Fringe Benefits	\$63,037	\$145,939	\$50,000	\$45,981	\$241,920
Tuition and Fees	11,856	30,460	8,000	5,820	44,280
Travel	7,603	12,014	7,000	5,986	25,000
Equipment	340	382	1,600	1,018	3,000
Other Costs	10,029	17,590	27,500	15,710	60,800
TOTAL	\$92,865	\$206,385	\$94,100	\$74,515	\$375,000

Figure 1. Schedule of Graduate Students on 211d

<u>Name</u>	June 1974	Sept. 1974	Jan. 1975	June 1975	Jan. 1976	March 1976	June 1976
a. Donnadiou							
b. Ng							
c. Ghobadi							
d. Lund							
e. Eshrati							
f. Veramallay							
g. El-Hurani							
h. Yerby							
i. Kulasingam							
j. New (?)							
k. New (?)							
Total Number of Students	8	7	9	7	6	4	

Solid line = commitment

Dashed line = tentative

APPENDIX A

Theses and Dissertations Completed, 1973-74

On Agricultural and Economic Development

Ama-Y-Leon, Carlos	An Income Analysis of the Demand for Food in the Lima Metropolitan Area
Applegate, Michael J.	A Multi-Sectoral Linear Programming Approach to Measurement of the Economic Costs of Income Distribution in Guatemala
Kayir, Şahika	Planning for Growth: The Case of Turkey
Mulleady, Jose T.	Technological Change: The Case of Corn Production in the Argentine Pampas
Pagoulatos, Emilios	The Effect of Agricultural and Trade Policies on European Economic Integration

Appendix B

Courses In Economic Development, Agricultural Development And International Economics

July 1, 1973 to June 30, 1974

<u>Course No.</u>	<u>Title</u>	<u>Key Professor</u>	<u>Enrollment</u>	
			<u>Under-graduate</u>	<u>Graduate</u>
306	Comparative Economic Systems	Adams	118	3
312	History of Economic Thought	Luckett	78	0
411	Economic Development	Applegate	31	1
455	International Economics	Messerschmidt	116	8
456	International Finance	Luckett	14	0
512	Agrarian Reform and Economic Development	Timmons	0	9
535	Economic Development and Transformation of Agriculture	Crown	0	14
541	Agriculture in the World Economy	Paulsen	0	26
555	Advanced International Economics	Lapan	0	8
557	Advanced International Finance	Lapan	0	7
570	Economic Development and Growth	Merrill	0	14
571	Economic Development and Growth	Merrill	0	8
605	History of Economic Thought	Luckett	0	8
606	History of Economic Thought	Luckett	0	9
TOTAL			357	115

Appendix C

Publications on Agricultural and Economic Development, 1973-74

- Blakeslee, Leroy L., Earl O. Heady, and Charles F. Framingham. World Food Production, Demand, and Trade, Iowa State University Press, Ames, Iowa, 1973.
- Crown, Robert W. and V. Nagadevara, "Tendencies in Relative Economic Efficiency and Their Consequences," Indian Journal of Agricultural Economics, July - September 1973.
- Lapan, Harvey, "Localized Technical Progress and Transfer of Technology and Economic Development," Journal of Economic Theory, December 1973.
- Merrill, William C. The Long-Run Prospects for Increasing Income Levels in Guatemala's Highlands, National Planning Council of Guatemala, January 1974.
- Srivastava, Uma K. and Earl O. Heady. "Technological Change and Relative Factor Shares in Indian Agriculture: An Empirical Analysis," American Journal of Agricultural Economics, Vol. 55, No. 3, August 1973.
- Srivastava, Uma K., Earl O. Heady, Keith D. Rogers and Leo V. Mayer. Food Aid and International Economic Growth, Iowa State University Press, Ames, Iowa, forthcoming.
- Srivastava, Uma K., Vishnuprasad Nagadevara and Earl O. Heady. "Resource Productivity, Returns to Scale and Farm Size in Indian Agriculture: Some Recent Evidence," The Australian Journal of Agricultural Economics.

211d Occasional Papers

<u>No.</u>	<u>Author</u>	<u>Title</u>	<u>Date</u>
1	Karl Fox	Combining Economic and Non-Economic Objectives in Development Planning: Problems of Concept and Measurement	Nov., 1973
2	E. Thorbecke G. Dambe	Agricultural Productivity and Employment in Taiwan	Feb., 1974
3	E. Thorbecke G. Dambe	Agricultural Production and Employment in Colombia	Feb., 1974
4	E. Thorbecke G. Dambe	Agricultural Production and Employment in Ivory Coast	Feb., 1974

<u>No.</u>	<u>Author</u>	<u>Title</u>	<u>Date</u>
5	E. Thorbecke G. Dambe	Comparative Analysis and Typology of Agricultural Development Performance and Strategy	Apr., 1974
6	Eric Graber	Potato Supply, Demand and Marketing in Central Peru	May, 1974

Appendix D

Foreign Graduate Students in Economics at Iowa State University, 1973-74

<u>MALAYSIA</u> (3)	<u>ISRAEL</u> (1)	<u>BRAZIL</u> (1)
Mokhtee Ahmad	Dan Dvoskin	Yoshihiko Sugai
Lu Ng		
Mohammed Yusoff	<u>INDIA</u> (8)	<u>MEXICO</u> (5)
<u>NIGERIA</u> (4)	Bryan D'Silva	Daniel Barrera
Kolawole Alli	Satyender Kaul	Fructuoso Caballero
Ikechukwu Nwobodo	Chandi Maji	Luis Chalita
Samuel Oluwude	S.S.V. Nagadavera	Enrique Donnadieu
John Osakue	Nagendra Nemani	Teran Hinojosa
	Shyamal Roy Chowdhury	
	R. Vaitheswaran	<u>NETHERLANDS</u> (1)
<u>IRAN</u> (10)	<u>BANGLA DESH</u> (1)	Doeke Faber
Haji R. Al-E-Jalil	Ali Manwar	<u>CHILE</u> (1)
Mohsen Bolooforoosh		Carlos Fernandez
Bahram Dadgostar	<u>BAHAMAS</u> (1)	
Parviz Eshrati	Hillary Deveaux	<u>CANADA</u> (1)
Farrokh Ghobadi		Craig Fulton
Hassan Honarmand	<u>PERU</u> (6)	
Ahmad Mojtahed	Jorge Checkley	<u>FRANCE</u> (1)
Mahamad Motomaden	Julio Echavarria	Jean Luc Guy
Mansoor Nematbakhsh	Hugo Maradiegue	
Seyed Pourmoghim	Marco Pajuelo	<u>EGYPT</u> (1)
	Miguel Tejada	Dyaa Kamal Abdou
	Jose Zegarra	
<u>THAILAND</u> (7)	<u>LIBYA</u> (2)	<u>TURKEY</u> (1)
Masang Banterng	Salem Abuzaid	Şahika Kayir
Budhaka Bconkerd	Abdussalam Bader	
Yodying Kongtong		<u>KOREA</u> (2)
Koset Manowailalao	<u>COLOMBIA</u> (1)	Won Whe Koo
Orawan Ongkananantlert	Luis Avalos	Jong Jeong Rhee
Supradit Prasit	<u>SAUDI ARABIA</u> (2)	
Ladda Bhisalbutra	Said Saad Martan	<u>CEYLON</u> (1)
	Orhan Saygideger	Murugasu Kulasingham
<u>TAIWAN</u> (2)	<u>NEW ZEALAND</u> (1)	<u>GREECE</u> (2)
Yie-Lang Chan	Anton Meister	Angelos Pagoulatos
Judy Lu		Athanasios Stamatou
<u>JORDAN</u> (2)	<u>CYPRUS</u> (1)	<u>INDONESIA</u> (1)
Mohamed El-Hurani	Dafnis Panagides	Irlan Soejono
Abdulfattah Kadi	<u>GREAT BRITAIN</u> (1)	
<u>CHINA</u> (4)	Jonathan Strauss	
Chi-Jiau Chen		
Louis R. H. Tseng		
George Wang		
Takahito Hayashi		

TOTALS 74 foreign graduate students
30 different countries

Appendix E

Annual Report
of the
Thailand Sector Analysis
Amendment to the Basic
211d Grant

Prepared by
Dr. Earl O. Heady

June, 1974

Agricultural Sector Analysis and Planning in Thailand

The Agricultural Sector Analysis program in Thailand is a cooperative program utilizing the resources of the Ministry of Agriculture and Cooperatives (MOAC) in the RTG, Iowa State University (ISU), and USOM/Thailand. The program was initiated in response to direct requests by MOAC for cooperation and collaboration in the development and application of sector analysis models and methods which have practical application in guiding the future development of Thai agriculture at the national level, as well as at the regional or agro-economic zone and the local level. The research program involves the construction and application of sophisticated research models for conducting rigorous and quantitative analysis leading to development of detailed and operational planning and policy-evaluation information for use by administrators and planners. The methods being adapted to Thailand will provide for the simultaneous evaluation of alternatives and trade-offs surrounding agricultural development. The research will develop and apply techniques that assist in making and evaluating decisions for allocating investment among location specific alternatives, assist in the discovery of the most efficient means of production stimulation, and assist in the development of detailed policies that can affect the well-being of particular farm, income groups or commodity groups regardless of the economic region in which they are located. The analysis will also enhance the contribution of agriculture to other sectors of the economy with emphasis on

employment, income generation, balance of payment, import substitution, export expansion, and integrated development.

The Iowa State University 211-d amendment project was initiated through AID funding mainly to facilitate sector analysis for Thailand agriculture. The project got underway fully during July, 1973 when staff could be shifted from other duties to the research involved. Important progress, somewhat more than expected in initiation of the project from scratch in collaboration with a largely inexperienced Thai staff, was made in the sector analysis project during the year. While the major activity is in building and applying a set of agricultural sector models for the policy planning and development of Thai agriculture, important auxiliary activities also are carried out by both long-term and short-term staff from Iowa State University. These auxiliary activities include: (2) Special guidance and scheduling of programs for Thai students who are at Iowa State University. Individual students are designated to become specialists in different analysis methods and subject matter before they return to the Division of Agricultural Economics (DAE) of the Ministry of Agriculture and Cooperatives. For example, Somporn is to develop a specialization in simulation models of macro relationships and his program includes experience in and familiarity with the models on a range of research projects outside formal class training and Thai application; Koset is similarly to become skilled in programming models of the agricultural sector and his program is organized and conducted accordingly. Eleven Thai students have become participants in the program on the Iowa

State University campus, with the program of each generally being oriented to needs in sector analysis programs of the Ministry of Agriculture. (2) Development of short-run analysis and models to solve immediate Thai policy and development programs for agriculture. For example, the export market, a sharp rise in rice prices during the year, the paucity of supplies in some local markets and speculation in the commodity caused Thai administrators to become concerned with buffer stock programs. Accordingly, the Iowa State University staff in collaboration with the DAE staff developed a buffer stock model for rice with objectives of stabilizing rice prices for both producers and consumers and evening the movement of rice into export markets. The model and its implied buffer stock policy was accepted by the Thai cabinet and is in the first stages of implementation. Short-term models and analysis also were initiated and completed with respect to problems and policies of: the location of fish markets; the location of farmers' markets; policies and market structure for fertilizer pricing and distribution (with a single fertilizer producer and restraining import and distribution programs, the real price of fertilizer in Thailand has been extremely high); development of a national experimental and analysis framework for research on rice-fertilizer response; special programming models for the measurement of marginal payoff capacity of irrigation projects financed partially by the World Bank loans; formulation of special LP models for assessment of new farming systems and development possibilities; initiation of an assessment program, at the suggestion of several international agencies, of problems and possibilities in cassava production and

and world markets; and others. (3) Upgrading the skills and professional capabilities of the Thai staff in the DAE. On the one hand this process was implemented through nearly one-to-one participation with the Thai staff helping to build sector models. Special groups, amounting to about 50 persons in larger or smaller degrees, were assigned to aid in developing data sets, model formats, data processing procedure and other activities involved in the sector research effort. Some of these persons are at a low level of scientific skill while others, particularly those with M.Sc. degrees, bear promise. With the latter group, Iowa State staff members worked individually and closely to promote an understanding of scientific method, the manner of developing analytical models, programming and summary or solution methods, analysis of results, etc. This involved procedure is used as a training device and a means of upgrading skills and capabilities of the DAE Thai staff. In addition, the Iowa State staff conducted formal courses as part of an in-house training program similar to a M.Sc. program in the DAE. Initial emphasis was given to computer programming because of the large amount of "raw" survey data, regression programs and other needs in building the sector models. Following the first computer programming course taught by Iowa State University personnel, a Thai participant in the initial computer programming class taught the recent programming class. Iowa State University personnel have become scheduled in in-house training courses of econometrics and demand estimation, linear programming (two levels in theory and application) and simulation models. (5) Consultative aids to DAE staff members doing research. Examples in-

clude guidance and advice on the sampling methods to be used in a market survey, regression models for estimating fertilizer response, writing computer regression models, estimating costs of beef production, developing models to evaluate least-cost rations for swine among ingredients such as sweet potatoes, maize, soybeans, ground nuts, rice bran, cassava chips and others. The initial schedule called for the Iowa State University personnel to spend 80 percent or more of their time on building the sector models and 20 percent or less on the total set of auxiliary activities. However, since these activities also are important, staff time devoted to them may have approached 25-30 percent in particular periods.

Sector Modeling Activities

Sector modeling activities were initiated with a 6,000 farm survey to develop sets of technical coefficients for the national and regional programming model and with the delineation of 19 agro-economic zones or regions based on climate, soils and market orientation. The 19 zones or regions have been further delineated into 3-4 soil areas each so that, effectively, the upcoming LP model will be composed of 57-60 regions. The agro-climatic regions were delineated with the help of agronomists and climatologists. The background survey was a random stratified survey to insure geographic, commodity and other coverage for the nation and was conducted by means of the field staff of the DAE. The survey schedule used, devoted to extreme detail on all technological inputs and outputs of farms and budget and consumption items of households, was 40 pages. The survey schedule, being supplemented by farm management records and

accounts, included details such as sown and transplanted rice, conventional and new varieties, glutinous and nonglutinous varieties, fertilized and nonfertilized crops, new and old varieties of maize, soybeans, groundnuts and cotton and encompassed all facets of inputs and outputs which relate to resource requirements, costs, yields, output and income. In building the programming models, these data are supplemented by soil and water surveys indicating the resource restrictions of each agro-economic region and the nation.

The linear programming model

One of the major models initiated and being developed is a national linear programming model based on regional submodels to express production possibilities, development potentials and the particular income and employment problems of the local regions. The research calendar calls for completing the national model, including detail of regions and interregional interdependencies, by around January, 1975 and the use of this model in developing the next 5-year plan for Thai agriculture. The model will include all crops, technologies for each and resource restraints of each region and the nation. Interaction will be allowed among regions through a transportation submodel and domestic and export market subsectors.

However, in initiating the work it was decided to begin on a region-by-region basis. In other words a model would be built for one region, then for another region, with each one solved upon the completion, until models were completed for each individual region. Then upon completion

of all, they are to be linked into a national model.

Work was initiated with a single regional model for several reasons:

- (1) To start on a smaller basis in terms of giving experience to the Thai staff, so that they might later take over the responsibility for some individual regional models in order to speed the sector analysis work along.
- (2) To allow evaluation of the data accumulated for the modeling activities.
- (3) To start with the most difficult region in terms of data availability and quality in order that the most complex problems would be encountered at the outset.
- (4) To give the Iowa State University staff detailed knowledge of the regions and the nature and problems of Thai agriculture.
- (5) To allow more detailed models on a regional basis than will be retained in the national model, with these models then serving as a foundation for developing specific models of regional economics.
- (6) To allow, in the next generation of models as integer variables are specified, the use of the models on a detailed project evaluation basis wherein a specific project can be evaluated against all major investment opportunities in the country.
- (7) To allow the detail of the regional models to be used in a validation process in the sector analysis or modeling effort. (For each region, the model is specified until it produces the pattern of production, use of resources and technologies currently in use in the region. The restraints and variables eventually added to reproduce the region as it exists then serve as restraints on development which can be examined for elimination through appropriate policies and programs.)

Regional modeling work was begun with agro-economic zone 7. A series of workshop sessions were held with the staff of the DAE to specify the nature of the model. After a first-stage specification of the zone 7 model, the form and kinds of data needed were indicated. Task forces or work committees were then designated to generate the necessary data sets such as labor supplies and requirements, land supplies, types and productivities (e.g. as lowland paddy, upland paddy, upland nonpaddy, etc.), alternative crop technologies and yields, subsistence and market use of crops, etc. The regional models were specified in seasonal detail so that alternatives in multiple cropping and water use could be explored eventually. Monthly parameters were specified for labor supplies and requirements, land and water supplies and requirements, capital requirements, subsistence demands, etc.

The Thai staff was taught methods of data processing and computer programming for this purpose. In the process of preparing data sets, it was found that certain limitation deficiencies had crept into the execution of the original 6,000 farm survey. Accordingly, survey crews were sent both to the field for resurveys to correct these biases. While this process, and the learning process of the inexperienced Thai staff slowed the work, the model for region 7 was solved and validated in January and February. It provided new insights and possibilities for agriculture in the region.

During the process of building and solving the regional model for zone 7, work also was started on other agro-economic zones. Zones 1, 2,

and 3 were selected for the next analysis effort, with a regional model built for each, because they make up the Northeast region of Thailand. The Northeast region, one with low incomes and unexploited agricultural opportunities, has been the center of attention of the government in Thailand and AID for some time and has already been subjected to several descriptive studies and consultant reports. The linear programming models of each of these agro-economic zones have now been solved and validated and the basic data sets and results are to serve as one foundation for developing a regional (rural development) model of the economy for the Northeast region. The formulation of a region-rural development model of the Northeast region is now being initiated and will explore development, employment and income possibilities as they relate to agriculture, agri-business industries and non-agricultural industry.

Work on models of remaining agro-economic zones is now underway and livestock has been incorporated because of the Ministry's intense interest in this potential phase of development. A PERT schedule has been drawn up with specification of (a) completion dates for each data set for each zone and completion of the regional model for the remaining zones, and (b) the staff members responsible for each data set and each regional model activity. As mentioned previously, the calendar specifies completion of all of the regional models by December, 1974 and their linking together through a transportation submodel and national and export markets by January, 1975 so that a national linear programming model will then exist. After further testing and validation of this national model,

it will be used for purposes of developing the next five-year plan of Thai agriculture. It then will be updated and kept continuously operational as a means for complete evaluation of developmental possibilities for Thai agriculture at national and local levels, for means of improving rural incomes and for project evaluation. Immediately also, work will begin on the second generation of the programming model with the expectations that it will incorporate commodity demand functions for endogeneous price determination, integer formulations for major projects so that they can be evaluated for relative payoff under investment limitations and a farm-simulation linkage so that outcomes can be projected down to typical farms.

To an extent, work of the latter nature was carried forward late in the year. The Iowa State University staff helped the Thai staff initiate programming models for individual farms of the regions. Also, after acquiring experience and skills in modeling and sector analysis, a group of the DAE Thai staff pushed ahead the LP models for agro-economic zone 10 and 11 which include major water projects financed partly under World Bank funding. Early solution of models for zones 10 and 11 was pushed to conform with the World Bank's exercise in evaluating the payoff ability of these projects.

Directions of Sector Analysis

Initially, the four full-time and two short-term Iowa State University staff members concentrated entirely on model specification and generation of data sets for the regional or agro-economic zone models

which eventually (a) are to be linked into a national model, and (b) will serve in developing the five-year plan for Thai agriculture. This emphasis was necessary for purposes of training the Thai staff in scientific method, modeling procedures, data collection and processing, computer programming, model solutions and summary, and result interpretation and report writing. However, the full range of sector analysis models to be developed also required that work also be initiated in other directions. Also, eventual linkage of the models for the individual regions or agro-economic zones requires the completion of analysis or submodels of other specific natures.

Demand analysis

One necessary set of data is that of (a) consumer demands by individual commodities for individual regions and the nation, (b) export demand trends and potentials, and (c) the total demand and market structure for Thai agricultural commodities. Certain of these data and estimates also are necessary for the national LP model to be completed in January. Demand estimates, projections and analysis is extremely lacking and limitational for Thai agricultural commodities. Time series data are incomplete and inadequate. Hence, a major future research activity is necessarily that of a major demand and market structure research program. Accordingly, one Iowa State University staff member initiated work with the Thai staff in demand estimates. This work includes two phases: (a) Estimation of regional and national commodity demands of a "point basis" for the first national LP model to be completed in January, and (b) Estimation

of demand relationships through appropriate statistical and econometric methods as part of long-run studies in demand for Thai agricultural commodities. Both phases have been started with emphasis on interaction with the training of the Thai staff in these research approaches and objectives. The longer-run analysis will necessarily extend for some period of time and will supply the demand component for the second generation national programming models, as well as serving other major purposes and objectives.

Market and transportation studies

Completion of the national programming model in January also requires the completion of a transportation submodel to allow linkage and relationships of interdependence among all producing regions and all markets. Accordingly, the Iowa State University staff member initiated a major research activity in transportation and market services in February. Current plans for completion of this research activity, including the quantification of water, truck and rail costs and the development of a complete transportation submodel, in time for the final national programming model in January, 1975. Thereafter, this work will be extended into a full analysis of the transportation, market service and structure and agri-business sector. This activity will be directed towards evaluation of the pricing structure of commodities, improved market and storage services (the latter is also needed for the buffer stock model and the new national rice storage policy) and the potential of developing an agri-business sector in rural regions to

alleviate employment and income problems therein and retard out-migration to Bangkok.

Much speculation and little knowledge exists in the market for major commodities such as rice. Much speculation exist on the extent of "monopolistic collusion" of buyers and market firms and farm price depreciation accordingly. Similarly, little knowledge actually exists on storage facilities and extent. Accordingly, an initial "observative survey" study was initiated in March on the market sector. This study will serve as one basis for building a simulation model of the market sector. The simulation model will be used to estimate the effect of various programs and policies related to the market sector. Also, the market simulation model will eventually be linked to the national programming model and to a macro model if it is built. The "descriptive" market study is to be completed by September, 1974 and the initial market simulation study by December, 1974. Linkage of the simulation model and the national LP model may be completed by July, 1975.

Regional (rural) development models

As mentioned previously, models of regional economies in rural development are to be built in terms of (a) the Thai government's interest in promoting growth and local employment for special regions of the country, and (b) the low level of income and underemployment which prevail therein. The initial data sets and solutions for the agro-economic zone models can provide an initial base for these, although the final models are expected to go much further in inclusion of agro-business industry and

non-agricultural industry. Accordingly, one Iowa State University staff member began work on regional or rural development models in April. The initial activity for this major research direction will be based on solutions for the regional linear programming solutions. However, various alternatives in methodology are being considered for more intensive time-sequenced rural development models relating to employment and income generation in rural areas. It is hoped that a recursive regional development model can be completed by January, 1975 and extended to one or more additional regions by July, 1975.

Miscellaneous analysis

As mentioned earlier, the Iowa State University staff has helped the Thai DAE staff in: developing models for several pressing short-run policy problems, learning background methods of analysis ranging from surveying and data processing methods to computer programming for regression analysis and in serving as advisers and consultants on research methods, interpretation of results and report writing. Also, the ISU staff has served in helping develop "intermediate" projects. One such "intermediate" project was in developing a "free standing" macro model of the agricultural sector (or, a macro model emphasizing the agriculture but incorporating other variables and relationships of the national economy). After construction, adaptation and use of this simple macro model, the decision was made that an extended and more substantial effort should be on a macro model which can be linked eventually (a) to the national linear programming model, and (b) a macro model of the general economy with little emphasis

on agriculture being developed at Chulalongkorn University.

International trade is extremely important to the agricultural sector and the national economy of Thailand. Hence, some background work was done on a trade model and potentials in export markets. Data synthesis has been initiated and major inputs will be devoted to this area of analysis in the year ahead.

Research Calendar

In an attempt to schedule necessary manpower, in both the DAE and at Iowa State University, a time schedule for completing various phases of the sector analysis and modeling work in Thailand over the next two years was developed and has been updated in terms of progress and future prospects. A summary of the schedule follows.

Time schedule for development and application of sector analysis in DAE

Year one(I)

1. Initiate model formulation and data processing for single period regional model in zone 07 on 1 September, 1973, with first solution 1 February, 1974. Complete model with further alternative technologies and cropping patterns.
2. After developing specification and analytical procedures for zone 07, initiate and press forward regional models for verification in each zone. Estimate first group of solutions for four zones 1 May 1974, second group of solutions for four zones 1 June, 1974, third group of solutions for four zones

- 1 August, 1974, fifth group of solutions for six zones 1 November, 1974, and final validation solutions 1 December, 1974.
3. Following solution and validation of 19 regional models, integrate into national inter-regional competition model by incorporating inter-regional transportation activities and national point demand estimates. First solution 1 January, 1975.
 4. Initiate data collection and synthesis on 1 November, 1973 to generate fixed point demand estimates for national model by 1 December, 1974. Begin statistical analysis of commodity market relationships 1 March, 1974 to estimate commodity demand functions by 1 January, 1975. Demand analysis work in long-term project which will be a continuing effort in DAE.
 5. Initiate data collection and analysis of marketing and transportation complex, 1 February, 1974, to provide descriptive study of marketing, transportation, and processing complex by 1 September, 1974.
 6. Start, by 1 February, 1974, building individual farm LP models, on "typical farms" in a relevant number of regions. Formulate models to simulate outcome (a) under present environment, and (b) under environment generated in solutions for national inter-regional programming model. Develop as independent models which can later be linked to the national programming model. Complete individual form modeling by 1 January, 1975.
 7. Initiate work 1 April, 1974 to build detailed recursive econometric regional model of rural development for a selected agro-

economic zone. Formulate the model to evaluate employment, income, and development opportunities over a five or ten year period. Model ready for solution and interpretation by 15 January, 1975.

Year two (II)

1. Continue models initiated in Year I with period of development and application extending into Year II. Continuously upgrade and use models for policy analysis.
2. Develop market sector simulation model, beginning 1 September, 1974, of the marketing, storage, transportation, and processing complex. Scheduled completion 1 December, 1974. Thereafter, utilize model to evaluate alternative opportunities and policies in this complex.
3. Develop and apply a national multisector macroeconomic model to link agricultural sector directly to the rest of the economy with detail by inputs, employment, income, and policy variables to provide cursory evaluation of impact of agricultural solutions on non-agricultural sectors.
4. By 1 January, 1975 begin integrating the market simulation model with the national interregional models to evaluate impact of alternative production patterns derived in the national models. First integrated solutions 1 April, 1975.
5. Analyze the need for additional types of regional analysis models which are relevant and useful in Thailand. To begin about 1

- January, 1975. Extend the regional development model (described above) or other types which are determined appropriate to additional zones or regions. Emphasize income generation, employment, and investment. Completion on or after 1 July, 1975.
6. Expand demand analysis, beginning 1 January, 1975, to other countries where production of selected major commodities relate directly to Thailand's export market. Export market analysis will be used to improve point estimates for export in the national model. Primary analysis to be completed about 1 July, 1975, with continuous upgrading to be carried on by DAE.
 7. Starting about 1 January, 1975, convert the national, inter-regional model into a model for sequential or chain solutions for analysis of the cumulative effect of policies or plans in the next five-year plan. Apply during the period April to July 1975.
 8. Starting 1 January, 1975, formulate developmental investment project evaluation model by adding discrete investments or projects to the national inter-regional single-year model. Completion after 1 July, 1975.
 9. Integrate market and transportation simulation with national interregional solutions and production patterns to extend evaluation of impact to marketing sector, and vice versa to link marketing, transportation, and storage policy to national model. Completion about 1 July, 1975.

Time schedule summary of completion dates

I.1	Zone 07 linear programming	1 February 74
I.2	Zones 01-19, except 07	1 December 74
I.3	National model	1 January 75
I.4	Fixed point demand	1 December 74
	Initiate demand function analysis	1 January 75
I.5	Descriptive marketing study	1 September 74
I.6	Individual farm models	1 January 75
I.7	Recursive regional model	1 January 75
II.1	Programming models use	continuous
II.2	Market simulation	1 December 74
II.3	National multisector model	1 July 75
II.4	Integrate market simulation of national models	1 April 75
II.5	Regional model evaluation and extension	1 July 75
II.6	S.E. Asia exports	1 July 75
II.7	Chain model-5year	1 July 75
II.8	Investment model-single year	after 1 July 75
II.9	Integrate simulation with national model	1 July 75

Special Considerations in Thai Sector Analysis Studies

The Thai sector analysis is an important study given high priority by administrators in the Ministry of Agriculture and Cooperatives and personnel of the U.S. AID Mission in Thailand (USOM). It also is a project of high interest to all international agencies with personnel and offices in Bangkok. Certain conditions surround the project which both promote and retard the rate at which it can progress.

Three major restraints serve to retard progress and include: (a) a lack of trained manpower and scientific leaders in the DAE where the work largely is being implemented, (b) lack of data, particularly of a time series nature, and (c) bottlenecks in processing survey data. While the DAE has a large number of employees, none except the director is trained at the Ph.D. level. The director carries an extremely heavy work load in research leadership and direction, in administration of a large number of employees and in responding to government requests for immediate policy solutions to short-run problems. The DAE has about 15 trained at the M.Sc. level at U.S. institutions. A large proportion of this groups also is heavily engaged in administration and management of the large number of technicians, clerical workers and others and have not been trained to high levels of modeling applications and scientific analysis. Below the director, the two most advanced and responsible persons in the division are away in the initial stages of a Ph.D. program. Ten other promising individuals are in the U.S. working on M.Sc. programs. Hence, whereas the sector analysis or modeling efforts under-

way for Thai agriculture are of an extent and nature which would engage 15-20 experienced Ph.D.-trained persons in the U.S., they are being implemented by a limited Iowa State University staff and the larger number of less experienced and trained Thai staff in the DAE. The program thus must be viewed in a long-run context. More persons must be trained to both the M.Sc. and Ph.D. level over the next five years. Return of the three staff members now engaged in Ph.D. work will greatly augment the scientific capabilities of the division when they return.

The lack of adequate time-series data is a problem not easily or immediately overcome. Largely the problem must be met by use of alternative quantitative techniques. In part, it can be overcome, as is necessary in a large number of developing countries, (a) in the modification and adaptation of econometric methods based on time-series data, and (b) the "splicing" and other "improvisations" with the various sets of data which exist. The restraint inherent in data processing can gradually be overcome through addition of computer programmers and data processing personnel to the staff of the DAE. With the acquisition of an IBM-1130 during the year and through courses in computer programming for DAE personnel during the year, this restraint will be lessened over the forthcoming year. However, with upcoming responsibility for Agricultural Statistics Center in the DAE, data processing will continue to be a bottleneck and draw down on the professional time of the Iowa State University staff members until more long-time computer programming and data processing experts are added to the DAE staff.

Some very distinct advantages of the sector analysis work in the Thai Ministry of Agriculture also prevail. Foremost of these is the intense interest and initiatives of Ministry administrators, especially Dr. Somnuk as director of DAE and with an important policy role in the government. There is an intense interest in developing a range of appropriate and operational models which can be kept ongoing to evaluate the alternatives futures, indicate payoffs and trade-offs of these and evaluate developmental opportunities of Thai agriculture. This initiative and active promotion of the sector modeling work has provided high expectations of the activity of Thai Ministry officials and has caused them to allocate an increasing amount of manpower and other resources to it. The interest and mode of operation also has caused the Iowa State University effort, probably more than any other provided by an international agency, to become an integral part of Ministry operations. The ISU staff works and is accepted as regular staff of the DAE and the Ministry. Successful sector analysis in Thailand can function effectively only in this capacity, one successfully attained between Thai and ISU staffs. Finally, a very positive characteristic of the sector analysis activity is the ongoing training of the Thai staff which is being accomplished. At every possible stage, the execution of modeling steps and the application of quantitative methods is being placed in the hands of the Thai staff. For example, after completion of the LD models for the first four agro-economic zones, a large amount of responsibility for subsequent regional models has been placed in the hands of the Thai staff. Similarly, as the demand functions

estimated for some commodities have been completed, responsibility for estimating functions for others is being given to the Thai staff. The plan is not only to develop the models and make them operations for guidance of development and policies of Thai agriculture but also to leave behind a staff which is expert in further model development, adaptation and use.