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Report of 1977 Evaluation of the  
DAF/ISU Thailand Sector Analysis Program

**Joint Thai-U.S. Evaluation Team**

**Bangkok, Thailand**

**May, 1977**

**REPORT OF 1977 EVALUATION OF THE**  
**DAE/ISU THAILAND SECTOR ANALYSIS PROGRAM**

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## I. OVERVIEW OF EVALUATION TEAM ACTIVITIES

This report presents the findings of the 1977 Thai-U.S. Evaluation Team which met in Bangkok during the period March 1-11, 1977 to evaluate the Thailand Agricultural Sector Analysis Program.

The Thailand Agricultural Sector Analysis Program is a co-operative project between the Royal Thai Government and the United States Government. Thai participation is provided by the Division of Agricultural Economics (DAE) of the Ministry of Agriculture and Cooperatives. U.S. participation is provided by Iowa State University (ISU) acting through the United States Operations Mission in Thailand.

The purpose of the program is to improve the ability of the Thai government to make decisions affecting agriculture. Thai and U. S. professionals are working together to develop a unit within DAE for providing information and analysis for top officials in agriculture and other ministries. The unit has been brought into existence under the present project, and it is already actively carrying out its mission.

The unit works on overall development strategies as well as policies of day to day concern. New information on farming and farm-related activities is being assembled. Predictive models with refined geographical breakdowns are being constructed using linear programming and statistical techniques. Chart 1 shows the time schedule for activities which began in 1973. U.S. support is scheduled to continue into 1978. The aims of the U.S. support are to complete the data collection and model building and to ensure that an independent and self-sustaining Thai policy analysis capability is achieved.

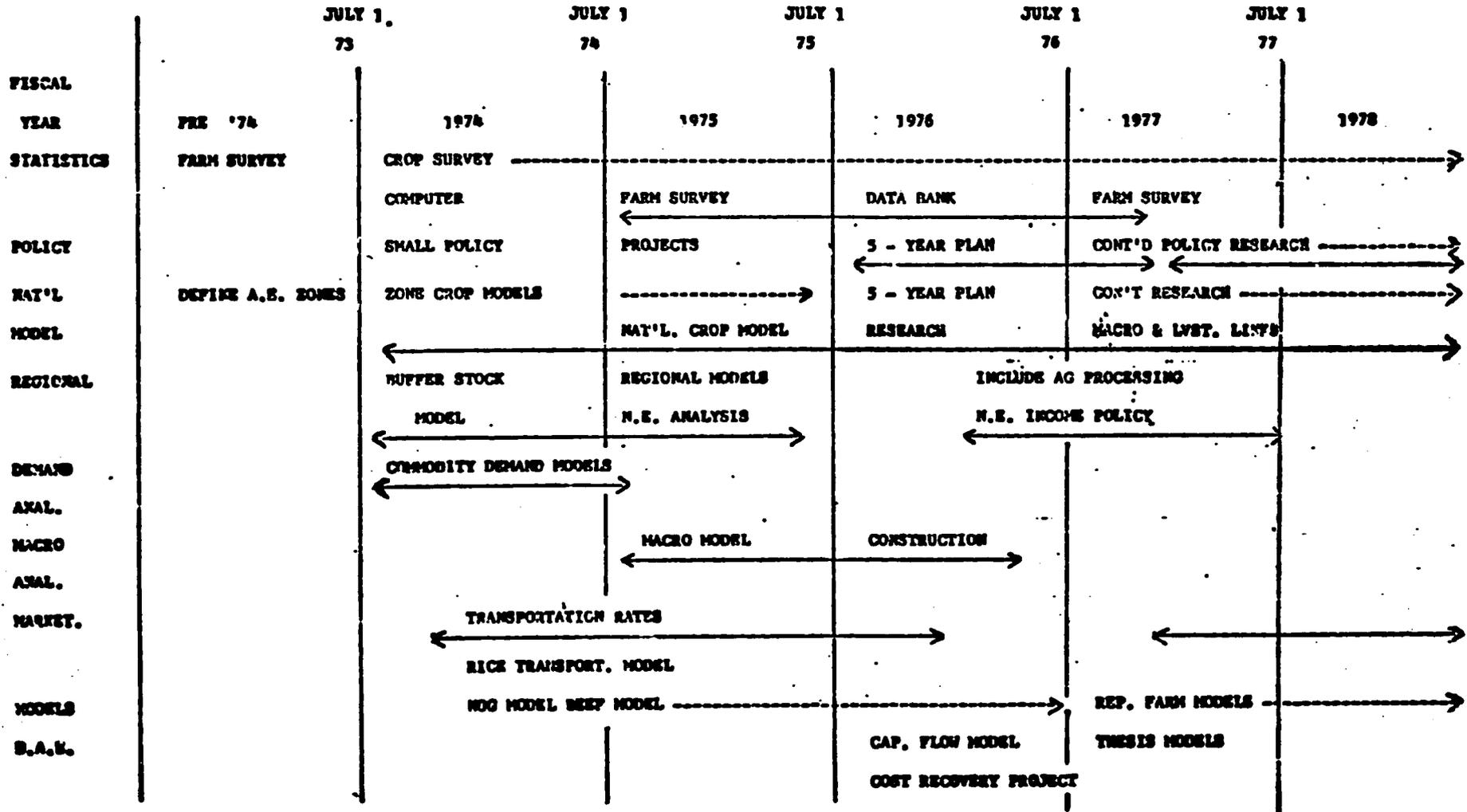


Chart 1. Schedule for Modeling and Data Assembly

The Evaluation Team was asked to concentrate on

- analytical methods and reliability of results
- uses and usefulness of results
- provisions for permanent Thai support

In addition, the Evaluation Team was asked to review the degree to which the recommendations of the prior evaluation in 1975 have been carried out.

The 1977 Evaluation Team met on March 1 and 2 with DAE/ISU personnel to finalize the terms of reference. These meetings were followed by review of written program outputs, attendance at an all day briefing on the program, and considerable further consultation with DAE/ISU staff members. The DAE/ISU personnel with whom the Evaluation Team met during the course of the evaluation are shown in Table 1.

Several days were devoted to meetings with users and potential users in and outside the Thai Government. In interviews, these persons were asked about their knowledge of the Thailand Agricultural Sector Analysis Program, their opinions on reliability of the results and the data, the usefulness of the program and suggestions for improvement. The users and potential users with whom the team members met are listed in Table 2.

Finally, the members of the Evaluation Team conferred among themselves to analyze results, arrive at recommendations and draft this report. Excellent cooperation and logistic support were received throughout the evaluation.

The members of the 1977 Evaluation Team were:

Dr. Chinawoot Soonthornsima (co-chairman),  
Economic Affairs Officer, United Nations,  
Economic and Social Commission for Asia and the Pacific.

Dr. George S. Tolley (co-chairman),  
Professor of Economics, University of Chicago.

**Mr. Souchit Nopakun, Planning Division,  
National Economic and Social Development Board**

**Mr. Sombhong Pattamavichaiporn, Technical Services  
Division, Department of Technical and Economic Cooperation.**

**Table 1. DAE/ISU Personnel With Whom the  
1977 Evaluation Team Conferred\***

<u>Name</u>	<u>Position or Area of Responsibility</u>
Dr. Somnuk Sriplung	Director of DAE
Dr. Arthur L. Stoecker	Linear Programmer, Chief of Party
Dr. Earl O. Heady	Senior Technical Advisor
Mr. Lawrence Kinyon	Research Statistician
Dr. Kenneth Nicol	Agricultural Policy Analyst
Dr. Neal Walker	Linear Programmer
Dr. Herbert Fullerton	Regional Economist
Mr. Narong Chuprakob	Chief Agricultural Development Planning Branch Fourth Five Year Plan
Mr. Narong Sroytong	National Model
Mr. Prapai Vongmonta	Regional Model
Mr. Kitipong Surainrungsikul	Supply Response Model
Ms. Orawan Ongkanananglert	I/O Model
Mr. Sakol Oorikul	Farm Level Planning Model
Mr. Boonmee Juntaravong	Livestock Model
Mr. Koset Manowalailao	Livestock Model
Mr. Chamlong Sakdidee	Rice Transportation, Storage and Processing Model

\*Each of these persons made formal presentations at the all day briefing to the team on March 4.

**Table 2. Users and Potential Users With Whom  
the 1977 Evaluation Team Conferred**

<u>Name</u>	<u>Position</u>
Mr. Chare Chutharatanakul	Deputy Under-Secretary Ministry of Commerce
Mr. Pisit Sasiphalin	Deputy Director-General Department of Agricultural Extension
Mr. Chalor Judjang	Agricultural Extension Planner
Dr. Olarn Chaipravat	Assistant Director of Economics, Research Depart- ment, Bank of Thailand
Mr. Charin Atthayodhin	Deputy Director-General for O&M, Royal Irrigation Department
Mrs. Winyu Molagool	Economic Sector Analyst, Planning Division, Royal Irrigation Department
Mr. Kosit Panpiemras	Assistant Secretary-General NESDB
Dr. Sopin Tongpan	Dean, Faculty of Economics and Business Administration Kasetsart University
Dr. Kampo1 Adulvithaya	Head, Department of Agricul- tural Economics, Kasetsart University
Dr. Amarn Siamwala	Professor, Faculty of Econo- mics, Thammasart University

## II. RESPONSE TO THE EVALUATION OF 1975

The DAE/ISU Agricultural Sector Analysis Program was first evaluated by a previous Joint Thai-U.S. Evaluation Team in January 1975.<sup>1</sup> A number of recommendations were made pertaining to (1) the composition of ISU specialists to meet the broader range of needs, (2) communication and DAE external linkages, and (3) data collection and processing.

It was recommended that the mix of skills of the ISU team be modified to include a senior policy analyst as team leader, a rural development specialist and a marketing-cum-demand analyst to strengthen the policy analysis work of the DAE, to assist in the analysis of policy issues relating to social services to the rural population, and rural industrialization and integrated rural development and to increase the work on marketing and demand analysis. In response to this recommendation a senior policy analyst joined the ISU team in July 1975. The research of the project was directed to policy analyses required by the Fourth Five-Year Plan. The current replacement for the policy analyst position will assume the Chief of Party position as soon as possible.

As regards the rural development specialist, it was felt by the RTG/USOM that a rural development effort would require the addition of two to three external assistance professionals and a core staff of Thai analysts. The resources were not available to the USOM or from the RTG side. It was agreed, however, that further consideration of this issue should be taken

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<sup>1</sup>Joint Thai-U.S. Evaluation Team, "An Evaluation of Development and Utilization of an Analytical Modeling Capacity in the Division of Agricultural Economics, Ministry of Agriculture and Co-operatives, Thailand".

up in this Second Evaluation. For relating to issues on rural industrialization and social services, the DAE has made commitments to co-operate with NESDB in surveys involving agri-business and rural industries. A full scale analysis of social factors is still beyond the capability of the DAE-ISU groups. One small-scale research effort, however, is underway to study the nutritional implications of regional and agro-economic zone production patterns. The technical assistance of Mahidol University has been secured in this effort.

The recommendation that the demand analyst and marketing position be combined is being followed. A job description combining the two positions has been written and widely circulated in the United States. So far, extensive recruiting efforts by ISU have not been successful in locating such a specialist. The number of qualified people is limited, and very few can be broken loose from their on-going assignments. The departure of a staff member (Dr. Lee Blakelslee) left a gap in demand analysis in the DAE. The need for professional guidance in this matter has been partly met by the use of a short-term consultant to maintain momentum on studies related to the demand for maize, mungbean and other crops. The need for continued guidance in the area of demand analysis is well recognized. Iowa State University will continue to make all possible efforts to secure the services of qualified marketing demand analyst.

Regarding the matters on communication and DAE external linkages, a number of recommendations were given by the First Evaluation Team. One of the recommendations was to set up a continuing liaison committee consisting of DAE and the major users or potential users of information from DAE to

exchange information and views, progress reports, statements of needs, requirements and other matters of common interest. The RTG considered this committee unnecessary and proposed that the formal committee created by NESDB to guide the preparation of the agricultural sector of the Fourth Plan should serve the purpose, since it included all appropriate agency representatives and would be directly concerned with the results of the DAE research. The proposal was implemented with other supplementary measures which proceeded along less formal lines. For example, NESDB was consulted and kept fully informed of the DAE research on the Fourth Five-Year Plan for Agriculture. Formal seminars have been held to present the results of the work, and a number of publications involving the results of the models and the data surveys have both domestic and international distribution. The seminars and publications are reviewed further in the section of this report on Dissemination of Results. In addition, a dialogue has been maintained between the DAE and NESDB. Differences between export targets of the MOAC and NESDB have been analysed in the national model. The links between the DAE and the higher ministry officials in the MOAC remain strong.

Other recommendations of the First Evaluation involved co-operation more directly with the academic community and efforts to communicate the results of the DAE modeling efforts in non-technical terms. In this connection, three graduate students are currently doing work on model development in the DAE in partial fulfillment of requirements for masters degrees from Kasetsart University. Data have been furnished to other graduate students for thesis topics on an informal basis. One staff member from Thammasat University is doing research for his Ph.D. degree in the DAE. DAE staff members also have presented seminars at various universities in Thailand.

A number of publications written in nontechnical language have been published, as for example, the publication of the Fourth Five-Year Plan Agricultural Guideline document and other documents for higher officials in the MOAC and NESDB.

As for the data collection and processing, technical assistance has been provided to the DAE for the purpose of improving the data system as recommended by the First Evaluation Team. USOM has provided outside the ISU contract, assistance in the development of area frame sampling. This work has been shown to increase the accuracy of crop survey data and is being expanded. The services of a computer programmer statistician (Mr. Larry Kinyon) were extended over a period of 27 months. This position is now a long term one in the ISU contract. USOM agreed to add extra money to the contract to support the position. Additional computer facilities were also added to the original DAE 8K IBM 1130 by USOM.

The DAE/ISU team has continued to work on the analytical modeling project under the support of the RTG and the USG as recommended. There have been a number of issues and problems which provide focus for Project and DAE research. Listed below are the set which are ongoing and anticipated to receive continued emphasis during the next 18-24 months:

- o Price and income response for major agricultural commodities including demand analysis and commodity supply response
- o Land and irrigation expansion potentials and alternative methods for increasing per rai and per capita productivity (new varieties, fertilizer, management)
- o Analysis of alternative land and fertilizer uses for rice and upland crops

- o Resource utilization and capital for labor substitution (labor, capital, machines)
- o Agricultural marketing and transportation
- o Distributional impacts of national programs on agriculture and of agriculture on the National economy, and
- o Relationships between retail prices of selected food crops, and foreign exchange earnings and farm income.

Much of the remainder of this report is concerned with the work in these areas.

### III. ANALYTICAL METHODS AND RESULTS ACHIEVED TO DATE

The section considers in turn each of the major categories of research and data activity under the project. For each category a summary of progress as reported by DAE/ISU personnel is given. The summary of progress is followed where available by a review of opinions expressed by users and potential users on reliability and usefulness of the activity, followed in turn by the opinions of the Evaluation Team.

#### A. Regional-National-Zone Farm Models

The farm models form the heart of the Sector Analysis work. The major objectives of analysis using these models include:

- (a) Assessing feasibility of meeting target levels of domestic and export demands.
- (b) Estimating the potentials of new technologies for increasing the productive capacity of Thai Agriculture. The technologies include new varieties as well as new mixes of current available inputs.
- (c) Estimating the effects of development policies on farm income and employment by geographic area.
- (d) Determining efficient locations and production levels for production, and acceleration of production, for crops and livestock.

The farm models consist of linear programming representations of farming for various parts of Thailand. A restricted optimizing model is used. Non-linear effects have been handled by linear approximations. For example, fertilizer response is handled by adding additional activities. The extent of disaggregation depends on computer capability coefficients for increasingly small geographical areas. Limited computer size forced the aggregation

of the monthly detail of zone models in the regional models. Since availabilities in crucial periods may be obscured in the national model, the regional models are used to check consistency and feasibility of national alternatives as well as to do independent studies of specific regional problems.

A first concern is to serve the other Departments and Divisions within the MOAC and the NESDB. Also served are the agencies with specialist missions which have an important influence on agriculture. For example, the Ministry of Commerce and MOAC jointly determine rice export policy. Thus a policy concerning a major component of demand is at least partially beyond the reach of MOAC. Likewise, population policy and investment in transportation are determined outside MOAC. Recently there have been demands for results by international agencies involved in development work within Thailand and by the governors of the 71 Changwats. Recent emphasis and heavy projected expenditure in the area of Tambon level agricultural extension may create further information demands.

The prime example of the use of the farm models to date is work on the Fourth Five-Year Plan. A good part of the project effort in the past year has been in this area, and the models appear to have provided the key results used in the agricultural part of the Plan. They are now being used in setting specific national and regional targets.

Table 3 shows examples of the type of output obtained. A full analysis is contained in the research reports of the project on the Five-Year Plan alternatives. Information similar to that shown in Table 3 can be generated for any of more than 40 production activities for 24 spatial units. These units start at the agro-economic zone level (19), continue to the regional

Table 3. Comparison of net crop income, employment, and technical inputs estimated for the production of rice and upland crops in solutions A through F for Thailand in B.E. 2524 and as calculated for 2514/15.

Item	Unit	B.E. 2514/15	Solution						
			A	B1	B2	C	D	E	F
Total crop income	bb	36.5	57.0	53.3	52.9	57.7	49.3	55.5	51.2
Percent total labor used	%	na	42	41	42	43	39	42	42
Percent W.S. labor used	%	na	46	45	47	46	43	47	47
Percent D.S. labor used	%	na	17	14	16	18	12	16	17
Percent peak month labor use	%	na	70	70	72	70	68	66	68
			Rice						
Net rice income	bb	25.2	35.5	34.2	34.4	36.1	33.2	34.4	30.0
Production	mt	11.6	16.1	15.8	15.8	16.4	15.0	16.1	15.3
Value variable inputs	mb	6058	7778	7530	7518	7888	7290	8548	7594
Capital use	mb	2938	4130	4727	4728	4414	3592	5196	4514
Labor used	mm	25	30	30	30	29	29	29	29
Total rai planted	mr	47.2	55.9	54.2	53.3	56.2	53.5	51.2	52.7
Total rai irrigated	mr	11.2	22.5	16.4	16.4	23.1	21.9	12.1	12.0
Rice irrigated, W.S.	mr	9.2	19.5	13.7	13.7	19.5	19.5	10.2	10.2
Rice irrigated, D.S.	mr	2.0	3.0	2.7	2.7	3.6	2.4	1.9	1.8
Total rai RD rice	mr	1.0	6.5	8.0	8.3	6.7	6.2	11.6	10.3
Total rai fertilized	mr	14.0	17.7	17.7	17.5	17.9	17.4	18.5	15.0
Tons fertilizer	tt	210	406	449	447	461	337	619	455
Fert. per rai fert.*	kg	15	23	25	26	26	19	33	30
Rice supply price, C.P.	bt	na	802	863	863	803	716	1295	2869
			Upland Crops						
Net upland crop income	bb	11.2	21.4	19.0	19.0	21.6	16.9	21.1	21.1
Area planted	mr	23.0	39.5	35.0	37.5	39.9	30.4	39.9	39.6
Labor used	mm	14	22	19	20	22	17	22	22

Abbreviations used: bb = billion baht, mt = million tons, mr = million rai, tt = thousand tons, mm = million man months, bt = baht per ton, mb = million baht, na = not available.

W.S. = wet season

D.S. = dry season

RD = Rice Department

C.P. = Central Plain

\* Fertilizer used per rai fertilized

level (4) and up to the Kingdom level. Potential resource use can be estimated by activity by month for the same units by using the regional models which allow monthly detail on resource use. Interregional and interzone production, utilization, and surplus can be generated for every activity.

Beyond the work for the Fourth Five Year Plan, another recent effort has been concerned with estimating the effects of proposed irrigation investments, the results to be used in connection with a World Bank loan. Other efforts are brought out in the chronology below and in the publications listed in the section on Dissemination of Results.

A chronology of work connected with the farm models is as follows:

- |                |  |
|----------------|--|
| September 1973 | Initial structure of agronomic zone crop model defined with monthly detail on use of four land classes, labor and capital. Pilot model for zone 7 started.   |
| November 1973  | Zone 7 model completed. Data estimation techniques and activity definition agreed on for zones 1, 2, 3, 10 and 11.   |
| December 1973  | Paper on research strategies for National Planning in Thailand presented at Agricultural Economics Society of Thailand. Zone models completed for the North Region. Installation of IBM 8K 1130 computer in DAE. |
| July 1974      | Completion of zone models in the Northeast region.   |
| August 1974    | Construction of regional crop models begun.  |
| September 1974 | Crop models completed and solutions obtained for the North (Zones 6, 8, 9 and 10).   |
| November 1974  | Initial solutions to crop models for the Central Plain obtained.   |

- January 1975** Project evaluation.
- February 1975** Northeast region model completed.
- March 1975** National crop model construction begun by aggregation of the zone models in Northeast. Testing of alternative aggregation methods.
- April 1975** Study of employment and potential migration in the Northeast completed. Studies of potential response in Northeast region were started.
- June 1975** DAE participation in FAO in-service Training Seminar. (see publication list). Preliminary inclusion of livestock activities in Northeast region model. Supply response studies for maize, cassava, kenaf and rice finished for Northeast. First solution to national crop model obtained.
- July 1975** Preliminary solutions regarding use of land areas in Thailand. Preliminary solutions representing alternative productive capacities for Thailand in 1981 were completed. DAE sector analysis presentations at ADC seminar on Agricultural Sector Analysis Project. Arrival of Policy Analyst.
- August 1975** Additional solutions regarding export levels and land use obtained from the crop model. Draft document entitled Thailand's Agricultural Crop Employment and Income Situation under Alternative Levels of Land and Water Use was presented to NESDB staff members.

- September 1975      Discussions on planning targets, data needs, and research strategies for national and regional planning models.
- October 1975        Model preparation for analysis of irrigation and new varieties of rice. The revisions included re-estimation of irrigated areas receiving water in wet and dry season, production functions for rice fertilizer response, demand, and labor force projections.
- January 1976        Arrival of regional economist.
- February 1976       Revised crop yields, fertilizer response function estimation completed. Draft copy of plan document given NESDB staff. Alternative directions for regional models discussed.
- March 1976         Preliminary solutions to revised model. Continued DAE/ISU staff meetings to discuss how particular specific policies could be implemented in order to model the policies in a realistic manner.
- April 1976         Revised solutions to national crop model. Research on export multipliers and regional base line studies begun.
- June 1976         Major results of 5-year plan research presented at seminar sponsored by DAE. The seminar was attended by more than 40 representatives including the Director Generals of the departments in the MOAC and other agencies.

- July 1976** Regional analysis of national crop alternatives F and B was started. Estimates of regional level multipliers was completed.
- August 1976** Eight DAE staff members leave for Ph.D. training in the U.S. Paper on Thailand Agricultural Sector Analysis presented.
- September 1976** Research plans for national, regional groups for 1976-77 finalized. Main issues are income-employment, balance of payments, and cost of living.
- November 1976** Thailand research from the Thailand Agricultural Sector Analysis Project presented at ADC conference in Singapore.
- December 1976** Development and specification of input studies. Study of alternative levels of exports with national crop model.
- January 1977** Report to USOM concerning "breaking" of regional models---base line runs with national alternatives completed with each regional model.
- February 1977** Supply response for maize, cassava, kenaf completed in Northeast region. Revision of land constraints for upland crops and medium levels of irrigation completed. Further export analysis in process.

### User Opinion

The primary users of the farm modelling results to date have been within the Ministry of Agriculture and Cooperatives (MOAC), particularly the Departments of Irrigation and Extension, and at the National Economic and Social Development

Board (NESDB) which is responsible for overall planning. The interviews revealed that these users are fully aware of the Sector Analysis effort, and that they are positive and enthusiastic about the results. At the decision-making level, the results appear to be transmitted and interpreted without going into detail on the analytical techniques used to obtain the estimates. At the technical level, there is communication between the staffs and considerable knowledge of the procedures used. Strong points expressed were that the consistency and accuracy of planning and target setting has been strengthened through necessity to take a unified look at agriculture, and that the logic of the results can be interpreted and provides an understanding of the magnitude of results to be expected from policy alternatives.

Among users and potential users outside of MOAC and NESDB, there is an awareness of the Sector Analysis effort and some familiarity with it, mostly as gained from seminars and presentations. The opinion appeared universal that the Sector Analysis effort is addressing important problems and that the models are capable of contributing greatly to their solution. Examples of technical questions asked pertained to how much attention is being given to off the farm work particularly in the off season and particularly as it involves seasonal migration, and about the number of alternative techniques being considered for fertilizers and water and for more labor intensive possibilities in land preparation and other cultural practices. These questions were largely in the nature of seeking information, as there is not yet enough working level knowledge for those outside of MOAC and NESDB to critique the procedures thoroughly.

### Evaluation

The Evaluation Team devoted a great part of its effort to assessing the overall usefulness and adequacy of the LP farm modelling effort, drawing on written reports as well as the opinions of users, and directing questions to DAE/ISU personnel. An assessment involves several issues, including whether important questions are being addressed, whether reliable answers are obtained, how sector analysis personnel interact with other analysts and with those having decision-making responsibilities, and how the results actually enter the decision-making process.

The Policy Questions. On the issue of whether important questions are being addressed, the major policy goals connected with Thai agriculture are widely accepted to be to increase agricultural productivity and incomes and improve the distribution of income within agriculture and between agriculture and non-agriculture. Although the details of approaches and the specific measures contemplated vary from year to year, the major issues have been recurring and are likely to continue to recur. It remains true that economic changes within Thailand, including population growth which may alter factor price ratios and availability of rice for export, will affect policies, as will political changes. Future events abroad, as they determine profitability of various types of exports, provide further reasons why the future will differ from the past. There is thus a need for basic analysis of the recurring questions of concern about Thai agriculture, combined with ability to adopt the analysis to changing policy problems. The DAE/ISU effort is taking a long step toward meeting this need.

Agricultural Planning. A major use of the modelling capability is in assessment of alternative broad strategies toward agricultural development, as for instance, in deciding on relative emphasis between irrigation, credit and other major policy thrusts. This use has been demonstrated in connection with the fourth Five-Year Plan. Making the models operational in time to be used for the Plan has been an almost remarkable feat. The contribution to the Plan by the Sector Analysis group has clearly been outstanding. The alternatives analysed for the fourth Five-Year Plan showed the sensitivity of results to various program efforts, and the version showing the substantial measures that would be necessary to achieve income targets appears to have been highly important in gaining additional emphasis for agriculture in the Plan.

A major virtue is that the sector analysis models make it possible to quantify contributions of strategies toward goals. The model can thus be used in assessing the effectiveness of the strategies, showing what the effect on goals will be of specific program actions. Much planning in the past has consisted of enunciating targets without indicating specific program actions to be undertaken and without considering numerically how various actions would affect goals. The sector analysis models make agricultural planning a tool for seriously weighing options and guiding programs subsequent to the planning exercise.

Analysis for Current Decision-Making. Apart from overall planning, the sector analysis models can be used in connection with specific policies being contemplated on a current basis. The current analysis of water productivity for the World Bank loan is but one example of uses already made, and many more applications are likely now that the models have become operational.

The uses of the modelling effort to aid in the analysis of such policies include drawing on the data base accumulated in connection with the models and giving informal help by model team members on particular farm production and marketing analytical problems, as well as making formal runs of the model.

To be of greatest effectiveness, a short turn around time in making runs is required, since the pace of policy formation is almost always such that the time between posing of a question and the need for answer is short. This has clearly been achieved.

The Model Components. The area breakdown into 19 zones with great detail as to possible cropping activities indicate that the models reflect much of the variety in conditions that exist in various parts of Thai agriculture, with provision for predicting changes in farmer choices in response to conditions such as might be altered by policies. Even greater detail within zones is needed for some purposes. These include planning for small areas and investigations pertaining to income distribution. Disaggregating within zones is already being undertaken for this reason.

Distinguishing between agriculture and non-agriculture helps to get at the personal distribution of income, in view of the income disparities between Bangkok and the rest of the economy. Furthermore, the severe income differences among regions, particularly as regards the Northeast, mean that the zonal analyses will throw light on income distribution. However, modeling income distribution effects within zones requires distinguishing between different farming situations within a zone. Attention to ownership of resources is desirable, since the incidence of many policies is on returns

to land, with the income distribution effect then depending on the distribution of land ownership.

In the original proposals for the DAE/ISU effort, rural income generation and development were mentioned, although they were not explicitly provided for in the work plan. More rural development emphasis would be useful in Thailand, both as regards industrialization outside Bangkok and as regards social services for rural people. There is much to be said for including rural development analysis within a rigorous modeling effort, where targets and effects can be quantified. Development planning could aim to optimize the provision of education, health and related services at specified levels and at minimum cost. Rural industrialization could examine firm profitability using the same optimization techniques as being used for farming and considering groups of activities to take account of economics of scale in urban activities. As mentioned in the last section, the 1975 evaluation recommended more effort on rural development. The input/output work and the transportation and processing models to be considered below provide a start in this area.

Reliability. The 1977 Evaluation Team has devoted a great part of its efforts to considering the technical adequacy of the linear programming models. As a result of these efforts, we are convinced that the basic economic logic underlying the modelling of farm activity is sound. Working papers were made available to us on the statistical estimation underlying fertilizer response and other technical response coefficients. These revealed that up to date statistical procedures have been used. For the most part, the estimated coefficients are reasonable and highly significant statistically. While it is not possible in a short period to completely check the numerous

details involved in a quantitative effort of this magnitude, the examination of overall structure and the sampling of checks on details reveal a research undertaking of extremely high calibre. Further adding to confidence in the results is that the estimates used are based on extensive surveys, are calibrated to real conditions and are checked for reasonableness by Thai professionals with years of experience and proven judgments on Thai agriculture.

The models should be viewed as first generation efforts, with revisions and extensions to occur on a more or less continuous basis. The Evaluation Team believes that the strategy followed of constructing operational models in a short period of time has been the correct one. Considerable refinements have already been built in, such as allowing for fertilizer response through different activities and distinguishing labor use by detailed time periods. The sector analysis personnel are fully aware that there is scope for new estimation, and for extension and revisions of the model. Effort along these lines that has already begun will be considered in the section of this report of the Future of the Program. The suggestions of the Evaluation Team for further behavioral analysis, and for further extending and revising the models in light of the behavioral analysis, are given in the Recommendations in the final section of this report.

Entering the Decision-Making Process. The lodging of a major policy analysis tool within DAE is effective if DAE is called upon for policy analysis and if DAE uses the tool. That DAE is being called upon to do the important policy analysis pertaining to agriculture is abundantly clear. Numerous examples of DAE participation in policy formation using the sector analysis capability have been given above. Significant policy analysis

capability for agriculture does not appear to exist elsewhere in the government. Our interviews with others touching on DAE convince us of the confidence the organization has gained among higher officials. Even though the models have only recently come into being, they are already being used actively, and there is every reason to believe that the uses will expand.

#### B. Macro Modeling and Input/Output Analysis

Effort in this area is concerned with the forward and backward linkages between the agricultural sector and the non-agricultural sectors, in order to estimate effects of agricultural policies on non-agricultural sectors, and vice versa. The linkages at the national level are of importance because of the large size of the agricultural sector. At the regional level, the linkages will provide a way of estimating income distributional effects of agricultural and non-agricultural policies.

Specific policy concerns will include

Balance of payments

Tradeoff between agricultural price policy and consumer cost of living

Levels of non-agricultural income and employment created by agricultural development programs

Effects of non-agricultural development policies on the demand for agricultural products, and on labor, capital and land resources.

The methodology for the macro-modeling is econometric analysis of time series data. The statistical method used is ordinary least squares in as much as the time series is too short to permit use of two stage least squares. The models will be refitted using a principle components methodology. The econometric models are tested by reduced form analysis. The methodology for the input/output analysis is standard linear coefficient calculation based on

**primary and secondary data.**

**A chronology of progress to date is:**

- |                       |   |
|-----------------------|---|
| <b>September 1974</b> | <b>Macro-economist arrived in Thailand.</b>   |
| <b>December 1974</b>  | <b>Specification of aggregate 25 equation models of Thai economy.</b>   |
| <b>March 1975</b>     | <b>Estimation of parameters in 25 equation models completed.</b>  |
| <b>June 1975</b>      | <b>21 equation macro model completed. Data collection and regression analysis for a more disaggregated model was started.</b>   |
| <b>July 1975</b>      | <b>Estimation of consumption and export sectors of disaggregated model completed.</b>   |
| <b>August 1975</b>    | <b>Revised data series received from NESDB. Respecification and reestimation begun.</b>   |
| <b>November 1975</b>  | <b>Aggregate demand, import and export sectors completed.</b>   |
| <b>December 1975</b>  | <b>Estimation of consumption, import, export, and income distribution sectors was completed.</b>  |
| <b>January 1976</b>   | <b>Disaggregated 45 equation model of Thai economy was completed.</b>   |
| <b>March 1976</b>     | <b>Further disaggregation and non-linear specification of 45 equation models underway. Preliminary work on monetary and balance of payments sectors. Experimentation with 45 equation models to provide multipliers of agricultural output on non-agricultural variables.</b> |

- May 1976 Preliminary discussions were held with representatives of the I/O Section of NESDB to explore their activities and to determine possibilities for cooperation in development of I/O analysis.
- June 1976 Meeting was held with Khun Boonlert and Khun Adul of the I/O Section of NESDB. Tentative agreement was reached to share all published data and to cooperate in providing information and review on questionnaires in the I/O data development.
- June 1976 Draft report on linear version of macro model completed (Model I).
- July 1976 Estimates of regional multipliers derived from regional income accounts were completed. The estimation and simulation of the non-linear version of the macro model was completed. The non-linear model with 45 behavioral equations and 10 identities treats consumption and imports on per capita basis. Discussions with NESDB to obtain I/O survey data so that regional agricultural and non-agricultural linkage can be better quantified.
- October 1976 Meetings were held with representatives from NESDB and DAE which resulted in an agreement to initiate a joint effort in the development of the next national I/O revision. DAE will have primary data responsibility for agriculture and agriculture related industries and NESDB the remainder. Of the total 120

industries identified DAE will be responsible for approximately 60. Both agencies will have full access to the data.

November 1976

A preliminary survey was conducted by a joint survey team composed of 6 persons from DAE and 6 from NESDB, and a major effort to develop the survey instruments for use in the next national general survey was begun.

November 1976

Conceptualization of linkage framework showing relationship between activity analysis models macro econometric models and input-output analysis presented at Regional ADC conference by Dr. Somnuk Striplung.

December 1976

Meeting to plan survey to update national I/O table in cooperation with NESDB.

### User Opinion

Potential users expressed the view that analyses of linkages between agricultural and non-agricultural sectors are needed and would be useful. While working papers are available on the macro-econometric model, the results are still too preliminary for wide circulation, and so there was little basis on which potential users could form opinions on the specifics. The same was even more the case for the input-output work, which is just getting underway.

### Evaluation

The working paper on the macro econometric modelling reveals that the formal structure is nearly complete, with two versions of estimates already obtained. Modern techniques are being employed, and the interpretation of

the coefficients is careful and reasonable. As the working paper recognizes, the production function specifications are an area of needed further work. Another area which should be given careful attention is the nature of overall resource constraints in the Thai economy. Because of importation possibilities, capital may be fairly elastic in supply. The question of what kinds of labor constraints are faced is more difficult. While it is widely stated that there is a surplus of labor in the Thai economy, this may mean at one extreme only that labor is relatively inexpensive, and does not necessarily mean that unlimited amounts of labor can be hired at current wage rates. It is anticipated that these matters will be given further attention when work on the macro model resumes.

The Evaluation Team did not have occasion to go into the details of the input-output work which is just getting underway, but the discussions indicated that reasonable applications of this technique are being undertaken.

### C. Commodity Demand

The objectives of commodity demand analysis are to:

- (i) Provide government policy makers with estimates of price-quantity relationships to assist in decisions involving policies on prices, export possibilities and domestic consumption.
- (ii) Provide estimates of price quantity relationships for use in sector analysis models and in specialized transportation and buffer stock models.

The techniques involve the use of standard principles of demand analysis. The analysis starts from conventional balance sheet methods for checking data consistency. The statistical methods used are ordinary least squares and two stage least squares techniques. The estimated commodity

models are subjected to a reduced form analysis, in which predicted values are used for lagged endogenous variables.

The progress in the demand analysis has been as follows:

- |               |  |
|---------------|--|
| October 1973  | Demand analysis work started with rice data gathered.  |
| January 1974  | Adoption and testing of TSLS regression package from University of California.   |
| March 1974    | Collection and evaluation of data on kenaf and maize markets. Specification completed for kenaf model. Software for reduced form analysis written.   |
| July 1974     | Computer software tested to develop simultaneous estimates of rice demand and stock change.  |
| August 1974   | Initial results with rice demand equations for glutinous and non-glutinous rice. Cell variables showing expected sign except with the price of rice.   |
| October 1974  | First attempts to estimate domestic and export relationships for mung beans.   |
| December 1974 | Kenaf model completed and manuscript written to describe results. Continued work on modification of mung bean equations. Specification on a soybean model was begun.   |
| August 1975   | 3-week TDY by Lee Blakeslee. Work with DAE staff in further specification and estimation of econometric models for kenaf, maize, and mung beans. Consultation was provided to marketing group on model building and policy analysis. |
| April 1976    | 3-week TDY. Review of progress on models for rice, maize, mung beans, and cassava.   |

Efforts will be made to complete the models under construction. The efforts in demand analysis will be enhanced by the anticipated arrival of a demand analyst-marketing specialist during the last year of the contract. The Demand Analysis section of the Marketing Branch is expected to be under the leadership of a Ph.D. candidate. This candidate is studying under the former Demand Analyst on the I.S.U. team.

D. Transportation, Processing and Marketing

The concerns here are with marketing channels, transportation networks, and capacities and cost of alternative milling and processing facilities. The objectives are to find efficient ways to transport, process and market individual commodities as well as to provide inputs to the larger sector models. The potential users of this include the other modeling operations and policy makers. For example, the analysis of a buffer stock policy on rice would draw on coefficients from the marketing channels as well as production coefficients from the crop model and rice demand analysis.

The major optimizing technique used to date has been linear programming. Both 2-stage random sampling and purposive sampling techniques have been used in the collection of basic data.

The chronology has been:

- |            |   |
|------------|---|
| April 1974 | Research plan involving data needs and model formulation for transportation networks and processing facilities developed.                       |
| July 1974  | Data for rice transportation model completed. Work in process for supply and disappearance estimates for corn, rubber, sugar cane, and cassava. |

- September 1974** First solution to rice transportation model with changwat detail was obtained. Data collection on other crops proceeding.
- December 1974** Survey on barge transportation rates prepared.
- February 1975** Development work underway to consolidate detailed transportation network for inclusion in national crop model.
- July 1975** Rubber transportation model developed, solution obtained. Computer software developed to print cost of truck, rail, and barge transport between changwats. Estimates of zone costs for transportation, processing, and assembly for maize, cassava, rice, and sugar cane completed for inclusion in the national model. Study of alternative transportation rates for rice was completed.
- September 1975** Discussions on revision of marketing, transportation, and processing models for policy analysis purposes were held. Additional detail was to be provided on the various channels between the farm level and the final consumer and/or exporter.
- November 1975.** Rice mill survey to obtain milling costs and charges for alternative sizes of mills was conducted.
- February 1976** Marketing analyst completed two-year tour.
- July 1976** Preliminary construction by DAE staff of rice model for the changwats in the Central Plain was completed.

Processing models for sugar cane, cassava, and kenaf under construction.

November 1976 Paper describing construction of rice processing model presented at ADC conference in Singapore. Plans were made to use I/O analysis to supplement linear programming models in evaluation of impacts caused by changes in the agricultural services sector.

#### E. Related Research Activities

There has been a variety of ad hoc work plus the development and testing of expansions of the L.P. models. The latter are often conducted as stand alone efforts where sector models are not available to further integrate and utilize the information and data generated. The linear programming studies of livestock, multiple cropping and poly-period crops should be of interest to national and regional agencies who supply capital in these areas and to agricultural planners and extension workers. The related research activities have been numerous, and only selected ones will be listed.

Recent activities of the ISU staff team include:

1. Relocation study on Bangkok fish market.
2. Specification and construction of linear programming model for study of rice buffer stock policy.
3. Development of computer software for estimation of production functions for fertilizer experiments and software for specification of optimal levels of fertilizer use.
4. Consultation on design of questionnaires for special surveys on marketing and processing.

5. Development and testing of experimental designs for crop experiments and for livestock experiments. These include fertilizer, silage for swine, and fertilizer-irrigation experiments.

The DAE staff has been involved in the following short-term projects:

1. Annual estimates of area planted and production for rice and maize. This information is used for setting annual export targets.
2. Analysis of reasons why area planted to kenaf is declining while the area planted to maize and cassava is increasing.
3. Plan for project on groundwater--using deepwells as a source for irrigation.
4. Fruit tree project. Fruit-tree area around Bangkok being reduced by urban growth and pollution. Study of feasibility of expanding production of certain trees including durian in other areas.
5. Meetings on cost recovery project and water charges for irrigation.

#### User Opinion and Evaluation for C, D and E Above

Few comments were made by users or potential users on the work on commodity demand, transportation, processing, marketing and the related activities. This was partly because much of the work is not far advanced, when made available it may not be identified as part of the output of the Sector Analysis Program, and there was not time to interview all users for these parts of the Program less central to the main thrust. Much of the knowledge of the Evaluation Team in these areas derives from conversations with DAE and ISU staff members. The research has been found to be well designed in itself and to fit in with the more major parts of this modelling. It is apparent that staff members have been able to be of use in related work without being unduly deflected.

**F. Data Bank Management, General Survey, and Statistical Support Activities**

**1. Data Bank**

The data bank currently has one section in operation, two in development, and one section proposed. The section in operation contains results from the DAE agricultural surveys stored by changwat. At present approximately 7400 characteristics from the General Farm Survey of 2516/17 is stored. For each characteristic, the estimated total (Y), the coefficient of variation, the percent of farms reporting the characteristic, and an item ID number is stored. Through use of a retrieval program, a user can obtain any of the following:

- (1) The population estimate (Y)
- (2) The population standard error
- (3) The population coefficient of variation
- (4) The percent of farms reporting the characteristic
- (5) The estimated number of farms having the characteristic
- (6) The average (Y) based on all farms
- (7) The average (Y) based on only those farms having the characteristic

The user can perform addition, subtraction, multiplication or division operations on any of the information. The survey information may be obtained by changwat or accumulated to agro-economic zone, regional, or Kingdom totals as tabular output or as punched output. Zero observations are not stored in the data bank (for efficient utilization of storage space), but are generated at user's request. This provides over 4 million pieces of information from the 2516/17 General Farm Survey. Results from the Survey of 2518/19 will begin to be stored soon.

Documentation for approximately half of the data has been published, and a usable set of instructions is available for the retrieval program. Temporary documentation is also available for the remainder of the data. Due to restrictions imposed by the IBM 1130 computer system, maintaining survey results lower than the Changwat (i.e. Ampher) level or the raw survey data is impractical.

A second part of the data storage system is to be a master list frame of villages to be used in sample allocation. The plan is to store information for each village, such as number of farms and major crops grown. This list of approximately 50,000 villages will reduce the time required for sample allocation (at present about 4 weeks for a general farm survey), and computer maintenance of the list will facilitate inclusion of the most recent knowledge in the list. At present data is being prepared for data storage and the computer software is being developed.

A third part of the data effort concerns price series maintained by the Marketing Branch of the DAE. Monthly price data are available at the Kingdom level for approximately 200 commodities for up to 30-35 years. Data by agro-economic zone are available for the past 2-3 years. At present these data are being prepared for computer input and the storage algorithm has been developed.

A fourth part of the data effort has been proposed related to the farm keeping programs. This information will be used to provide an analytical capability at the farm level.

During the next six months plans are to finish documentation of the data of the survey results, to have the price data and list frame sections operational, and to make preliminary plans for coding procedures and the

storage algorithm to be used with the farm records. The plan for the following 12 months is to make the farm records data available as an operational section of the data bank.

## 2. Survey Processing

Analysis programs for two and three stage cluster surveys have been written and are in operation in the DAE. Because of differences in the various two and three stage surveys, these programs must be revised for each survey. For each survey a data file must be set up containing the sampling fractions. Also a data input subroutine must be prepared for each section of data to be processed.

Surveys processed to date include General Farm Surveys for 2514/15 (tabulated by hand), 2516/17 and 2518/19 (currently being processed), specific yield surveys for rice (2516, 2517), kenaf (2517), maize (2518), second rice crop (2518, 2519), crop production (2518, 2519), and rice stock (2519 currently being processed).

The DAE staff is currently fully capable of writing the input sub-routines required by the analysis programs, making data checks by computer, and setting up the data file for the sampling information. Further work is being done to familiarize DAE staff with the analysis program and the type of changes required for the different surveys.

## 3. Statistical Support Activities

### a. Development of Computer Software

Computer software developed to date includes:

- (1) RFORM--solves for the reduced form of a simultaneous set of linear equations (will handle a maximum of 70

- endogenous and 105 exogenous variables).
- (2) GENGS--a program using the generalized GAUSS-Seidel technique to solve a system of simultaneous equations which may contain non-linearities (will handle a maximum of 70 endogenous and 100 exogenous variables).
  - (3) INOUT--a program which performs an input-output analysis on a system of up to 200 factors.
  - (4) DYNAMO--a version of the DYNAMO simulation language has been developed for use of the IBM 1130 computer.
  - (5) The IBM programs for Factor Analysis and Stepwise Regression have been revised to handle up to 65 variables instead of 30.
  - (6) In addition a multiple regression and 2 stage least square package and other application program are available such as to calculate a moving average, weighted average, etc.

Plans for the future include maintenance of the above software, expansion of INOUT to provide more use options, and development of more user software for the data bank.

#### b. Staff Training

During January and February 1976 a Fortran course was presented to 19 DAE staff members. At present two persons are receiving additional training, one at Iowa State and one in Bangkok. Also presently under way is a seminar on data structure and data management for computer center staff.

#### 4. Computer Utilization

To give an idea of how the DAE has progressed in the area of computer utilization over the past 3 years, in 1974 the computer was in actual use for 1345 CPU hours. This increased to 3568 hours in 1975 and to 5563 hours in 1976. The 1976 total does not include over 100 hours used in October and November. Due to computer maintenance time, electricity failures, and time lost between jobs this figure for 1976 should represent very nearly the maximum capacity of this computer. The extremely low totals reported for November and December 1975 were due to the installation of the new equipment which upgraded the machine from an 8K word-1 dick drive machine to a 16K word-3 dick drive machine. Nearly one month of computer time was lost to installation related problems.

After installation of the new equipment, the survey analysis programs were rewritten to make efficient usage of the equipment, which resulted in the computer time being reduced to 25-50% of what it had been previously. To relieve the load on the computer the MPS LP program is to replace LP. This should result in at least a 50% savings in time for LP programs (most of the time used by the Planning Branch). Also access to an IBM 370 computer in the Bureau of Business Economics is expected in the near future.

#### User Opinion

There is awareness among most of the users and potential users interviewed that a great deal of new data are being collected in connection with the sector analysis effort, and there is interest in obtaining access to parts of the data. In some cases, the question of timeliness not directly related to the sector analysis as such was discussed. A further removed question also discussed had to do with the existence of sometimes conflicting

estimates emerging from different agencies. The Evaluation Team learned later that the general problem of ensuring consistency of estimates is under RTG review.

### Evaluation

A high order of data storage and accessibility capability is clearly being developed, which will be of use not only to DAE but to other users as well. A strong point of this effort is the attention to reliability of estimates, with measures of reliability being supplied to users along with the estimates themselves.

Experience within Thailand in working with DAE on data matters, known to Thai team members, led to the following specific comments:

(a) The DAE/ISU's approach to agricultural information collection and processing as well as presentation in order to help formulate the agricultural plan and program implementation is centered on the philosophy of cross section effort instead of a cumulative effort approach. This is to say not only its own information in the past should be fully utilized as the basis for the new data collection, but there should be attention to how to maximize utilization of related series obtained by others. This approach is based on the following considerations. (1) Being aware of the time and costs involved in any original fact-finding research, one way to minimize such expenditures is to identify the minimum additional information necessary for the study by utilizing existing information from related information or other data sources. (2) Case studies and sample surveys are helpful in generating hypotheses, but more important is how they can be systematically fitted together in a broad conceptual framework, such as national accounts and overall balance sheets, for policy planning purposes. Such a framework

can be developed by sequential research efforts in a cumulative manner. This is particularly important in the light of the search for new development strategies. (3) In order to avoid duplication in research effort the design should not only be limited to a new focus but also to strengthen the interrelationships between the present and past researchers.

(b) Since the Fourth Plan, which heavily emphasizes agricultural development, is an indicative scheme, the operational plan of the MOAC remains to be formulated. The DAE/ISU staff should play an important role here, and has already begun to do so. A basic function is to strengthen the current development approach in the MOAC and to initiate project identification and formulation, assuring better integration of agricultural development programs. As a complementary approach to the LP model based on cross-section information, a macro-economic model for the Thai economy such as the one already under development should be utilized. Aggregate planning can become more useful by using basic data series particularly of NESDB's national accounts.

(c) Since the coverage of the agricultural studies for comprehensive planning should be expanded to cover not only crops and livestock but also fisheries and forestry, consideration should be given to expanding computer facilities and manpower efforts. The DAE/ISU should consider utilizing the Government Computer Center at the NSO or the MOC. The DAE staff should also consider how to supply as much of the national account data possible within its areas of expertise, which is indeed happening as brought out in the chronology for the macro modelling and input-output analysis above.

The remainder of the Evaluation Team's findings on data have to do with knowledge and availability of the data outside of DAE and will be considered in the next section on Dissemination of Results.

#### IV. DISSEMINATION OF RESULTS

One form of formal dissemination of project results has been seminar participation. The DAE/ISU sector analysis team held two seminars during FY 1976. The first was sponsored by the Agricultural Development Council (ADC) in Bangkok. The papers presented at the two-day seminar (July 29 and 30, 1975) were:

Dr. Somnuk Sriplung	Role of the DAE in Agricultural Development Planning
Mr. Prasit Supradit	Income Elasticity of Demand for Foods
Mr. Thongchai Petcharatana	Agricultural Demand Analysis
Dr. Dennis Conley and Mr. Chamong Vatana	Effect of Transportation Cost Changes on Rice Agriculture
Dr. Arthur Stoecker and Mr. Kanok Khatikarn	National crop model
Mr. Prasit Itharattana	Northeast crop model
Mr. Chamlong Sakdidee	Zone crop models for the Central Region
Dr. James Stephenson	Macro Economic model

The second seminar was held on June 22, 1976 to present the major results of the DAE/ISU research for the Fourth Five Year Agricultural Development Plan. The program of this seminar is shown in Table 4. The conference was attended by more than 58 representatives from NESDB, the Thai Universities, and relevant government agencies outside the Division of Agricultural Economics, as indicated in Table 5. An additional 49 representatives from the DAE attended.

**Table 4 Program for  
Seminar on Thailand's Fourth Five-Year Agricultural  
Development Plan-B.E. 2520-2524**

**FAO Conference Room  
Pra Artit Road, Bangkok**

**June 22, 1976**

- |                      |  |
|----------------------|--|
| <b>9:30 - 9:40</b>   | <b>Opening Address: "Thailand's Fourth Five-Year Agricultural Development Plan"</b><br>- Mr. Adul Niyomviphat<br>Deputy Under-Secretary of State<br>Ministry of Agriculture and Cooperatives   |
| <b>9:50 - 10:50</b>  | <b>Present Situation of Thai Agriculture</b><br>- Dr. Somnuk Sriplung<br>Director, Division of Agricultural Economics<br>Ministry of Agriculture and Cooperatives  |
| <b>11:00 - 12:00</b> | <b>Fourth Five-Year Agricultural Development Plan Model</b><br>- Dr. Arthur Stoecker<br>Chief-of-Party, ISU/Thailand<br>- Kanok Khatikarn<br>Economist 4<br>Division of Agricultural Economics   |
| <b>13:30 - 14:30</b> | <b>Fourth Five-Year Agricultural Development Plan Formulation</b><br>- Dr. Charles Framingham<br>ISU Team/Thailand<br>- Winai Tayyaitieng<br>Economist 5<br>Division of Agricultural Economics   |
| <b>14:45 - 16:30</b> | <b>Evaluation of the Fourth Five-Year Agricultural Development Plan</b><br>- Dr. Olarn Chaiprayat<br>Assistant Director<br>Department of Economics Research<br>Bank of Thailand<br>- Dr. Narongchai Akrasanee<br>Lecturer<br>Thammasart University<br>- Mr. Tweesackdi Sesawatch<br>Deputy Director-General<br>Department of Agricultural Extension<br><b>General Discussion</b><br>- Participants |

**Table 5. List of Participants at the Seminar  
on Thailand's Fourth Five-Year Agricultural Development Plan**

**FAO Conference Room  
Pra Artit Road, Bangkok**

**June 22, 1976**

1. Office of National Economic and Social Development Board (NESDB)
  1. Nai Kosit Punpiamrat
  2. Nai Chaiyos Chaimankhong
  3. Nai Staport Kavitanend
  4. Nai Prophat Viratananand
  5. Nai Sorasak Chantharacharaswat
  6. Nai Songvudh Imsoon
  7. Nai Chamnan Roongsaeng
  8. Nai Somsak Wongsamanote
  9. Nai Roongroeng Isarangkul Na Ayudhya
  10. Miss Bang Orn Nilsee
  11. Nai Adirek Nakornthap
  12. Nai Boonthavee Tantisira
  13. Nai Montri Foengfunuj
  14. Nai Pairoach Suchinda
  15. Nai Sanan Charoenying
  16. Nai sonsarn Kanchanaphirom
2. Bank of Thailand
  1. Dr. Orarn Chaysprovat
3. Khon Kaen University
  1. Dr. Aran Phathanothai
4. Thammasart University
  1. Dr. Narongchai Akkharaseranee
  2. Dr. Lilly Kosaiyanond
5. National Institutional Development Administration (NIDA)
  1. Dr. Pipit Soobphaphiphat
  2. Dr. Pairaj Krisanamis
6. Chiangmai University
  1. Nai Sidh Kosin
7. Bank for Agriculture and Agricultural Cooperatives
  1. Nai Suwan Traiphol
8. Ministry of Industry, Industrial Economics Division
  1. M. C. Piriyadis Disakul
9. Office of Parliament Secretariat-General
  1. Nai Chana Sa-Ard Iem
10. Ministry of Interior, Interior Policy and Planning Office
  1. Nai Sanan Wongthambhand
  2. Nai Praphan Sunthornmon
  3. Nai Boonchuay Koedsukhon
  4. Nai Niraj Vatjanaphoom

Table 5. (Cont'd)

11. Ministry of Commerce, Internal Trade Department

1. Miss Phaungsee Yudhasarnprasit
2. Miss Upsorn Roengwan

12. United States Operations Mission (USOM)

1. Mr. A. D. Lundberg

13. Food and Agriculture Organization

1. Dr. Kamol Chanlekhekha
2. C. P. William

14. United Nations International Children Emergency Fund (UNICEF)

1. Miss Suda Thippayaum

15. Ministry of Agriculture and Cooperatives (MOAC)

1. Nai Adul Niyomviphat

Irrigation Department

1. Nai Suthep Tingsaphat
2. Nai Charin Atthayotin
3. Nai Pradit Ritvirawan

Land Development Department

1. Nai Sitthilarp Vasuwat
2. Nai Pinit Suwannachod
3. Nai At Sourang

Agricultural Technical Department

1. Nai Prsidhthichai Sookthavee
2. Nai Sompoach Suwannawong
3. Nai Sommart Thammanuwong
4. Nai Roengchai Sucharit

Agricultural Extension Department

1. Nai Thaveesak Sesavej
2. Nai Bunyat Chaiyaphreuk

Cooperatives Promotion Department

1. Nai Choen Bamroonwong

Forestry Department

1. Nai Thanaum Premrassamee

Livestock Department

1. Nai La-Iad Duangdee

Fisheries Department

1. Nai choedchai Amatayakul

Central Office of Land Management

1. Nai Jaun Boonleu

Office of Agricultural Land Reform

1. Nai Sudhiporn Jirabhand

Table 5. (Cont'd)

Project Planning Division

1. Nai Pichai Karunyavanij

Division of Agricultural Economics

- |                                |   |
|--------------------------------|---|
| 1. Dr. Somnuk Sriplung         | 23. Miss Kanchana Phromphaei            |
| 2. Nai Khloen Chaiyasang       | 24. Miss Apha Taphaonoi                 |
| 3. Nai Thavaj Leelanuj         | 25. Miss Siriporn Chantha senanond      |
| 4. Nai Choen Srisurak          | 26. Miss Vasana Sudhivanij              |
| 5. Nai Narong Chaupraksub      | 27. Mrs. Amphai Phadungsattayswong      |
| 6. Nai Surat Muthrasin         | 28. Miss Suwakhon Thamraksa             |
| 7. Nai Bamroong Pensupha       | 29. Mrs. Suwanna Leelaphat              |
| 8. Nai Chamras Ungkarbla-aung  | 30. Nai Loertchai Nilsalab              |
| 9. Nai Chlasiri Suwannasiri    | 31. Nai Prasidh Ittharat                |
| 10. Nai Chamras Inthachaisri   | 32. Nai Chamlong Sakdi                  |
| 11. Nai Supot Techates         | 33. Nai Praphai Wongmontha              |
| 12. Mrs. Khachornwan Ittharat  | 34. Nai Kanok Khatikarn                 |
| 13. Nai Thongchai Petrat       | 35. Nai Chamnong Wattana                |
| 14. Nai Manu Thienniam         | 36. Nai Aran Roonsawang                 |
| 15. Nai Vinai Taiyaithieng     | 37. Mrs. Phatcharee Phadoongphattanodom |
| 16. Nai Narong Poonsilp        | 38. Miss Suphatthra Phromluck           |
| 17. Nai Yudhana Tosuwan        | 39. Nai Loebongs Sarabhaya              |
| 18. Mrs. Atchara Choedchuchai  | 40. Mrs. Pranee Puchamanond             |
| 19. Miss Ratana Thanakil       | 41. Nai Rassamee Kasemsap               |
| 20. Miss Rewadee Nilawong      | 42. Miss Oeumporn Ruayruen              |
| 21. Miss Nirachorr Chanyasak   | 43. Miss Phayaum Niamliang              |
| 22. Miss Yuphin Rangsardthaung |   |

ISU/Team-DAE

1. Dr. Arthur L. Stoecker
2. Dr. Keith Rogers
3. Dr. James A. Stephenson
4. Dr. Charles Framingham
5. Dr. Laurence C. Kinyon

In November 1976, presentations were made describing the Thailand agricultural Sector Analysis project at the Regional ADC conference on sector analysis held in Singapore. The members of the Thailand sector analysis team who attended the conference and papers presented were:

- |                        |   |
|------------------------|---|
| Dr. Somnuk Sriplung    | "The Framework of Agricultural Development Planning Activities of DAE/ISU in Thailand". |
| Mr. Prapai Vongmonta   | "Applications of the Regional Crop Model of Thailand"                                   |
| Mr. Chomlong Sakadidee | "Livestock Model" and "Rice Transportation, Storage and Processing Model"               |
| Dr. Herbert Fullerton  | "Future Plans for Agricultural Sector Analysis in Thailand".                            |
| Dr. Charles Framingham | "Interaction between the Policy Maker and the Policy Analyst".                          |
| Dr. Arthur Stoecker    | "National Crop Model of Thailand, Structure and Application".                           |

The purpose of the conference was to share sector analysis planning experiences from countries where sector analysis projects are in process with countries which have potential interests in developing a sector analysis project. The conference was attended by representatives from Thailand, Korea, Phillipines, Malaysia, Indonesia, Pakistan and Nepal. Members of international agencies including ADC, FAO and AID also participated.

Another form of dissemination has been publication. The 44 project publications issued to date are listed in Table 6.

As is apparent from the preceding sections of this report, the most important forms of dissemination do not take place through the formal channels of seminars and publications, though these have a role. Rather, the most important dissemination is through the use of results in decision-making. This type of dissemination, which is the ultimate purpose of the program, can often not

Table 6. Thailand Sector Analysis Program Publications

A. Annual Project Reports

1. Annual Report: Agricultural Sector Analysis in Thailand, FY-1974, Iowa State University, Ames, Iowa.
2. Annual Report: Agricultural Sector Analysis in Thailand, FY-1975, DAE-CARD Sector Analysis Series No. 2, February 1977.
3. Annual Report: Agricultural Sector Analysis in Thailand, FY-1976 (Draft).

B. Conference Papers.

(The Agricultural Economics Society of Thailand, Bangkok, Thailand, December 1973):

4. Research Strategies For National Agricultural Planning in Thailand by DAE and ISU Team. (Lee Blakeslee, Arthur Stoecker, Keith Rogers)

(The Food and Agricultural Organization Sector Analysis Seminar, Bangkok, Thailand, 19-21 June 1975):

5. Macro and Sector Linkage Models by James A. Stephenson.
6. DAE/ISU Marketing Research in Thailand by Dennis Conley.
7. Sector Analysis Planning in Thailand by Somnuk Sriplung.
8. National Crop Model by Arthur L. Stoecker.
9. Regional Sector Analysis in Thailand by Keith D. Rogers.
10. Demand Analysis Applications by Thongchi Petcharatana.
11. Agricultural Statistics Center by Laurence Kinyon.

(The Agricultural Development Council Seminar on Agricultural Development Planning in Thailand, Bangkok, Thailand, 29-30 July 1975):

12. A Report on the ADC Seminar on Techniques in Agricultural Development Planning by Chaktip Nitibhon.
13. A National Crop Model of Thailand in B.E. 2524 by Arthur L. Stoecker and Kanok Khatikarn.
14. The Northeast Region Crop Model by Keith D. Rogers and Prasit Itharattana.
15. Zone Crop Models of the Central Region by Arthur L. Stoecker and Chamlong Sakdidee.
16. Econometric Modelling by James A. Stephenson.

Table 6. (Cont'd.)

17. Income Elasticity of Demand for Foods by Prasit Supradit.
18. Agricultural Demand Analysis by Thongchai Petcharattana and Leroy Blakeslee.
19. Effects of Transport Changes on Rice Agriculture by Dennis Conley and Chamnong Vatana.
20. Role of the DAE in Agricultural Development Planning by Somnuk Sriplung.  
(Division of Agricultural Economics Fourth Five Year Agricultural Development Plan Seminar, Bangkok, Thailand, 22 June, 1976):
21. Crop Model for Thailand Fourth Five Plan Development Guidelines (Draft Form)
22. Thailand Fourth Five Year Agricultural Development Plan B.E. 2524 Guidelines. Revised Publication available under the Title: Agricultural Development Planning in Thailand: Some Supporting Analysis by Charles F. Framingham, A. L. Stoecker, K. Khatikarn, S. Sriplung and E. O. Heady, Iowa State University and DAE, MOAC, Royal Thai Government, February 1977.  
  
(The Agricultural Development Council Regional Seminar on Agricultural Sector Analysis, Singapore, Rep. of Singapore, 8-11 November, 1976):
23. The Framework of Agricultural Development Planning Activities of DAE/ISU in Thailand by Somnuk Sriplung, A. L. Stoecker and E. O. Heady.
24. Applications of The Regional Crop Model of Thailand by Prapai Vongwanta and Herbert H. Fullerton.
25. Livestock and Rice Transportation, Storage and Processing Models by Chamlong Sakdidee and Somnuk Sriplung.
26. Future Plans for Agricultural Sector Analysis in Thailand by Herbert H. Fullerton.
27. Interaction Between the Policy Maker and the Policy Analyst by Charles F. Framingham and Somnuk Sriplung.
28. National Crop Model of Thailand: Structure and Application by Arthur L. Stoecker and Kanok Khatikarn.

Table 6. (Cont'd.)

C. Data and Survey Reports.

29. 1975/76 Soybean Survey Report by Agricultural Statistics Center, Agricultural Statistics Bulletin No. 50
30. 1973/74 Livestock Number Survey Report by Agricultural Statistics Center, Agricultural Statistics Bulletin No. 49
31. 1975/76 Sorghum Survey Report by Agricultural Statistics Center, Agricultural Statistics Bulletin No. 52
32. 1975/76 Mung Bean Survey Report by Agricultural Statistics Center, Agricultural Statistics Bulletin No. 53

D. DAE Research Reports.

33. Thailand Selling-Pattern of Major Agricultural Commodities By Region in Percentage by Economic Marketing Branch, Agricultural Economics Bulletin No. 98
34. Cost of Production of Major Economics Crops by Production Economics Economics Branch, Agricultural Economics Bulletin No. 100
35. Production and Sale Time-Period Pattern of Thailand's Major Agricultural Commodities by Economic Marketing Branch, Agricultural Economic Bulletin No. 102
36. 1974/75 Chicken Production Status in Chachoengsao Province by Production Economic Branch, Agricultural Economics Bulletin No. 105
37. 1976 Cost of Production of Early Rice Crop by Production Economics Branch, Agricultural Economics Bulletin No. 106
38. 1974/75 Costs and Returns of Duck Egg Production in Cholburi Province by Production Economics Branch, Agricultural Economics Bulletin No. 113
39. Kenaf Demand in Thailand by DAE and ISU Team (Lee Blakeslee)

E. End of Tour Reports.

40. Leroy Blakeslee, July 1975 (Demand Analysis)
41. Keith Rogers, January 1976 (Project Management and Programming)
42. James Stephenson, August 1976 (Macro-Econometric Model)
43. Charles Framingham, December 1976 (Policy)

Table 6. (Cont'd.)

**F. Other Research Publications.**

44. Agricultural Employment and Migration in Northeast Thailand: Application of a Regional Planning Model, DAE-CARD Sector Analysis Series No. 1, December 1976 by Keith Rogers and Prasit Itharattana.
45. Conclusion of the Study on "Appraisal of the Land Consolidation Project, Chanasutr, Singhaburi, and Study on Recovery of the Cost" an Additional Phase by Prasit Itharattana.
46. Agricultural Development Planning in Thailand: A Sector Analysis Approach by Charles Framingham, Arthur Stoecker, James Stephenson, Herbert Fullerton, Keith Rogers, Leroy Blakeslee, Somnuk Sriplung, and Earl Heady in cooperation with the DAE Staff. (In Draft)
47. Agricultural Sector Analysis Planning in Thailand by Somnuk Sriplung (Paper presented at meeting of the Agricultural Representative of ASEAN Countries in Djarkata, Indonesia, 20 August 1976).
48. Macro Econometric Analysis of Economic Activity in Thailand, 1962-1974 by James A. Stephenson and Kajonwan Itharattana, DAE Series No. 9, November 1976.

**G. Data Bank and Computer Software.**

49. A Reduced Form Program by Laurence Kinyon. DAE Series No. 1, July 1976.
50. A Generalized Gauss-Seidel Program by Laurence Kinyon. DAE Series No. 2, July 1976.
51. DAE Data Bank from the General Farm Survey, Volume I by Laurence Kinyon. DAE Series No. 1, September 1976.

be documented in writing and can at best be ascertained through the recollections and impressions of the persons involved. The Evaluation Team's highly positive findings in this regard have been reported in Section III on Results to Date. The dissemination of results within MOAC and to NESDB has been excellent and thorough, occurring as part of normal working relations, and the sector analysis activities have clearly had a significant impact in these two parts of the government.

Partly as a result of the seminars that have been held, there is wide awareness of the existence of the program outside of MOAC and NESDB, but knowledge of the details is not great. Potential users expressed interest in learning more. Aside from a wish to have more technical information, desires were expressed to have statements of major project results and descriptions of methods, as well as problems and economic assumptions. The opinion was expressed that non-technical descriptions would be helpful. There was a substantial interest in learning more about the data being collected and how to gain access to the data. The expressions of interest by persons outside of MOAC and NESDB suggest that it would be useful to undertake further outreach efforts to others. This could be done partly through additional seminars and publications, as suggested in the Recommendations of this report.

## V. THE FUTURE OF THE PROGRAM

An appraisal of the prospects of the Sector Analysis Program involves considerations of the near term and long term subject matter that will be worked on, as well as the capability of the Thai staff to carry on and the expected future role of the Program in the Thai government. In undertaking an appraisal of these matters, this section draws on materials supplied by the DAE/ISU team and opinions expressed by Thai officials.

### Future Subject Matter

The future work of the Agricultural Sector Analysis Program will be determined by three major influences. First, the thrust of on-going work remains to be completed. Second, there are needs to complete and extend the modelling and statistical projects which serve as the basis for the program. Third, problems occurring in connection with government policies, programs and projects are likely to arise more or less continuously, calling for sector analysis input.

Activity will be ongoing in:

1. Linear programming models of agricultural production and distribution.
2. Macro econometric and I-O models.
3. Projects in special work areas and policy studies.
4. Data bank maintenance and statistical support.

Table 7 gives a division into subprojects with manageable and goal specific efforts. The table distinguishes as to whether the subprojects are ongoing or planned for the intermediate or longer term.

Table 7. Subproject Work Components

Activity	Presently Ongoing	Intermediate Term	Longer Term
<u>Line of Programming Models of Agriculture</u>			
<b>I. National Agricultural Model</b>			
<b>A. Modification and Improvement.</b>			
1. Coefficient verification and defining new technologies	X	X	
2. Defining and adding livestock and processing sectors	X	X	
<b>B. Applications.</b>			
1. Supply response and price policy	X	X	
2. Agricultural sector capacity		X	
3. Regional production patterns and targets	X		
4. Determining regional and national priorities		X	X
<b>II. Regional Agricultural Models (4 Regions)</b>			
<b>A. Modification and improvement.</b>			
1. Activities corresponding to the national model	X	X	
2. Poly period analysis	X	X	
<b>B. Applications.</b>			
1. Evaluate regional price and supply policy	X	X	
2. Evaluate irrigation and land policy	X	X	
3. Evaluate regional and local priorities		X	X
<b>III. Zone-Farm Type Models.</b>			
<b>A. Model construction.</b>			
1. Identify farm types and production activity	X		
2. Assemble coefficients and resource data (test model)	X	X	
3. Expand beyond pilot area and farm types		X	X

Table 7. (Cont'd.)

Activity	Presently Ongoing	Intermediate Term	Longer Term
<b>B. Applications.</b>			
1. Evaluate farm level production activity and technology		X	
2. Assist in developing extension guidelines		X	X
3. Assist in incorporating the capability to all zones			X
<b><u>Macro Econometric and Inter-Industry (I-D) Models</u></b>			
<b>I. National Macro Econometric Model.</b>			
<b>A. Modification and improvement.</b>			
1. Disaggregation to facilitate linkage	X		
2. Re-estimation with new and recent data		X	
<b>B. Research applications.</b>			
1. Annual projection of Thailand economy from L.P. analysis	X	X	X
2. Link with the National agricultural model		X	X
<b>II. Inter Industry Models</b>			
<b>A. Inputs.</b>			
1. Assemble data for agricultural sector	X	X	
2. Incorporate and test national model		X	
3. Disaggregate data and develop regional models		X	X
<b>B. Research Application.</b>			
1. Facilitate fuller economic impact analysis by incorporating with national LP and Macro Models		X	
2. Evaluate implied changes in demand for other industries			X

Table 7. (Cont'd.)

Activity	Presently Ongoing	Intermediate Term	Longer Term
<u>Special Study Areas and Analysis</u>			
<b>I. Marketing, Transportation and Demand.</b>			
A. Further development and extension of existing efforts on the major commodities.		x	x
<b>B. Research Applications.</b>			
1. Estimation of rural and urban demand by commodity.	x	x	
2. Provide market information on commodity demand.	x	x	
3. Estimate transports and assembly costs	x	x	x
<b>II. Processing, Livestock and Multiperiod Models.</b>			
<b>A. Inputs.</b>			
1. Develop coefficients and resource supplies.	x	x	
2. Test models and add to the national and regional I.P.		x	
<b>B. Research applications.</b>			
1. Extends the analysis of the agricultural sector to reflect livestock and processing		x	x
<b>III. Statistical Support.</b>			
<b>A. Data Bank Maintenance.</b>			
1. Documentation of data sets from General Farm Survey	x	x	
2. Complete general retrieval program with user control options		x	
3. Complete specialized price data retrieval capacity		x	
<b>B. General Survey.</b>			
1. Computerized sample allocation program		x	
2. Statistical check on data reliability using previous year data		x	
<b>C. Farm Records.</b>			
1. Computerized data storage and retrieval capacity		x	x
<b>D. Other Statistical Support.</b>			
1. Maintain programs for OLS and TSLS, regression, RFORM, GAUSS-Seidal, Moving Average	x	x	x
2. Extend and maintain Input-Output and simulation programs	x		
3. Adapt and develop new software as required by research activity	x	x	x

The Evaluation Team believes on the basis of the materials supplied to it that a well worked out plan exists for future work, which has been thought out in some detail for the Near term and which provides a logical framework for the longer term.

### Staff Development

The DAE/ISU staff members work as a single unit to formulate, solve and analyse models. The responsibility for structure and manipulation of models is given to the DAE members as soon as possible. At the current time the actual running of all linear programming models are in the hands of the DAE staff. The ISU staff maintains close contact so as to be available for the numerous small things which come up, including answering questions and offering suggestions. The important part of the training is on the job. From oral presentations of the Thai personnel and conversations with them, it appears clear that capability is in fact being transferred to them, as demonstrated by their ability to operate the models at present, and that they will be able to continue the basic operation of the Program after ISU personnel depart.

Contributing to the ability to maintain and operate the models, and to the upgrading of general analytic capabilities, has been the formal staff development program. At the beginning of the project the DAE staff contained one Ph.D. (the Director) and 30 people with M.S. degrees. There were a large number of B.S. and technical school graduates. There has been a building from the ground up, as the Division had little previous exposure to either linear programming or computer programming. With the desire for the DAE staff to better understand the economic problems and upgrade their economic and statistical analysis capability, several types of training have been instituted. These include two types of higher education training programs plus an inservice training program and on-the-job training.

### Higher Education Training Programs

The first category of higher education involves sending staff to continue their education abroad. The second category involves staff continuing their higher education in domestic institutions.

For the first category, DAE has been greatly assisted by AID since 1962. Forty-two persons have completed M.S. degrees under AID scholarships. Two Ph.D. candidates have now come back to do research work for their dissertations. Nine persons are still in the United States, studying for Master's degrees. Ten persons are currently abroad studying toward Ph.D. degrees. Under this category, the Agricultural Development Council (ADC) has also participated. One of the staff is abroad working for a Ph.D. under an ADC scholarship.

The Thai government sent one student abroad to study agricultural economics at Ph.D. level some time ago and another is currently studying at the Ph.D. level in Germany. FAO has also participated in this program. One Master's degree graduate has received grant support from FAO.

Under the second category, a number of the Division staff are studying or have studied for M.S. degrees in Thai Universities. The Ford Foundation began sponsorship of this type of activity in 1971. Now 6 persons have graduated, and another 9 persons are working on Master's theses. Some others are still taking courses.

The formal training program provide short-run competition with the sector analysis activities. People with high research productivity and leadership qualities are selected for additional training. Furthermore, staff members who have left for training experience a period of start-up time on their return. The Sector Analysis Program achievements are thus occurring

despite heavy investment costs in the form of reduced current productivity for the sake of staff developments. These new investments will be reflected in enhanced future productivity of the Thai staff.

#### In-service Training

Beginning in 1971, ADC, jointly with DAE has offered in-service training programs for the staff members of the Division. Three two-month training program sessions have been offered to 20-30 staff members each year. The courses offered are mathematics for economists, economic theory, statistics, linear programming, computer programming, econometrics and simulation. Special and short courses are also offered periodically in order to develop particular technical skills. The courses have enhanced work efficiency of the participants who gain a better understanding of work objectives and improve their analytical capability. The ISU Team has participated as faculty for the In-service Training program along with some of the DAE staff.

#### On-the-Job Training

Any models constructed in DAE involve participation both by the people primarily responsible for model construction and DAE technical staff who assist them closely. The members of ISU team engage in two jobs, one as model builders and one as teachers. This practice is followed so that the technical staff in DAE can learn research methods and techniques to improve their ability to conduct independent research looking to the time when the AID project is completed.

With its present complement of manpower and with the return of those staff members who have departed for training, the DAE should be able to carry on the major elements of the sector analysis project after July 1978. Table 8 depicts the present and potential strengths of the DAE with their educational qualifications.

Permanent RTG Support

The DAE should clearly have the resources available to carry on the work developed after the ISU contract is completed as the number of professionals required for the Sector Analysis Program is small compared to the total number of DAE professionals shown in Table 8. Evidence of RTG support for DAE is the fact that the budget of the DAE excluding counterpart funds has increased from 16.19 million baht in 1973 to 24.16 million baht in 1977. The impression given by all the Thai officials with whom the Evaluation Team met was that the Sector Analysis Program is now an integral part of government analysis for decision-making and that it will have a permanent and an expanded role in the period after the ISU team departs.

Table 8

Professional Staff of the DAE and Their Educational Qualifications  
(Number of Persons)

	1976	1977	1978	1979	1980
<u>Existing Manpower</u>					
Ph.D. from abroad	1	3	15	15	15
M.A. from abroad	50	52	61	61	61
M.S. from Thai University	10	13	16	16	16
B.A. from abroad	4	4	4	4	4
B.A. from Thai University	162	162	162	162	162
<u>Studying</u>					
For Ph.D. abroad	12	12	-	-	-
For M.A. abroad	9	9	-	-	-
For M.S. in Thailand	3	3	-	-	-

## VI. CONCLUSIONS AND RECOMMENDATIONS

The DAE/ISU team has made operational a set of models for analyzing responses of Thai agriculture to policy alternatives based on detailed data. This has been accomplished in an extremely short time. Results from the models have been used in important ways in Thai policy decisions. The Program started will with virtual certainty continue on a permanent basis after ISU personnel leave, indicating that a lasting impact has been made.

The Evaluation Team feels that these accomplishments meet the criteria for a highly successful project. The project is well planned and well administered, and there were reasonable responses to the recommendations of the 1975 evaluation. All these considerations lead to our first and most important recommendation :

1. The Evaluation Team has determined that the project is basically on course and finds no reason to depart from support as originally planned.

A fully developed personnel plan has been presented indicating permanent Thai capability. By all indications there is no problem in financing the support given the modest size of the Thai effort required to sustain the models, relative to overall size of DAE. A general plan of model development has been formulated.

2. To further ensure institutionalization, a long term plan of personnel and financial support by RTG should accompany the final report on the project that will eventually be made to USOM.

Carrying out the foregoing recommendation should be accompanied by the formulation in more detail of a long term plan of substantive development, as is the concern of the next four recommendations.

3. There will be much work in further developing the models to be done after the scheduled departure of the ISU team. For instance, the Evaluation Team was told that detailed modelling by soil type and farm size are likely to be completed for only one of the nineteen major agro-economic zones within the time of the present project. This will provide a proto-type for extending the work to other zones. A specific plan is needed for the future work along these lines. Similar needs exist for the input-output linkages, rural development modelling more broadly, the transportation and storage optimization models and possibly other areas to supplement the general plans given in Table 7. In short a comprehensive and specific schedule for extending the models should be prepared.
4. As a particular extension, with the development of the more detailed farm models giving capability for replicating farm household income distributions at the local level, the capability for analyzing farm poverty as an income distributional problem has been attained. Consideration should be given to undertaking one or more special studies aimed at analyzing the effects of policy actions on incomes of those in the lowest part of the income distribution, accentuating the thrust of the work already begun on rural development.
5. It would be helpful to further develop the plan for revising the models over time. Revisions will be needed to incorporate new data becoming available and to refine the behavioral assumptions, particularly as these pertain to varietal adoption behavior and planting of new crops, double cropping, input demand behavior, marketed surplus behavior, labor constraints and family labor participation including hired labor and off farm work on and off season, seasonal labor migration among farm regions, longer term migration, attempts to account for sources of rural household income, and water use.
6. It would be helpful to develop a long-range plan for analysis in DAE proceeding in tandem with the LP modelling efforts, which would be concerned with coefficient estimation and quantitative policy analysis for which the models provide a partial but not complete input. Examples include: analysis of major policy alternatives for the rice premium and rice price alternatives more generally, rural

industrialization, delivery of public services in rural areas, policy problems connected with impediments to adoption of high-yielding varieties and agricultural credit policies. The distinction being made here is between the LP modelling effort as such and the parallel analytical capability required to generate reliable coefficients and assumptions for the models, as well as carry out economic analysis of alternatives going beyond the model results as such.

The needed additional developmental work discussed in the four foregoing recommendations indicates that provision should be made for contacts with ISU and others abroad beyond completion of the present plan of work in 1978.

7. While no full-time permanent support is needed to implement a permanent capacity in DAE, continued short-term consultation, having to do with technical aspects of further model development and the development of related policy analysis capability will be of extremely great value.

That the project has emerged with useful results is attested by the many uses that have been documented in this report. Particularly noteworthy is the key role of the models in developing the alternatives for the Fourth Five-Year Plan and in setting the action targets for inclusion in the final version of the Plan. There is awareness and enthusiasm for the model results at the National Economic and Social Development Board (NESDB) and in the user agencies in the Ministry of Agriculture and Cooperatives (MOAC). There is less knowledge about the models elsewhere, though seminars and related outreach have had impact.

8. Further efforts would be rewarding to bring the analytical capability connected with the project to the attention of persons concerned with agricultural policy questions other than in NESDB and MOAC. The usefulness of the models has been so great that most available effort has been devoted to developing and running the models in current policy work for the principal users. To widen their application still further, a plan for outreach to other government users should be developed.

9. Additional conferences, seminars and semi-formal consultative meetings would be useful at which work by researchers working on the DAE/ISU models and researchers elsewhere conferred on mutual interests. This would enable others to benefit from knowledge being generated by the models, and it would give occasion for those working on the models to benefit from the latest results available for use in coefficient specification and other numerical estimation. A conference, seminar or consultative meeting should be held on at least each of the following: future adoption of high yielding rice varieties, seasonal rice storage, estimation of domestic and international demand for the products of Thai agriculture, and macro-modelling.
10. It would be useful to prepare and implement a publication plan in which the structure of the models in considerable detail is made available.
11. It would be useful to prepare a publication indicating what data are available, including those from the new computer routines of the Agricultural Data Center. The publication would instruct users on how to go about obtaining data.

There is an emerging focus of planning in Thailand at the Province level to implement National plans and provide emphasis in each area suited to local problems. Agricultural and rural development measures will be an integral part of Province plans.

12. Efforts should be made to further adapt the modelling efforts to the Province level and to integrate results with Province planning efforts.
13. It is highly desirable for the DAE to respond to the Governors' request for data and analysis at the Changwat level. Some progress has already been made on this.

The Evaluation Team feels that the on-going capability places DAE in a unique position to provide training for this type of modelling effort to personnel from other Asian countries, as envisaged in the recommendations of the ASEAN committee we were asked to consider. The Sector Analysis Program in Thailand is more geared to problems in those countries than is training in countries such as the United States, and the training costs would be less. Some additional support to DAE for teaching and demonstrations would be needed, but it is beyond the scope of this report to consider the details and availability of such support.

14. The Evaluation Team endorses the idea that there is capability for the establishment in Thailand of a regional training center in sector analysis.