PD-AAJ-741
ISN 1311

CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) — PART I

Report Symbol U-447

1. PROJECT TITLE	2. PROJECT NUMBER	3. MISSION/AID/W OFFICE
Agricultural Economics	493-11-190-180.4	USAID/Thailand

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 78-3

☐ REGULAR EVALUATION ☒ SPECIAL EVALUATION

5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING		7. PERIOD COVERED BY EVALUATION	
A. First PRO-AG or Equivalent	B. Final Obligation Expected	C. Final Input Delivery	A. Total	$ 2,230,000	From (month/yr.)	1973
FY 73	FY 78	FY 78	B. U.S.	$ 3,285,000	To (month/yr.)	1978
					Date of Evaluation Review	10/78

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
Current project has been completed. Recommendations listed in part VII have been reviewed by USAID. It was decided that additional limited technical assistance would be valuable. The form and source of additional assistance will be addressed in the context of the ongoing TTMS project and future year budget availabilities.		

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS NA

- ☐ Project Paper
- ☐ Financial Plan
- ☐ Logical Framework
- ☐ Project Agreement
- ☐ Implementation Plan e.g., CPI Network
- ☐ PIO/T
- ☐ PIO/C
- ☐ PIO/P
- ☐ Other (Specify) _____
- ☐ Other (Specify) _____

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT NA

- A. ☐ Continue Project Without Change
- B. ☐ Change Project Design and/or ☐ Change Implementation Plan
- C. ☐ Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

Thomas L. Cooper, Project Officer

12. Mission/AID/W Office Director Approval

Signature

Typed Name: Donald D. Cohen, Director

Date: 8/15/79

AID 1330-18 (3-78)

AGRICULTURAL SECTOR ANALYSIS IN THAILAND:

1978 EVALUATION OF THE FIVE-YEAR REPORT

Bangkok, Thailand

October, 1978

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I. BACKGROUND

Overview of Project

The Agricultural Sector Analysis Project of Thailand was initiated in 1973 with the purpose of enhancing the agricultural policy analysis capability in the Thai government. The project is carried out cooperatively between the Division of Agricultural Economics (DAE) and Iowa State University (ISU) with funding provided by the U.S. Agency for International Development and the Royal Thai Government through the Department of Technical Economic Cooperation.

The need for the project in the context of overall needs for agricultural development in Thailand was considered in a 1971 USOM Agricultural Strategy Paper, and the specific approach for the project was suggested in a Project Design paper by Earl O. Heady and Arthur J. Coutu in that year. Meanwhile, within DAE, preparation for the project included delineation of the nineteen agroeconomic zones based on climate, soil conditions and farm characteristics, to be used as the basis for zonal models. In 1972 DAE conducted a 20,000 farm survey (7,000 detailed) to provide initial data for the zones. In the period January-June of 1973, further preliminary surveys were taken, the 5-year sector analysis work plan was prepared, and the ISU contract was signed.

The work since formal inception of the project in July of 1973 has consisted of model development, survey and data bank development, policy applications to aid current Thai decisions, dissemination of results, and staff training and development both in the United States and in Thailand. The initial

modelling activity concentrated on developing farm linear programming models for the individual zones that replicate production and development possibilities under various investment, price and other alternatives. This was followed by formulation of linkages between the individual zone models to arrive at regional models and a national crop model. Later work on the farm linear programming models, still continuing, has given attention to disaggregation within zones in order to analyze income distribution effects of policies and respond to planning needs at the Chungwat level.

Meanwhile, modelling efforts were undertaken on agricultural related activities including processing and transportation, local economic input-output models were constructed, and a social accounts matrix still in the planning stage was devised for a fuller analysis of local economies in rural areas. Demand analyses for important crops were carried out. A macro-economic model for Thailand economy was developed to study interactions between agriculture and the remainder of the economy.

An initial and major policy application was the analysis of seven development policy alternatives chosen in conjunction with the National Economic and Social Development Board (NESDB) and used in formulating Thailand's Fourth Five-Year Plan. There have been a number of other shorter and longer term policy activities including planning for MOAC irrigation and extension activities, evaluation of investment possibilities in connection with World Bank loans, planning of specific marketing facilities, analyses of effects of land reform and analyses of implications of minimum wages, to name some typical policy activities.

Computerization, surveys and data bank development have continued throughout the project. Dissemination has taken the form of personal contacts, participation in briefings and seminars, and publication of methods and results.

Figure 1 displays the major chronology of efforts for the five-year period of the project. The resident ISU team in Thailand has varied from 3 to 6 persons during the contract period, with a greater number of TDY personnel. Figure 2 shows the 7 positions in which the resident ISU team have served, with the names and period of participation for each individual. Figure 3 gives greater detail on the project for the past three years indicating the steps in developing Thai capabilities.

Approximately 100 members of the Division of Agricultural Economics staff (DAE) worked directly with the ISU team during the contract period. Many staff members have been associated with the project indirectly. Among the four subdivisions of DAE, namely, Administration and Regional Agricultural Economic Branch, the Agricultural Policy and Planning Branch, the Agricultural Economic Research Branch, and the Center for Agricultural Statistic, principal interactions with the ISU staff have occurred in the latter three subdivisions.

Ten members of DAE's staff were selected for study at the Ph.D. level and 30 members personal graduate school training at the Master level. Aided by funding from other sources such as the Agricultural Development Council and Royal Thai Government scholarship provided support for additional graduate students. DAE now has 5 staff members with the Ph.D. degree and 10 more currently in graduate school in the United States with a number of others having received masters level training or currently completing degree requirements.

The Two Previous Evaluations

The present evaluation of the project is the third to be carried out. The issues considered in each of the evaluations have been similar, in that each has been concerned with 1) validition and appropriateness of the analytical work and data; 2) contributions to policy; and 3) institutionalization.

Figure 1. Major Work Areas

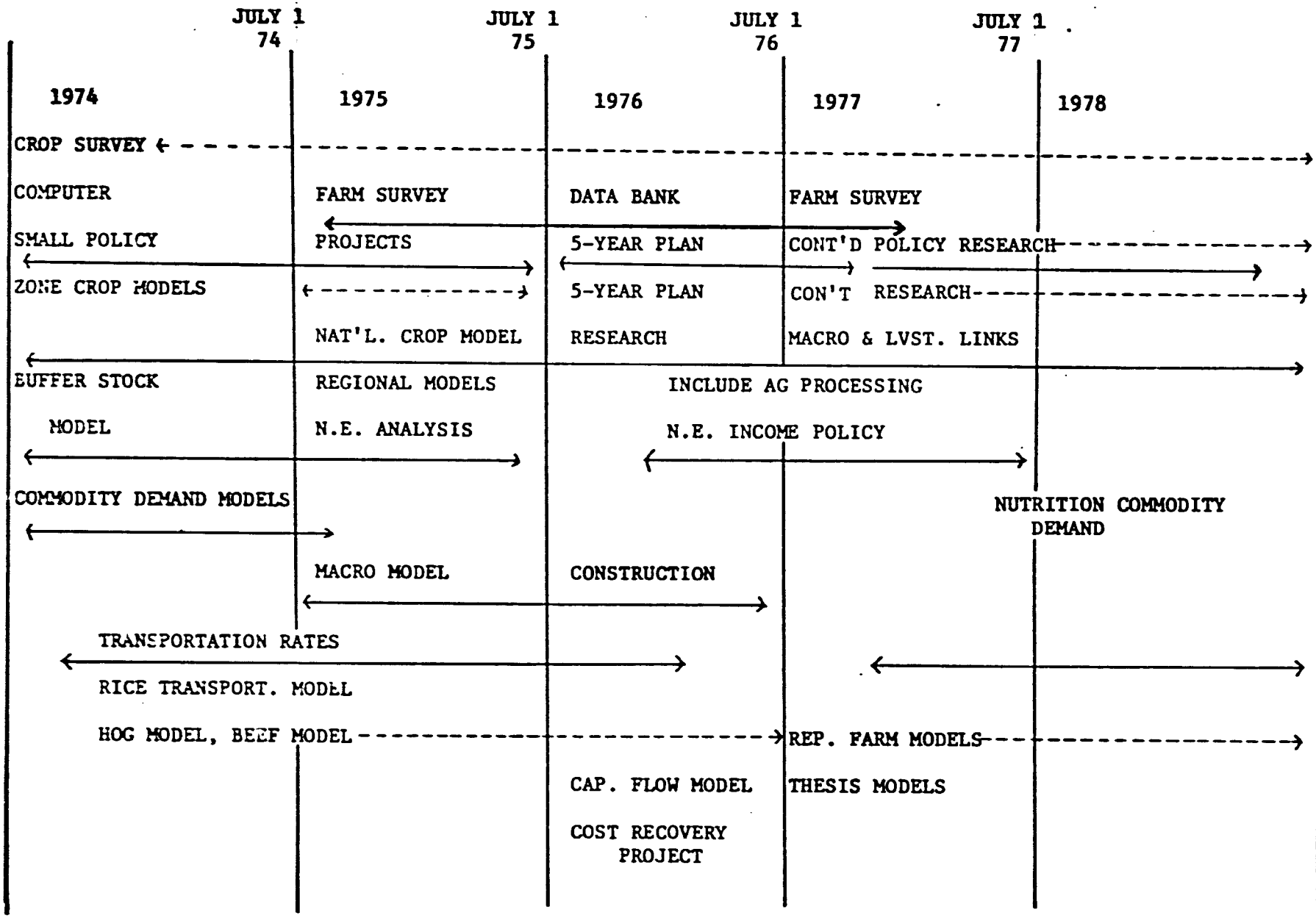
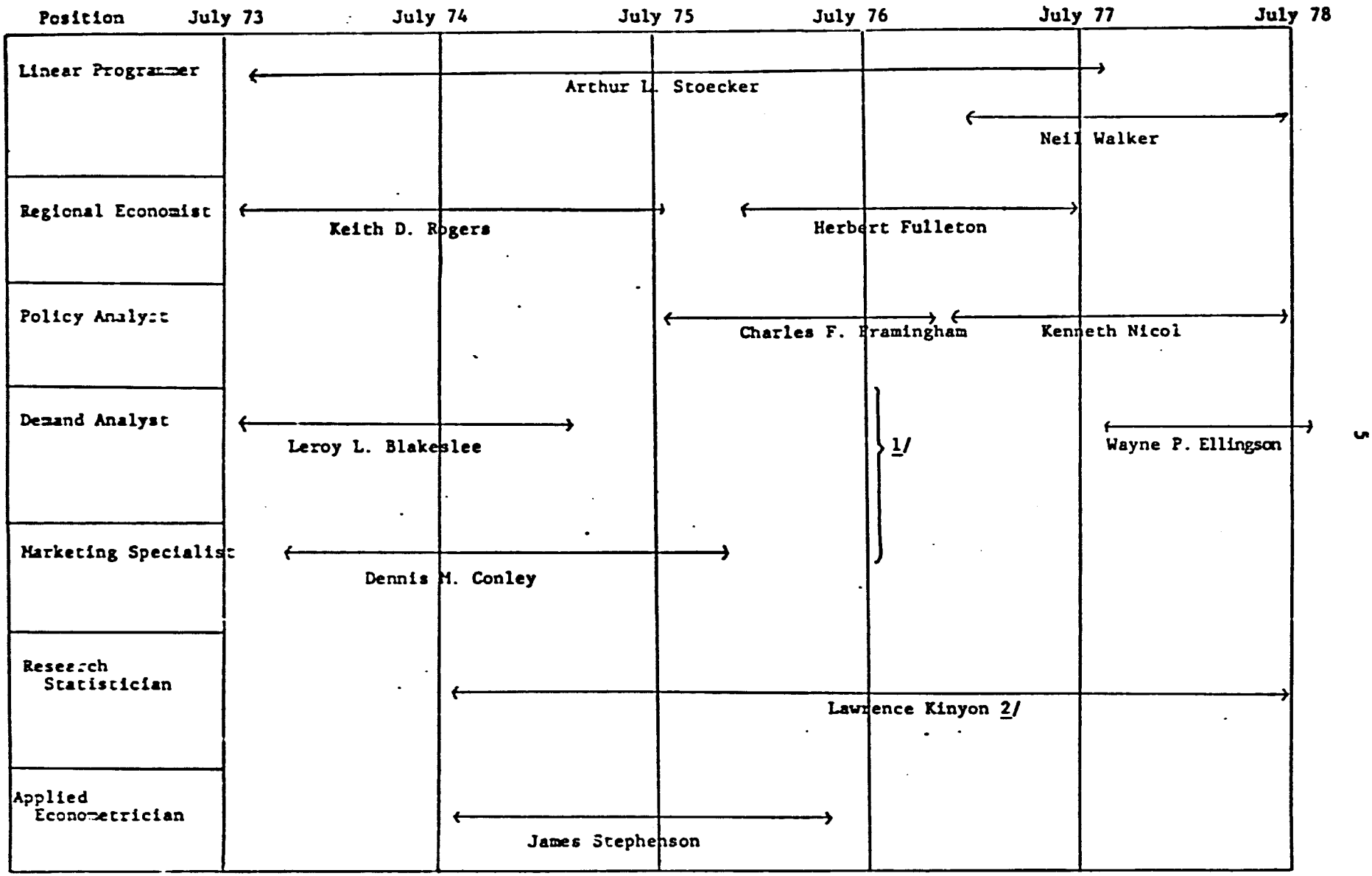


Figure 2. Long-Term Staff of Agricultural Sector Analysis Project



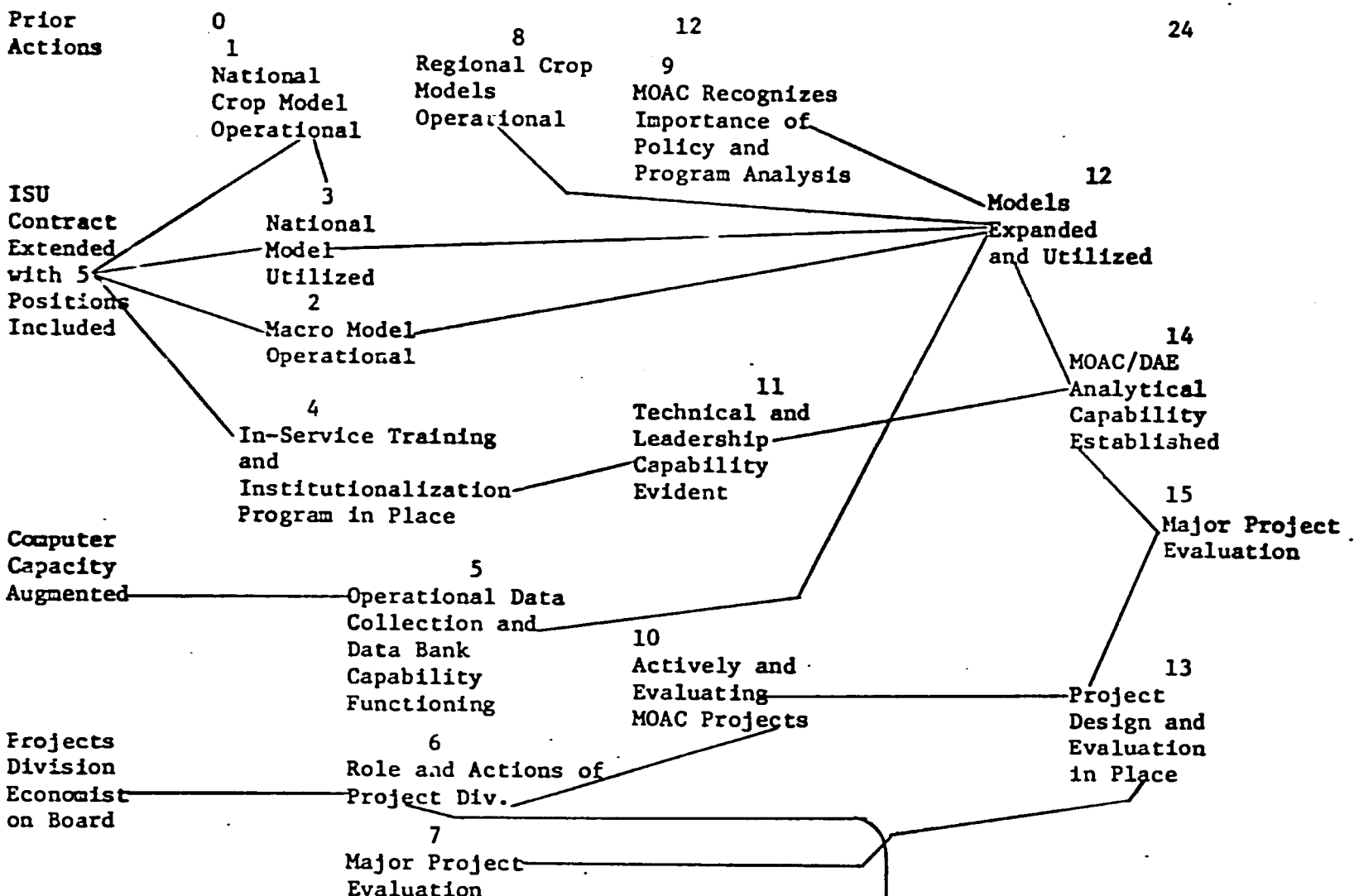
1. Positions combined

2. First 27 months statistified by three 9 month short term tours, last 18 by long term staffing position.

Country: THAILAND	Project No. 498-11-190-180.4	Project Title: AGRICULTURAL ECONOMICS	Date: 7/16/76	[X] Original [ ] Revision #	Approved:

FY or CY: CY 1976

Month: JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN



Evaluation Schedule:	X	X

CRITICAL PERFORMANCE INDICATOR (CPI) NETWORK

Figure 3. Relation of Project Activities to Development of Thai Capabilities

The methods used in each of the evaluations have also been similar. In each case, a joint Thai-U.S. evaluation team has been assembled in Bangkok for a period of up to two weeks. The team members have in each case attended formal briefing sessions featuring presentations by DAE-ISU project staff, talked in depth with the staff, reviewed written project materials, interviewed users and others outside of DAE having a concern for the project, and conferred among themselves to arrive at a team concensus. In each case, the team has met with members of the DAE-ISU sector analysis staff for a de-briefing giving major conclusions orally at the close of the Bangkok activities, submitting the formal written results of the evaluation a short time later.

Beyond these similarities, there have been differences in the evaluations. The major differences stem from the unfolding of project progress over time. The first evaluation, carried out in January 1975, concentrated on the initial linear programming farm production models, as these had received almost all of the project effort up to that time. Because the project was still in its initial stages, the first evaluation made several recommendations pertaining to general focus and personnel for the remainder of the effort. In the second evaluation, it was determined that the recommendations from the first evaluation had been substantially implemented.

The second evaluation, carried out in April and May of 1977, came when the linear programming models were far advanced, when initial results of the macro modelling had been obtained, several econometric demand studies had been completed, initial formulations were available on the transportation and regional input-output work, and serious policy implementation had been achieved. The second evaluation concentrated heavily on analytic issues emerging from the

greatly increased amount of model results available, and also gave particular attention to policy applicability and dissemination, making recommendations in all of these areas.

Progress on Recommendations of the 1977 Evaluation Team

An initial task of the present third evaluation effort was to review progress on the recommendations of the second evaluation. The findings on these recommendations are as follows.

1. The first of fourteen recommendations made in the second evaluation report was that the project be allowed to continue on course, which it has. Project activities and staffing have proceeded essentially as planned, as have funded and other support from the participating parties.

2. The second recommendation was that a long term plan of personnel and financial support for continuation of activities beyond termination of the project be prepared. A definite plan is being carried out as the temporary staff assigned to the DAE as the outset of the program are shifted to permanent funding. The second recommendation has been largely fulfilled in the work underlying a legislative bill presently moving through the government committee structure which would elevate the status of the DAE from a Division in MOAC to an office directly under the Minister of Agriculture and Cooperatives. With this reorganization the DAE will assume formal responsibility for evaluating all policies and programs developed by the MOAC departments. The DAE will have a more important role in formulating, supervising and implementing Ministry programs including evaluating policy proposals emanating from within MOAC and from the Cabinet and Prime Minister's office.

3. The third recommendation was that a schedule be developed for further extending the modelling efforts after termination of the project, in

view of the needs that will remain for further disaggregation of the farm models within zones and for further development of the models dealing with non-farm linkages. Future work for the DAE's sector analysis program has been outlined in a set of working papers prepared during the last period of the ISU teams activities. Discussions have also been carried out in a series of weekly meetings with the regional groups on the direction and maintenance of the sector analysis linear programming systems. Emphasis has been put on developing procedures to incorporate the yearly general farm survey data into the present technology base for the models. This entails working with the statistics center to help prepare the survey summaries in a manner compatible with the data needs of the model input routines. Discussions have been conducted on data improvement and model structure changes to reflect a broader indication of impact and to expand the types of policies which can be analyzed.

The linear programming and imput-output analytical capabilities are being combined to provide a more flexible means of allowing technology shifts in the agricultural production sector and to facilitate study of restrictions on the expansion capacity of specific sectors. A recent TDY has outlined a program to expand the input-output analysis into a complete Social Accounts Matrix, SAM, which will allow the incorporation of income, employment and consumption directly in the analytical system. Plans also exist to incorporate the SAM with the linked linear programming input-output system to increase the scope of analysis available with each. The DAE has begun staff allocation and data preparation for each of these programs. Completion will be contingent upon data consistency and lack of diversions by the staff to conduct analysis with the presently functioning analytical systems.

Another extension of the program is being developed in the link of the macro econometric system to the recursive linear programming. A paper was

prepared on this linkage, and staff have begun to develop data series and programs to implement this system.

The analytic methodology for these modelling efforts will be considered further in the remainder of this report, particularly in Part II on the quality of the work.

4. As a particular extension of the modelling, it was suggested in the fourth recommendation that detailed farm models be developed to replicate farm household income distributions at the local level, in order to increase the capability for analyzing effects of policies on rural poverty. Farm modelling has progressed in two geographic areas with the individual farm analysis being outlined but not advanced at this stage. This effort will facilitate the work of the farm records groups as they begin to provide extension type guidelines for the farmers in this program. The major farm level analysis is occurring in conjunction with the zone level models. In these models a set of farm classes is being defined reflecting size based on sales, type based on operation, and land ownership. This program is beginning with an example conducted in zone 7 with future work being directed at the zones of the low income northeast region. This model extension will provide the DAE with increased capacity to identify the impact on the small and low income farmers as policies for agricultural development are evaluated.

5. The fifth recommendation concerned the need to provide for periodic revisions of the sector analysis models, updating them as new data become available and incorporating more refined behavioral assumption as knowledge about Thai agriculture accumulates. Model revisions were discussed in part in connection with the third recommendation above. Additional considerations include the fact that the new data procedures being developed will have time

as a variable in their estimation which will facilitate the complete reestimation of the technology sector in conjunction with the recursive linear programming models being developed. Soil and rainfall data are being included in variables to distinguish the farm production patterns and provide a clearer accounting of the factors affecting yields and production costs. Much of the effort in redefining the models and in the data revisions is being undertaken in order to be able to disaggregate the analysis to the farm level. Some of the data from the general farm survey provides good support for the expanded farm class sectors in the analytical models. For some variables the farm record data are being used as a supplementary source.

6. In the sixth recommendation, a distinction was made between the modelling efforts as such and the capability to generate coefficients and assumption for the models, including analyzing policy alternatives going beyond the models as such. It was recommended that a long range plan for this capability over and above the modelling capability be developed. In response, DAE has devoted resources to long range policy analysis, although priority work continues on the presently developed system and reestimation and update of these systems. Plans have been discussed to modify the national linear programming model to give equilibrium analysis capabilities at a time span 10 to 15 years in the future. This requires projections for the technologies involved in crop production, the resources available for use, as well as the estimation of demand at that time both on a domestic and international level. The demography model developed will provide an indication for population and when combined with estimation of per capita demand it will give demand at the zone levels. Similarly, the age, sex, and urban-rural breakdowns in these models will give estimators of labor supplies. To provide extra supporting data DAE is maintaining time series data set on most relevant agricultural statistics which can

be used to outline relationships of price cycles, inventory changes and technology use for incorporation into or supporting work with the planning models.

7. A conclusion from the second evaluation was that, while a permanent capacity was being developed at DAE, there was likely to be a need for continuing assistance, particularly of a short term nature, to help in further model development. The seventh recommendation suggested that provision be made for this help. Since the time of the second evaluation, permanent staff member from ISU have remained on site in the DAE as the project has still been in full swing. Supplementing the permanent staff members have been TDY personnel who have assisted in the demographic, macro, macro-LP linkage, demand, rice stock reserve, and rural development modelling. Each of these have been relatively successful at implementing, completing, or updating research programs in the DAE. Work to supplement or revise ongoing programs has proven to be most successful when follow up required was only minor. In areas where the program is new or the TDY did not complete adequate quantification of the procedure the DAE staff required a longer period to complete the adjustment. If TDY researchers can lay out an adequate documentation of procedures and have sufficient time to accomplish this during their tour a significant help can clearly be obtained.

At the time of the present third evaluation, a request for extension of the project without additional funding is pending which would enable at least one long term ISU staff member to remain for several additional months and apparently would provide from some minimal TDY effort. In addition, a request for a three-year extension of the project is pending to intensively develop the modelling ability to deal with rural poverty and rural development policies. Approval of this extension would enable meeting the needs for continuing

assistance during this period. If the extension is not approved, some additional arrangements for continuing TDY activity would be needed to carry out the recommendation for continuing short-term help.

8. In view of the finding by the second evaluation team that MOAC and the National Economic and Social Development Board (NESDB) have been the principal users, it was suggested in the eighth recommendation that a plan for outreach to other users be developed. The DAE has in fact worked with other agencies particularly in areas of mutual policy interest. DAE has recently completed a verification of the feasibility of a set of Ministry of Commerce export targets for agricultural commodities in the 1978-79 crop year. This work resulted from a request from the Ministry of Commerce stemming from their awareness of past work done by the DAE on behalf of the MOAC which evaluated export targets for the major agricultural commodities. The DAE's staff is presently fully extended on priority research programs. If requests for more cooperative analysis were received, individuals would need to be diverted from ongoing research. As the Ph.D. and MSC students return from training they will be capable of handling this type of analysis with minor support from the data handling staff. At that time more direct involvement with non-critical research is planned. Until that time the DAE will continue to work on an as-requested basis and continue to support other agencies with its data bank and publication programs.

9. The ninth recommendation pointed out the usefulness of additional conferences, seminars and semi-formal meetings between DAE researchers and those elsewhere. The DAE has operated to expand the capability to make others aware of their ongoing research. DAE initiated publication of Agricultural Economics Research, prepared by the DAE, which reports on data, policy analysis and model development. This is distributed to other agencies and provides

information on the DAE program. The DAE is involved in a series of meetings with other agencies to outline programs for expanding use of modern technologies. Papers have been presented at seminars outlining, for example, alternative policy decisions for Thai storage for rice and its impact on trade and rice availability in the ASEAN countries.

10. Further addressing dissemination, the tenth recommendation suggested that publications be issued on the structure of the models. Efforts by the DAE to publish the results and structure of their analytical system have progressed with the completion of the national crop model publication and drafts of the four regional models being prepared. Also, the macro model and many of the commodity specific models have been published as DAE or joint DAE-ISU reports. The outline of the recursive LP-macro linkage is published in the DAE publication Agricultural Economics Research as is the example of the LP-10 linkage based on zone three. Each of these publications allow both the Thai and international community of policy analysts to review the structure of the systems and to provide comment on the program.

11. There is evident a demand by researchers and others outside of DAE to have access to various parts of the considerable body of data generated by DAE farm surveys which are being used in the sector analysis. The eleventh recommendation indicated the desirability of a publication on what data are available and how to obtain it. Publication of the data available on the DAE's computerized data bank has progressed from the 2516-17 and 2518-19 surveys. The 2519-20 survey is on the data bank and the documentation of the data location and definitions is being developed in the statistic center. Also being developed is a document on the methods of returning this stored data. The estimates of crop production, area and yield are published in the government programs to estimate and report final production figures for all the main crops. A price series is being started and will be computerized and documented

when the series reach a sufficient length to accommodate reliable trend indications.

12 and 13. In view of an emerging focus on implementing plans at the Province level suited to local needs, the twelfth and thirteenth recommendations indicated that further efforts should be made to adapt modelling to the Province level and that DAE should respond to requests by Governors for results at the Changwat level.

Preparing recommendations for the Changwat level policy programs was begun a year ago in response to requests by the Changwat Governors. Presently, these requests are fulfilled by interpretation of the national and regional analytical system. Also, model development is underway to expand the regional and eventually the national models to reflect Changwat characteristic and thereby increase the reliability of recommendations for Changwats. This effort is beginning in the Northeast where the development requirements are most needed and the Governors are faced with the most difficult income problems.

14. In its final recommendation, the second evaluation term endorsed the idea expressed in ASEAN meetings that Thailand would be a suitable location for a regional training center in sector analysis. Plans have progressed for a regional center to be operated by DAE, both in terms of outlining specific training that would be offered and in terms of seeking funding assistance through the ASEAN organization, as will be considered more fully below in Part V on Thai permanent capability.

Purposes of the 1978 Evaluation

The foregoing report of findings on the recommendations of the second evaluation team completes one of the tasks of the present third evaluation. The fact that project activity has been substantially responsive to the

recommendations sets the stage for the remainder of the present evaluation, which can proceed to the major issues raised in assessing the success of a project of this type.

The present third evaluation differs from the first two, not only in coming at the end of over a year of additional effort, but in being charged with considering accomplishments of the project since its initiation. What remained as plans in the first two evaluations is either accomplished or not. The full range of modelling and analytic capability can now be evaluated from the point of view of whether it is adequate and operational. A more complete test is possible of how the capability is employed in actual policy analysis and how reliable and useful it appears to be. With all the ISU team members except one having departed from Thailand, the extent to which the project has succeeded in developing an independent and self-sustaining capability that will carry on the work can be judged.

The team was asked to give more particular attention to rural poverty than the previous evaluations, for two reasons. First, since inception of the project, there has been an increase in the policy concern for the rural poor by both the Thai and the U.S. governments. Second, the proposed three-year extension of the project would have as a primary aim giving added emphasis in this area. The team was asked to examine how the project has addressed the needs of those on Thailand's smaller farms, to test the hypothesis that improved analytic capabilities in fact benefit the poor, and to make recommendations in this context on how best to meet the needs of the rural poor in the future.

The remainder of this report gives the results of the investigation of these major issues by the third evaluation team. The members of the evaluation team were:

Dr. Warin Wonghanchao (Co-Chairman)
Dean of Economics Faculty
Chulalongkorn University

Dr. George S. Tolley (Co-Chairman)
Professor of Economics
University of Chicago

Dr. Tongroj On-chan
Professor of Agricultural Economics
Kasetsart University

Mr. Sombong Pattamavichaiporn
Technical Services Division
Department of Technical and Economic Cooperation
of the Royal Thai Government

II. QUALITY OF THE WORK

History of Development of Models to be Evaluated

This part of the report reviews and evaluates the models which have been put in place. These are the models whose uses in policy and whose performance are evaluated in subsequent parts of this report. While summary information is given on the models, the primary purpose is to make evaluative comments and not to exhaustively catalogue what has been done. A source giving more detail on what has been accomplished is contained in the DAE briefing materials which were prepared for this evaluation and which are appended to this report. Still further information is contained in the research documents and the annual reports of the project listed at the end of the briefing materials.

Basically, three types of models have been developed and employed by ISU-DAE:

(1) Linear programming models which include
- National LP model
- National Livestock Model
- Regional Models
- Transportation-Storage-Processing Models
- Models to be used in the Nutrition Project

(2) Econometric models which include

(2.1) Macro econometric models, i.e.:
- Model I which is linear in both parameters and variables

- Model II which is linear in parameters but nonlinear in some variables.

(2.2) Micro econometric models, i.e.:

- Commodity demand models
- Population model using regression analysis (Basic model was developed without using regression analysis. The intended population model with regression analysis has not been constructed as yet.)
- Rice buffer stock model

(3) Input-Output Models

- Semi-input output table of support sectors for agriculture.

During the first year of the project the emphasis was first directed to staff training and development of a typical zone linear programming model. This allowed for familiarization of the ISU staff with Thai agriculture and data sources. The zone 7 model became the prototype for the agroeconomic zones. After the general form of the crop model was established, further zone model construction was largely handled by DAE staff. After the programming models were well established econometric studies of individual commodity demand markets were initiated.

At the start of the second year the macro economist position was filled and work began on a national macro econometric model of the Thai economy. The agroeconomic zone modeling effects continued. When enough zone models were completed for a region they were combined into region programming models.

These regional models maintained the resources use detail of the agroeconomic zone models, with specification of monthly land use by five land classes, monthly labor and capital requirements, and monthly demand for borrowed capital by three sources.

By the end of the second year the national crop programming model was completed. The initial results were presented to National Economic and Social Development Board staff for their consideration. NESDB responded by requesting analysis on a set of seven alternative development plans to be used in formulating Thailand's Fourth Five-Year Plan.

The macro econometric work continued during the year. A preliminary twenty-one equation model of the Thai economy was completed. The Transportation, Storage, and Processing (TSP) model for rice was formulated and estimation of parameters and coefficients started. The Regional Crop models were used for supply response studies for major export crops of Thailand. Additional studies detailing the demand for agriculture labor and potential migration between the agricultural and non-agricultural sectors were done.

The demand for kenaf commodity model was completed. Commodity models for rice, mungbeans, soybeans, and maize were initiated. Computer programs for survey processing were made operational. Software for reduced form simulations were created.

Much of the projects third year efforts were devoted to the analysis of the seven development plans alternatives. These results were presented to NESDB staff, department directors within the Ministry of Agriculture and Cooperatives and other selected guests in a seminar sponsored by DAE in June 1976.

The macro econometric models of the national economy were completed. Model I consists of 45 equations with 36 behavior equations and 0 identities. Model II is a slightly more disaggregated reversion with 55 equations. It differs also from Model I in that it is non-linear in the variables, a monetary sector is added, and the gross fixed capital formation equations are more disaggregated. Model II was simulated using Gauss-Seidel techniques to study the predictive performance and dynamic stability characteristics. Model I was likewise simulated using reduced form analysis.

The regional crop models were used to analyze in more detail the regional implications of the agricultural development plan alternatives. Also additional supply response and labor utilization studies were completed during this period.

Preliminary arrangements were made with representatives of NESDB to cooperate in the development of input-output models for major planning regions.

Work was continued on the TSP model and commodity demand models. Rubber and cotton commodity models were initiated. Surveys of the rice mills were conducted to obtain more detailed technical coefficients for rice processing in the TSP model.

A national livestock model concentrating of cattle and buffalo was initiated. With this model the spatial distribution of livestock production needed to satisfy the demands for meat and draft animal power can be analyzed. Also the competition for land and other farm resources between crop and livestock production can be quantified.

In November the installation of additional computer equipment was completed. This increased the CPU to 16 K words and added to two more disk drives. With the upgrading of computer facilities a significant reduction in the execution time of programs was realized. Survey processing programs were redesigned to the advantage of the new equipment. Additional computer software developed during the year included a Generalized Gauss-Seidel iterative procedure for solving a system of simultaneous equations.

A Data Bank containing General Farm Surveys results was developed for the 2516/17 BE survey. The Data Bank contains approximately 8,500 characteristics from the General Farm Survey for each changwat. For each characteristic the population estimate, the coefficient of variation, and the percentage of farms reporting the characteristics is provided.

During the fourth year continued use was made of the national and regional crop programming models for policy and planning purposes. Areas of particular interest were export potential, income generation of the agricultural sector, and supply response of major upland crops. Updating the models to incorporate additional survey data also utilized considerable staff resources.

The development of the National Crop and Livestock model continued. Due to the size of this model and other computer programs the capacity of DAE's 1130 computer was becoming a very constraining factor. Arrangements were made to use the IBM 370 computer of the Department of Business Economics in the Ministry of Commerce. FORTRAN compiler and MPSX-370 computer packages were ordered.

In the process of disseminating the results of national and regional planning efforts at a meeting of the changwat governors of Thailand, a request was made to DAE to provide assistance in making development plans at the changwat level. The ISU/DAE staff outlined a set of research methods and models that could provide the information needed at this level. Work started on developing changwat programming models that would contain detail of farm type characteristics. Also effects were made to determine the interactions of agricultural and non-agricultural sector at the changwat level. A preliminary model of crop production and important non-agricultural sectors was started to test the feasibility of an integrated linear programming social accounts approach to local development planning.

Efforts were started in developing the interface needed to link the national crop and livestock model with the macro econometric model. To allow the programming models to be used in a recursive fashion, behavior equations of supply response were specified and estimation began. These relationships would be used to place flexibility constraints upon year-to-year changes in agricultural production.

The surveys processed during the year included the 2518/19 General Farm survey, specific surveys for rice main crop, kenaf, maize, second crop rice, and rice stock surveys. Software developed included survey processing programs for two and three stage cluster surveys, programs for input-output analysis, making the simulation program DYNAMO operational, and upgrading factor analysis and stepwise regression packages.

During the fifth year the recursive national crop model was completed. Recently this model has been used to analyze the export targets proposed by the Ministry of Commerce. By using this behavioral relationship developed about farmers response, the recursive model can predict production levels forthcoming. The feasibility of export targets can be analyzed and recommendation made as to price and other policies needed to obtain the production to satisfy both domestic usage and export targets.

A very important development during this year has been the availability of the 370 computer at the Department of Business Economics. This has been helpful in two respects. The speed of execution of jobs or execution times is considerably faster with the 370 computer versus the DAE's 1130. For example, programming models that took days to solve on the 1130 can now be solved in hours. Secondly, jobs that were impossible to run due to the limited capacity of the 1130 are now possible using the new facilities.

The National, Regional, Zone and Farm Level Linear Programming Models

The models have been constructed at four levels; the national, the regional, the zone, and the farm levels. The national models are used to study the development objectives and goals. Regional models allow more detail on the resource use and production alternatives given the limited computer capacity. The zone models based on the agroeconomic zones allow

more detail in resource use, production and income. Finally, the farm level models now being constructed will among other accomplishments, generate information on the distributional effects of policy on the various farm groups. Considering that planning at the changwat level has become an important policy in recent years, the farm level analysis will aid the planning process of the changwat throughout the country. The national crop model was particularly constructed to give some guidelines of production in order to meet the domestic demand and to achieve export goals. Recent analysis involves the study of the potentials of new technologies. Some refinements of the models have also been made to study the effects of cost of credit on resource use and income. A considerable effort has been made to modify the national models. As a result, the newly modified Recursive Linear Programming models (RLP) have been constructed and applied. The RLP models will give better and more realistic estimates for short-run policy analysis than the original linear programming models. To date, the RLP model is still being tested.

In the opinion of the evaluation team, the refinement of the linear programming national models is a good step in the modelling effort. While it involves more data and analysis, it should improve the reliability of the solutions.

As regards regional models, a series of regional models was developed with internal consistency so that they could be linked together in a national model. Since there are many differences in agricultural and economic characteristics of the whole country, the regional crop model has been constructed in order to study the optimum allocation of national resources and the distribution of outputs under various conditions, and also to give resource supplies in each region of the countries.

For the planning purposes, the 71 changwads have been grouped into 19 agroeconomic zones. These 19 zones are also grouped into 4 regions. The Northern regional model which has been completed contains seven plan alternatives for the agricultural development planning objective of the government. Data used were revised from the coefficient data for 1971-76 using the General Farm Survey of 1972-74. Prices used were the average farm prices of 1973-75 except for those of non-glutinous and glutinous rice that the support prices were used. Targets and bounds were used.

The Northern model illustrates the usefulness of the results which indicate considerable underutilization of land and labor resources. The need for credit is also quite great as less than twenty percent of the total operating capital comes from the internal source.

Current work includes: (1) improvement and revision of data by using the latest data of the GFS and latest data from the other surveys of the govern-ment agencies; (2) the analysis of the effect of the change in non-agricultural wage rates on the labor market; (3) the analysis of fertilizer use, irrigation, and price and marketing of farm commodities. It is recognized that an improvement of input-output coefficients is necessary, and this is being done. At the farm level, farm level models are being constructed to indicate the advantage and disadvantage of different farm groups. They are developed for consistency between the national, regional and farm level models. Farm type is defined by grouping farms that have the same land characteristics together. The frequency distribution of net income for farming from the GFS in 1975 was the major criteria in dividing farm by size. Farms have been divided into 6 types, 3 sizes and 3 land ownership categories. This gives a total of 54 possible type-size-ownership classes. Data used come from the GFS (1975-1976) with supplementary data on soil type and rainfall.

The farm level modelling program will differentiate farm characteristics within 71 changwads. The changwad models are linked to the solution of the national model through the regional prices determined for the crops in the national model. The farm models are solved as a profit maximizing model subject to the resources available, the fixed demand of rice for home consumption and the market prices specified.

The continuing work in farm modelling will emphasize the relationships and interaction of the local farm units. More study will be done on defining unique farm type and size units. Estimates of production coefficients for each of the farm types and sizes will be completed simultaneously with the on-going program to develop a new coefficient estimating system for the nation and regional models.

The 1978 evaluation team has paid much attention to the technical adequacy of the linear programming models. We believe that the basic economic logic underlying the modelling of the agricultural sector is sound and the results obtained are reliable. The data used are from extensive national farm surveys conducted yearly. The methodology used in sampling design appears to be statistically adequate.

There have been revisions and modifications of the models and the data used. The introduction of the RLP model has improved estimates for policy decisions. The farm level models will give useful information especially for the planning at the changwad level. Revisions of the coefficients at all levels of analysis are being made which will improve the quality of the estimates obtained.

Attention given to land ownership and farm size in the farm level models is appropriate as it will now be possible to investigate the distributional impacts of policies on incomes of certain farmer groups. However, it may be desirable to modify the models so that a study on the possible effect

of the change in land ownership pattern and farm size may be conducted. This should be part of broader efforts that attempt to link current developments as reflected in the models to longer run influences on agriculture including building in migration predictions along with migration responses to policy alternatives, off-farm work as endogenously determined, effects of the cost of labor in the economy as a whole on farming and income distribution taking account of effects of policies on returns to different factors of production and on transfers of wealth between generations.

The Input-Output Models

A pilot input-output project has been carried out in Zone 3 which consists of changwat Khan-Kaen, Mahasarkarm, Roi-et, and Kalasin. Input-output relationships are estimated by sampling survey. Two stage stratified random sampling, systematic random sampling and purposive sampling techniques were used in the survey. It is expected that linkage between the farm linear programming models and the input-output model can be established. By developing the industry accounts for the input and product marketing sectors in a manner that maintains a quantity identification with the I-O value a link between the production sector and the other sectors can be developed in a linear programming framework. The input and product marketing sectors can replace part of the distribution system associated with the production sector in an LP model. Also, the LP of production can replace the production sectors in the I-O table. Hence, the linkage can be easily put together at the zone, regional or national level. By including input and output sectors, a better estimate of employment and income impacts can be obtained. It can also help to expand the analytical capacity. For example, it is possible to evaluate increases in the production by introducing marketing capacity or availability of inputs rather than only the more conventional LP restraints in production

possibility such as land, labor, capital and production technology.

The following excerpts from the input-output study indicate the substantial progress that has been made and demonstrate that it provides operational tools for making quantitative comparisons among a number of alternative farm and nonfarm policies:

> Developing the I-O for each zone provides policy analysts with the facilities to calculate multiplier effects of alternative sector investments, Table 6. Given the policy goals selected different industries would be promoted based on the industries contribution to these goals. Income multipliers are high for smallrice mills (17.49), rice wholesalers (15.53), rice retailers (14.82), cassava chip mills (14.40), cassava chip dealers (11.59), and rice buyers (10.51). Of this group only rice wholesalers have a high employment multiplier. Thus the income from those firms with high income multipliers must accrue mostly to profit or rent rather than wages, the base for employment determination. The high employment industries include kenaf buyers (27.59), rice wholesalers (12.82), large rice mills (11.31), and cassava pellet mills (10.27).
>
> The output multipliers are high for those firms which create a large impart on other sector outputs. Sectors which have little demand for goods from within the zone have a low output multiplier (transportation at 1.00 and fertilizer wholesales at 1.01). On the other hand those firms generating high levels of demand in the region from the purchase of inputs and non agricultural or intermediate products have high output multipliers such as cassava chip dealers (3.49), rice retailers (3.48), cassava pellet mills (3.26), cassava chip mills (2.74), rice wholesalers (2.70), and large rice mills (2.58). The rice retailer exceeds the rice wholesaler as it is a step further in the rice handling systems. The production sectors have low multiplier effects for all three categories as they are at the base of the product production and distribution system. Their only effect comes from their own impact and the secondary impacts generated by their demands in the fertilizer and transportation industries.
>
> Evaluating projects to determine the relative effect each will have on the zone's development potential is a complicated procedure based on many political considerations as well as the economic benefits determined from the projects balance sheets. Cost-benefit analysis has been the major component of project appraisal used to compare the advantage of various proposals. This system only directly evaluates the impact of the project as a separate economic sector without looking at the resulting benefits or costs associated with the required changes in other sectors servicing the project. Resmussen and Hirschmand have developed a linkage criteria which measured the cost and benefits of a project taking into account linkages within the economy. Their procedure is to use the semi-input output method of Tinbergen as a means to evaluate the growth potential of a project in terms of its effect on the total national economy.

To determine the feasibility of using this procedure for zone evaluations the I-O matrix was divided into two sections, with production of agricultural products in one section and the input and output service sectors in the second section. A direct cost-benefit ratio evaluation ranked the sectors in a similar pattern as the semi-input criteria. In both cases cost is expressed as capital needs per unit of output and benefits are measured as contribution to value added. Using the semi-input method for evaluation changed the relative position of the production sectors even though the absolute rank of the sectors did not change. Kenaf production has remained at the top of the scale (changed from 2.52 to 2.68) with non-glutinous rice (changed from 6.08 to 6.86) and glutinous rice (changed from 4.14 to 5.81) at the bottom. This indicates a low capital requirement for kenaf relative to the other crops. As an alternative for upland use for cassava production requires more capital than kenaf and has a lower ranking under the semi-input criteria, 5.07, as compared to its position relative to kenaf on a strict benefit-cost basis of 3.97.

Changing the classification of the sectors to facilitate an evaluation of the processing sectors increases the scope of the sector investment evaluation. This definition of the analysis leaves those strictly local sectors including the retailers, wholesalers, buyers and commodity dealers as the sectors against which the others are measured for their contribution onto zone development. Using the direct cost-benefit ratio as defined as this procedure, the agricultural production sectors rank low on the scale, kenaf sixth, cassava seventh, nonglutinous rice eighth, and glutinous rice tenth. The highest ratios in order are kenaf baling, cassava chip mills, cassava pellet mills, and cassava flour mills. By changing the criteria to include the impacts on the local service sectors, kenaf moves from sixth to third and all other production sectors move up slightly in rank. Small mills fall from fifth to tenth in the rank. The kenaf bale and cassava chip mill sectors still maintain the top two spots.

The procedure of using the semi-input output table can also be used to evaluate new projects to compare their feasibility against present sector allocations of benefits (value added) and costs (capital) Now projects using the resources available in the input sectors or as intermediate inputs from the producing sectors can be evaluated using this procedure. There are discussions about introducing a kenaf pulp factory which would process the kenaf into a product similar to wood pulp for paper manufacturing. After the data for this factory is completely developed by the project supporters it will be evaluated in the model in comparison with other sectors such as the cassava flour and pellet producers. These compete for the productive capacity of the upland area and should be considered more competitive investments as compared to rice processing.

The difference in response between that indicated by the I-O analysis and the LP production sector solutions reflects the evaluation criteria used to control output. The I-O evaluation uses cost as expressed in capital requirements to evaluate sector expansion. In the LP the present formulation has capital availability only controlled

by its interest rate. Thus, it is not a strictly limiting resource and cassava production increases based on its higher contribution to profit given the expandable capital availability. A change in the LP formulation to include investment capital and competition by the production sectors with other capital users may cause a shift to kenaf. An inter-dependence of the capital and labor markets between the production and nonproduction sectors is being developed in conjunction with expanding the sector analysis project beyond agricultural production.

The example above exhibits a compatability between a flexible production technology represented by the LP and the I-O input and processing sectors. Much work must yet be done to completely link the system. The labor and capital markets need to be integrated and a restraint reflecting the expenditure of development funds separate from operating capital needs to be included. The logical step beyond this may be to investigate integer constraints reflecting large development projects and their contribution to the zones growth. .

The step after completing the zone models will be to link these on a regional rather than national basis. This will give a completely interactive agricultural sector model which can be linked to the other sectors as the NESDB completes its work. Efforts to link agricultural production to other sectors are just beginning in DAE. It is hoped that over the next year or so representative models can be developed and serve as an important tool in the DAE-MOAC policy evaluation program. A policy analysis system constructed with these components would allow the policy analysis to specify development targets relating to zone income, employment or other measurable target variables and develop alternative government actions to reach these targets. A critical input in most countries is development capital. The model could be constructed in a manner that specifies acceptable levels of the target variable and solved with the objective function of minimizing government development expenditures. The major goal in this type of formulation would be to select a set of government investment or government policy actions which would contribute to the development of the zone to a specified level. Each of the projects or a set of compatible and complementary investments would be included as separate activities in the model and the solution select those meeting the goals with minimum government investment.

The evaluation team finds the I-O analysis extremely promising, particularly in connection with possibilities for an expanded focus on policies concerned with much poverty. Further attention would be valuable to the relations between results from the I-O analysis and policy criteria and effects, including not only cost-benefit and semi-input criteria as already done but also availabilities of local labor supplies, short-run impacts versus longer run consequences, and income distributional consequences within and between local economies.

The proposed Social Accounts Matrix (SAM) will help to extend the I-O analysis and will facilitate giving attention to the effects just mentioned. The social accounts approach proposed is very ambitious, and it may be desirable to proceed incrementally in developing it to ensure that an operational capability is established.

The Macro-Economic Models

Two macroeconometric models have been constructed and validated over the data period from 1962-1974. The final report on the development of the macro models including validation results and data is titled "Macroeconometric analysis of economic activity in Thailand" (by Stephenson J. and K. Itharattana, published by the Center for Agriculture and Rural Development, DAE-ISU Sector Analysis Series: No. 6, 1977). Both of these models have been reestimated and revalidated following annual data revisions in the National Income accounts. The reestimation for the 1962-1975 data period was completed during June 1977.

The general methodology for completing the linkage between the macroeconometric model and the programming models of the agricultural sector has also been completed. These methods were discussed and comments solicited at the second ADC seminar on Sector Analysis in Asia held in Cebu City, Philippines in November 1977. The linkage between the macro-econometric models (see "Structure of a recursive model for policy analysis in Thailand, by A. Stoecker, K. Nicol, and Somnuk Sriplung) involves a rather large research effort to put the agricultural sector models on a recursive formulation, incorporate the commodity demand analysis into the system, and further disaggregate the macroeconometric model.

The estimation of flexibility coefficients and the reformulation of the linear programming model in a recursive format has been completed for the major crops. The crop model in recursive form has just been used to study the feasibility of meeting export targets during the coming crop year at the request of the Minister of Commerce. The recursive crop production equations for rice were used during the previous drought to estimate the impact of reduced fainfall on rice production. This information used in determining export policy enabled policy makers to make interim decisions pending the completion of the more complete rice production survey.

The program software and data collection necessary to complete the estimation of the linkage equations for the recursive policy model referred to above have completed and the data set has updated through 1976.

The macro models are currently being updated through 1976. The methods used in this update are also contained in an appendix to this report. This has progressed more slowly than anticipated because NESDB has changed the base year for constant prices from 1962 to 1972, previously obtained unpublished data series obtained from NESDB are no longer available or being calculated, and because of personnel changes in DAE. The person who originally worked on the macroeconometric model is obtaining a Ph.D. degree from Iowa State University. This person is expected to return and assume responsibilities in this area. The current replacement on the macromodel is making good progress but has had only two months experience in this area.

The future work in this area is expected to be guided by either TDY assistance, the marketing analyses or a combination of both. In summary, the data has been collected, some of the recursive parts of the agricultural

models have already been used for policy analysis but considerable estimation work remains before the system is fully operational. Of the two macro-econometric models being constructed, Model I consists of 36 behavioral equations and 9 identities. The model includes standard variables in the Thai national income accounts with no specification on monetary sector. All equations in the model are linear in both parameters and variables. Model II has 55 equations with some of them, mainly private consumption functions, impact functions and production functions, are nonlinear in variables. However, all the parameters in the model are linear. Model II is an extension of Model I by incorporating monetary sector into the model.

Due to data limitations, all equations in Models I and II are estimated by ordinary least square method. All equations have good statistical fit. Predictive performance of the two models, evaluated by Theil's U-statustic, is reasonably good. However, due to the level of aggregation in the behavioral equations and identities for describing the government and monetary sectors, fiscal and monetary policy instruments in the models are limited. The models, therefore, are not as useful for policy simulation as for forecasting macro variables. Also, the inability to disaggregate income distribution equations makes the two models inefficient in describing all the interactions between and within the agricultural and non-agricultural sectors, reducing the usefulness of the models for analyzing some issues of sectoral income distribution.

While data deficiencies and the high level of aggregation limit the usefulness of the models for policy purposes, the models will be useful in this respect when combined with other models provided consistency can be ensured. If the efforts of ISU-DAE in developing linkages between these models with other sectoral or sub-national models can be realized, the macro models will be of considerable value in solving policy questions.

As indicated in the preceding sections, within DAE attempts have been made to link Model II with the National LP model for the agricultural sector through a group of commodity demand models. The linkage retains the essential structure of the macro model but substitutes agricultural crops and livestock production processing, marketing and transportation from agricultural sector models via commodity demand models for all or part of the relevant equations in the macro model. The resultant system is recursive in the sense that the current year variables are independent in part on their values in previous years. It is also recursive in that the agricultural sector model depends on the macro model and commodity demand models to determine totally or partially the demand for agricultural product, labor supply and other factor inputs which affect agricultural outputs. The outputs from the agricultural sector model then become predetermined variables for solving the relevant equations of the macro model. The current period results of the combined macro and agricultural sector system are then used to update this system for the following year.

The key element of the linkage between the macro and agricultural sector models is thus the existence of a market sector consisting of commodity demand models that can determine demands and prices based on the outputs derived from the agricultural sector model. The results from the econometric commodity demand models then determine the values of some of the predetermined variables in the macro econometric model. Likewise, the prices obtained can be used in determining the flexibility constraints for the next iteration of the agricultural sector model.

Although at present it is not possible to establish the success of the linkages between the macro model and the agricultural sector, the

methodology toward this end has been very well developed. The success of such linkage will depend on the development of various sub-models such as the above-mentioned commodity demand models and other models currently in the process of construction such as the transportation-storage-processing model for rice, models to be used in the nutrition project, and the population model. If the linkage can be successfully established, the value of variables determined by macro and agricultural sector system will be useful in the rice buffer stock model.

Other Models

In terms of commodity demand models, models for kenaf, mung beans, soybeans, cotton and maize are completed. Preliminary models for rice, sugar, and rubber are also finished. The work on dairy products and cassava is also started.

A recursive crop-livestock model is being completed by the DAE staff. This model will undergo a 5 year validation run during the near future. DAE staff members from the Statistics branch are proceeding with the necessary statistical estimation of flexibility coefficients for the remaining commodities.

The adding of the livestock industry to the national model helps make the model more complete and more realistic. There is however, need for some revision of the livestock sector so that it can provide information on the potential effect of the current livestock development policy on the resource use, production, and income. An extension of the crop and bovine model to include other animal activities namely hogs and poultry will be desirable as they are presently of much concern by the policy makers.

For the transportation-storage-processing model for rice, only the part pertaining to Zone 3 is finished. The study is supposed to cover a total of 19 zones. Basically, the linear programming technique is used to develop the model.

The nutrition project is a joint effort of DAE and the Institute of Nutritional Research of Mahidol University and covers a period of three years starting from October 1978 to September 1981. The first phase of the project will focus on collecting secondary data on food consumption, family income and expenditures, and nutritional condition of villages. The second phase will be the construction of production model by having the eating habits and nutritional conditions as the variables in planning for production. Field surveys for the project will be conducted twice during 1979 and 1980. A total of 20,000 samples from the selected areas all over the kingdom will be collected. The data from the nutrition project will be able to supplement and update the data presently in use by DAE for constructing various existing models.

The population model developed by DAE is in an experimental stage. A simple model is constructed by using 1970 population census and the 1970 birth and death statistics from the Ministry of Public Health. The model provides population projection of the whole kingdom by age and sex for 1979. It is expected that a new model with better accuracy will be developed. The population projection to be derived is important for determining demand conditions for various agricultural output and the availability of labor supply to be used in other models.

Regarding the rice buffer stock model, among ASEAN countries, interest on the establishment of a food security reserve system within the

ASEAN region has been expressed for quite some time. Administrative and political problems seem to have delayed the implementation. Lack of information and careful analysis have added to the difficulties in forming the program which is supposed to benefit all parties concerned.

The project study of rice buffer stocks is therefore of particular relevance for policy implications. The simulation approach is also appropriate. However, keeping in mind the large data requirements may usefully affect the construction of the model as well as the reliability of the results obtained.

It seems, furthermore, that this kind of analysis requires cooperative effort of researchers from other ASEAN countries. Participation of a political scientist may also be needed so that he can provide some insight into political factors affecting policy decisions.

The Data

Macroeconometric Models. The data for the models are yearly observations for the period 1962-1974. In Model II, the data base has been extended to 1975. With only 13 to 14 observation points (13-14 years) stability of the estimates cannot be ensured. Although the results of the backward simulation in both models shows that the models can be used for making forecasts, annual changes due to external factors, both social and political, may affect greatly the prediction performance of the models. The changes in foreign trade can also affect such performance. For those who have some experience of using Thailand's national income data, the data deficiency in capital formation is well-known. More disaggregated data on gross fixed capital formation by industry group are available only for the

period beginning in 1967. Hence, it is necessary to use the backward forecast data of 1962-1966 for estimating the gross fixed capital formation equations. Also, in estimating production function, it is essential that data on capital stock are available. However, such data cannot be obtained in Thailand. In model II, therefore, estimated capital stock data are used in deriving the statistical production function. If better data are available, several behavioral equations in Models I and II will have to be re-estimated.

Microeconometric Models:

(1) Commodity demand models. In most cases data limitations consist of lack of time series data. In other cases existing data are of questionable reliability. The most reliable data used in commodity demand models is the foreign trade data. Price and production data are next in order of reliability, although they vary among commodities. More recent production data are less subject to error as better statistical survey techniques have been used to estimate crop production. Price data for commodities that are subject to government control are sometimes subject to more error than non-regulated commodities. The most severe data problems exist in determining domestic utilization. For most commoditities only sketchy information is available about quantity of processing of agricultural commodities.

(2) Population model. Data base used in the model is obtained from 1970 population census and the birth and death statistics from the Ministry of Public Health. The reliability of both data sources is questionable, an underestimation has been found in both sources.

(3) Rice buffer stock model. The model includes all ASEAN countries. Although Thailand's data on rice are fairly reliable, the data from other countries are of questionable quality . In all countries, data on rice stock carry-over are of less reliability than data on consumption and production.

Input-Output Models. The major data source for the input-output models is field surveys. Although DAE has the facilities to develop and carry out the required surveys, the major limitation on the I-O program concerns the scope of the surveys. To this point the authorization has only been received for conducting necessary survey of agricultural sector. Because of the limitation of the budget appropriation, DAE has conducted surveys on input suppliers and output marketing and processing in connection with only 7 major crops, i.e., rice, maize, kenaf, sugar-cane, soybeans, ground nut and rubber.

Other Models:

(1) Regional models. The models have separate bound sets for each zone which include land by type and month, labor by month, capital by month and capital borrowing by source. In addition to the bound sets for each zone, point demand estimates which were taken from the national model have been added in the form of regional marketing bounds for each selected commodity. The data requirement is satisfied by field surveys conducted by DAE. Quality of the data has been improved considerably through the years under the joint effort of ISU and DAE.

(2) Transportation-storage-processing models. Data deficiency is formed mainly in costs of processing paddy into rice and the loss of paddy and rice during storage period. This data deficiency has created difficulties in constructing the model.

(3) Models to be used in the nutrition project. As few secondary data are available, the data condition will depend greatly on the outcomes of the 1979 and 1980 field surveys.

III. USES IN POLICY ANALYSIS AND DECISION-MAKING

Review of Policy Applications

The fact that DAE has been increasingly involved in the policy making process is well known. The DAE through the use of the planning models has been providing information for policy decision making to various planning and implementing agencies such as the NESDB, the Ministry of Commerce and the agencies within the MOAC.

The type of policy analysis DAE conducts is wide ranging. On one hand, long range development plans must be analyzed and recommendations made to government planning decision makers. On the other hand, policy recommendation must be made sometimes in a matter of days or even hours to alleviate an immediate crisis. In addition to the differing time frame of policy issues, the scope of target groups can be very different. Many policy questions are national in scope, such as pricing policy and trade policy. Other policy questions involve a particular region or changwat, or even a particular target group within a changwat. In all cases the DAE must be ready to quantify the consequences of proposed policy issues and to make recommendations to decision makers as to the best policy to achieve the desired goals. To be able to handle this task DAE must have a very complete set of analytical techniques, models, and skilled policy analysts.

Through the Agricultural Sector Analysis (ASA) models, DAE has clearly been enabled to respond more effectively to these policy needs, particularly in supplying quantitative assessments. The evidence for this is the wide use of the ASA models in DAE policy work. The initial extensive use of the work in the development of the Fourth Five-Year Plan and other

uses during the first four years of the project were documented in the 1977 Evaluation Team report. The uses have greatly proliferated since that time. In addition to the areas of application mentioned in the Overview of the Project in Section I of this report, further uses of the models include:

Estimation of annual exports targets for rice and other crops for MOC

Analysis of overall agricultural economic situation with recommendations to MOAC every six months

Analysis of sugar cane location and possible alternative crops to sugar cane

Analysis of location of cassava production

Analysis of price stabilization for beans

Analysis of fertilizer policy

Analysis of location of tapioca plants

Analysis of maize export controls (whether to have long term agreements with Taiwan or Japan)

Analysis of contract poultry farming losses experienced by some contract farmers

Analysis of the pork situation with recommendations on how to overcome the current low price

Analysis of possible alternative crops to sugar cane

Analysis of how to increase the second rice crop to make up for the last year's small main crop

Analysis of possibilities for storing rice to aid drought stricken farmers in future years

Adequacy of Policy Focus

The following statement supplied by the ISU-DAE team indicates views on policy problems and possibilities for model application in the Thai setting:

The Thailand Agricultural Sector Analysis Projects faces many issues and problems which are similar to those faced by policymakers and researchers in other developing countries. Thailand is concerned about growth in income and employment; in reducing income and employment disparities between rural the urban people, among regions, and between the agricultural sector and the rest of the Kingdom. Thailand is also concerned with expanding the potential for increasing agricultural production to insure adequate food supplies and to earn foreign exchange. Export expansion and import substitution are recurring topics. Thailand has an unusually large and still dominant agricultural sector in terms of GNP, population and export earnings (rice, rubber, cassava, maize). Rapid expansion of domestic demand, primarily in the form of increased population, can slowly erode these important sources of foreign exchange and reduce per capita productivity in the sector. For many years agricultural production has been expanded primarily by land extensive methods, and this cannot be relied upon in the future.

Thailand also faces some rather unique political and economic challenges in large portions of the rural sector where poverty and unrest are common. There appears to be motivation to explore the potential of expanding irrigation, tp push for higher participation in multiple cropping and to utilize improved farming technologies. Underemployment is a serious problem for agricultural laborers. Currently there is a high rate of immigration from low income rural areas into the urban centers (primarily Bangkok), which accentuates problems of congestion and unemployment in the nonagricultural economy.

There is no scarcity of issues and problems which could provide focus for Project and DAE Research. Listed below are the set which we feel has some chance to be addressed within the limits of what we expect our capability to be: (a) price and income response for major agricultural commodities including demand analysis and commodity supply responses, (b) land and irrigation expansion potentials and alternative methods for increasing per rai and per capita productivity (new varieties, fertilizer, management), (c) analysis of alternatives and fertilizer use for rice and upland crops, (d) resource utilization and capital for labor substitution (labor, capital, machines), (e) agricultural marketing and transportation, (f) distributional impacts of national programs on agriculture and of agriculture on the national economy, and (g) relationships between retail prices of selected food crops, foreign exchange earnings, and farm income.

It appears that major policy issues are recognized by the research team and the development objectives concerning productivity, income disparity and employment are particularly well taken. Aside from the question of emphasis, other policy issues can of course be mentioned. Among these is agricultural credit. Since 1974, the commercial banks, in response to the

Bank of Thailand's request, have expanded its agricultural credit operations considerably. In 1978, a minimum eleven percent of its total deposit will be provided to agriculture (approx. 14,000 million baht). This will certainly affect the farm production and income of the farmers. It would therefore be useful to analyze the impact of institutional credit on production organization and income.

Still another current policy issue is land reform. The implementation of land reform is expected to be extensive during the fourth plan period. This may change the farm structure (size and ownership pattern). It would be useful to take this into consideration as land reform policy will likely affect the wealth and income distribution within the agricultural sector and between the rural and urban sectors. A beginning has been provided in the DAE work on land reform.

From the many actual uses of the project tools in policy making, it is clear that the project has been highly useful. The above discussion of possible uses of the tools indicates that they are flexible instruments that can be applied to an even greater range of policy problems. Judged by responsiveness to demands for policy analysis within the Thai government, the policy focus has been largely appropriate and has contributed to the ability of the government to meet its objectives.

A question to which the present evaluation team has been asked to give special attention, namely the extent to which rural poverty is alleviated, involves judgments as to whether the demands made for use of the tools give as much attention to rural poverty as they might, whether efforts could be made to more fully address rural poverty problems in tool development and whether alternative approaches involving other kinds of

projects would be more effective. Consideration of these issues is reserved for the latter section of this report on rural poverty.

Dissemination

The formal dissemination activities of the project during the first three years of the project were documented in the 1977 evaluation. The list of publications given at the end of the present report documents activities since then. Of particular note is the initiation of the periodic publication by DAE on agricultural economics which provides a specific vehicle for continuing dissemination. In addition to participation in various seminars and briefings, research reports of DAE have thus been distributed among researchers and scholars at research institutes, government offices and universities. They have provided a better understanding of the Thai agricultural economy and have almost certainly stimulated further research in related areas.

In addition to these formal activities, the dissemination of project results has taken place through informal contacts, particularly in connection with the uses of the modelling efforts in policy applications for various client agencies within and outside of MOAC. This may indeed be among the more effective means of communication among DAE researchers and others.

In the opinion of the present evaluation team, the dissemination efforts have been admirable and effective. A balance has been maintained between carrying on useful work and communicating with others to spread knowledge and obtain professional feedback. It is to be emphasized that the

major purpose of the project is to provide useful policy analysis rather than to disseminate research results as such. The problem encountered in some countries has been avoided of undertaking activity solely for the sake of publishing professionally.

The evaluation team is in favor of continuation of the dissemination activities and feels that they could be supplemented with small seminars and meetings including those concerned with some specific aspects of the research. Meetings among a small group of persons concerned will encourage an exchange of views which may be used to improve the modelling efforts of DAE.

Two-Way Communication

Related to dissemination but going beyond it is the issue of two way communication which the evaluation team was asked to address. DAE has been active in formulating agricultural development programs both on policy and operational levels. In this role, it is necessary that DAE has good inter-agency communication with departments within MOAC and other relevant departments outside MOAC. The top echelon officials of MOAC appear to support DAE's role fully with resultant excellent cooperation within MOAC. Cooperation outside MOAC depends greatly on the types of jobs and functions assigned. In general, DAE maintains good working relations with the Office of National Economic and Social Development Board (NESDB) and Ministry of Commerce (MOC) and has widespread liasons which are generally less formal among other agencies.

It is the impression of the team that DAE has been extremely responsive to any possibilities for responding to requests for policy

analysis, both within and outside MOAC. Regarding the question of DAE reaching out to others, the dissemination discussed above indicate that DAE has actively communicated to others on research methods and findings. On the policy side, in addition to responding to requests, it is the opinion of the evaluation team that DAE should be encouraged to reach out at the working level in making contributions to solutions of policy problems. In view of the large amount to be done to foster the development of Thai agriculture, inputs from other agencies and from universities should be maximized. DAE has been making efforts along these lines and in the opinion of the evaluation team should be encouraged to expand these efforts.

IV. DEGREE TO WHICH A PERMANENT CAPABILITY HAS BEEN TRANSFERRED

Briefing of the Evaluation Team

The most reliable evidence on the ability within the Thai government to carry on the work beyond the project period was obtained in face to face discussions, in the written materials authored by Thai personnel at the briefing sessions held for the team and in the handling of questions and discussion at the briefings. The briefings and discussions for the present evaluation were carried almost entirely by Thai personnel, the extent of Thai responsibility being markedly greater than in the two previous evaluations. The written materials prepared for the briefings are included as an appendix to this report and attest to the fact that abilities now exist encompassing understanding, use, maintenance and updating of the models as needed within the Thai government. The impressions of competence from these written materials were reinforced in the oral communications which the team had been the Thai government personnel.

The progress in capability results from the formal and informal training efforts and from experience acquired over the five years of the project. There is definitely now a core staff capable of carrying on applying the existing models without outside assistance. A group exists whose members are technically competent and knowledgable about modelling, and there seems to be the beginnings of a group for assuming senior guidance and assistance roles in policy and program analysis whose strength is likely to develop naturally over time. The basic situation appears to be that

there is full ability to carry on with the models that have been developed so far and that there is some but as yet a constrained ability to develop the models further as these require expertise in specialized fields.

Staff Development Indicators

A comparison of the DAE staff as it existed prior to the present project and as it exists now attests to the substantial upgrading of DAE personnel that has resulted from the project. Key staff of DAE has been selected to do graduate studies, and other staff members have replaced the departed students with apparently a minimal disruption of work. The training at the Master's level is nearly complete. Those trained have resumed their duties in the Division. Three staff members have completed their Ph.D. requirements in the last year and have resumed normal duties. Ten more Ph.D. students are in the United States at the present time. During the next two years these students are scheduled to be back on the job in DAE.

In addition to formal graduate training DAE has also sponsored inservice training sessions in FORTRAN programming, econometrics, agricultural policy, demand analysis, linear programming, mathematical economics, and job control language for the DOS/VS 370 series computer. Teaching responsibilities have been shared by ISU and DAE staff.

Table 1 gives information on Ph.D., Master's, Bachelor's and Diploma training overseas, indicating a total of 16 Ph.D's (10 still in training), 35 M.A.'s (3 still in training).

Change of Status of DAE Within Government

The change of the Division of Agricultural Economics (DAE) to the Office of Agricultural Economics within MOAC which is now in progress

Table 1. Advanced Training of DAE Staff

	Ph.D	Master	Bachelor	Diploma
Number of Officials on Study & Training Abroad				
U.S.A.				
Back	4	32	2	-
On-going	10	1	-	-
Total	14	33	2	-
Australia				
Back	-	1	-	2
Total	-	1	-	2
Philippines				
On-going on IRRI Support	-	2	-	-
Total	-	2	-	-
Germany				
Back	1	-	-	-
Total	1	-	-	-
Graduated from Abroad on own Support	-	6	4	-

is evidence of the confidence of the Thai government in the expanding agricultural economics capabilities. Figure 4 shows the organization chart for the DAE as it is at present, and Figure 5 shows the organization as it will be after transformation into the Office of Agricultural Economics with enlarged responsibilities operating directly from the Board of Agriculture and Cooperatives Policy and Planning giving it greater leverage within MOAC and in relation with other agencies generally. With the re-organization it will be possibly easier to obtain grade positions necessary to keep and attract the more highly qualified personnel needed to carry on the policy analysis made possible by the project.

Lodging of ASEAN Training Center in DAE

Recognizing the importance of agricultural development planning and Dividion's capabilities and experience in this area, the countries of the ASEAN committee have approved the concept of establishing a Development Training Center to be located in Thailand. A funding request to the Agency of International Development is being discussed in the joint ASEAN-United States dialogue.

The center would provide training to two groups of participants. One group would consist of high level government officials who have the major responsibility for government planning. The primary training would consist of a number of seminars and short courses which would allow these policy decision makers to interact with each other discussing problems of mutual interest and concern. This group would also be responsible to see that the second group of long term participants receive the type of training most useful for their respective country needs.

Figure 4

Organization Chart Befor the Adjustment of DAE

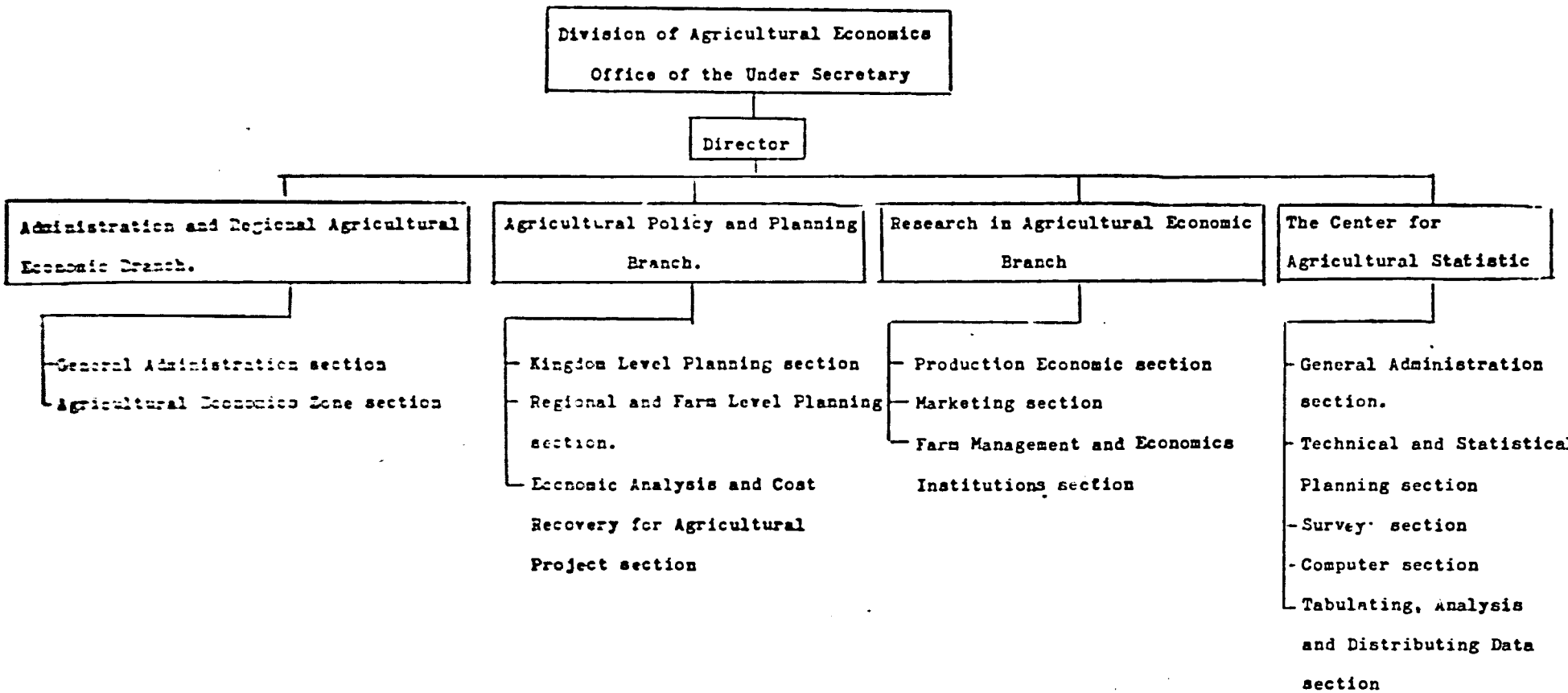
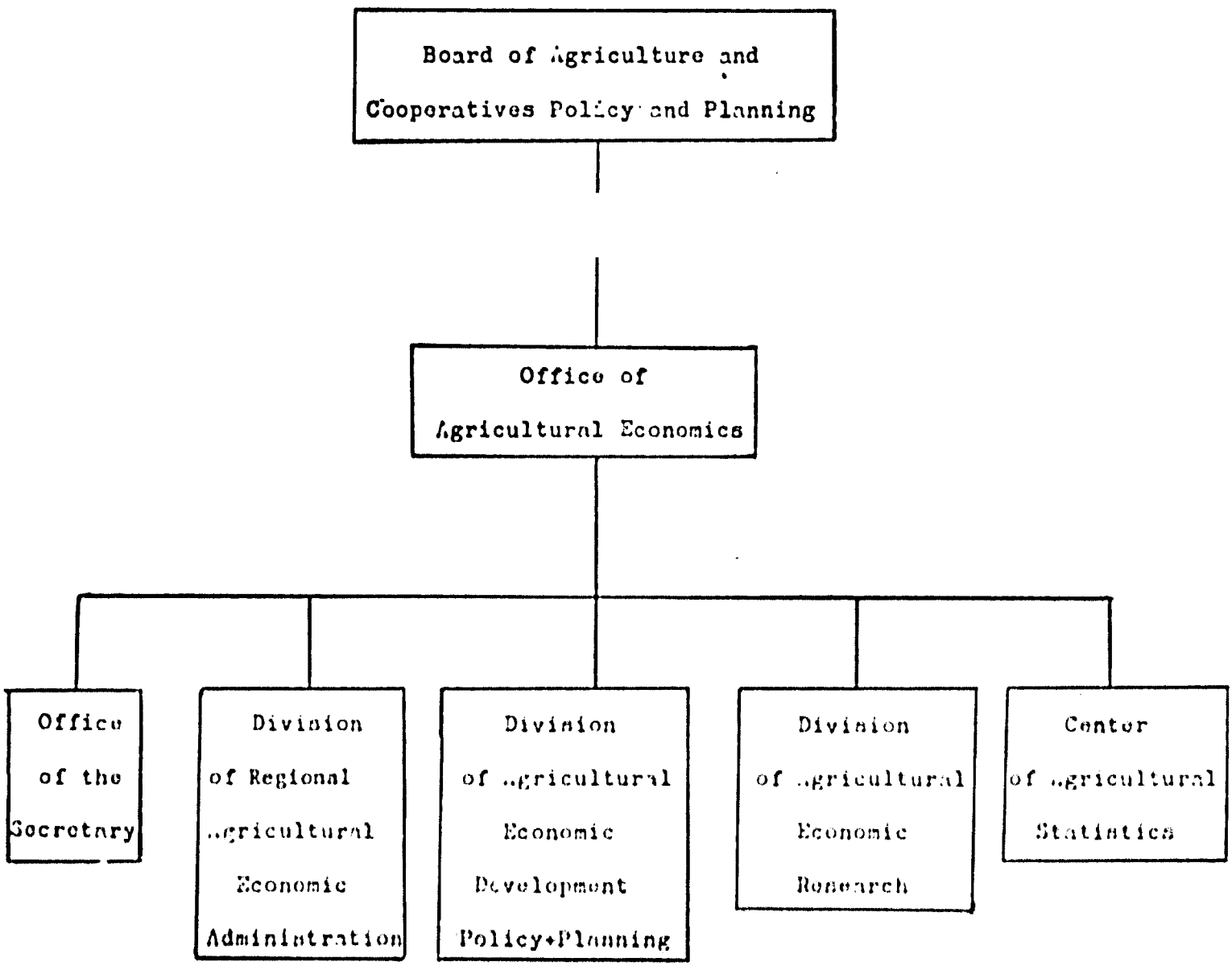


Figure 5

Organization Chart of the Office of Agricultural Economics



The other group of participants would be technicians who would take part in a technical training program with a duration of approximately two years. The first six months would consist primarily of academic training. The remaining eighteen months would consist of applying planning techniques to problems using data from the respective participant's country, under supervision of DAE staff. This training would be at the level of a Master of Science degree equivalent.

Needs and Prospects

Financial support for carrying on the work by Thai personnel appears assured, as indicated by Table 2 giving the DAE budget for past and projected years in which there is continuous rise in funding. As indicated in the briefing materials appended to the present report, objectives for future work include an expanded policy analysis capability to meet national and local development requirements in the agricultural sector with particular attention to the position of the rural poor in project selection and project monitoring. At the national level DAE will be evaluating the impact of the agricultural development program on the repayment capacity of Thailand, the effect on the balance of payments and the effect on the cost of living, among many other phenomena.

Regarding needs for foreign technical assistance, three areas in which DAE is now working which call for further technical assistance are: (1) coefficient estimation for changwat models with farm characteristics using raw survey data, (2) linkage of the macro econometric model with the national agricultural programming model, and (3) developing and testing the integrated linear programming social accounts model for localized

Table 2

DIVISION OF AGRICULTURAL ECONOMICS BUDGET

	RTG.Bg.(฿)
1979	29,701,300
1978	25,979,500
1977	24,162,000
1976	21,804,600
1975	20,345,700

development planning. Particularly in the latter two areas, only limited literature exists anywhere in the world, and assistance is important in the early stages. Another area of needed assistance is in developing or modifying computer software to fully utilize the 370 computer.

As a need of a different kind for building competence within Thailand, personnel in agricultural offices at the Province level who are responsible for supplying much basic information would benefit greatly from work and training at DAE, if there were some means for arranging for them to spend some time there.

A final major need that may be mentioned is in the further development of models concerned directly with rural development and rural poverty to meet the basic analytic requirements accompanying increased policy emphasis on these problems.

Under the present project, it appears that an extension without additional funding will occur which will enable one ISU team member to remain for several months which will help to meet needs for completing model development work now underway. There is a particularly great need for continuation at some level until the return of the majority of the Ph.D. candidates who are now abroad. If it is necessary to terminate the DAE-ISU program, it would be highly desirable to make arrangements in the transitional period with econometricians and programmers available in Thailand outside DAE, in universities and consulting firms. In any case, to ensure maintenance of DAE capability, continued exchanges on temporary bases between DAE and ISU should be encouraged even after the termination of the ASA project.

A proposal for a full-fledged extension of the DAE-ISU is pending which would give primary emphasis to developing models explicitly concerned

with rural development and poverty. Realistically, whether models along these lines are developed would seem to depend on whether the proposed extension is approved.

V. THE RURAL POVERTY QUESTION

Ways the Project Deals with Rural Poverty

In Thailand programs concerned with the agricultural production sector necessarily assist many of Thailand's lowest income families, in view of the concentration of low incomes in agriculture. Programs directed to agriculture in the Northeast particularly affect the lowest income farm families for whom there is heavy reliance on rain fed agriculture, small size of farms (average of about 10 Rai or 2.5 acres), and great distance from the major marketing center, Bangkok.

In its present work program DAE has addressed the income situation in agriculture in many ways, with a concentration of efforts on the Northeast. The initial large scale use of the national crop model was in the development of an overall program for agriculture in the Fourth Five Year Plan. Emphasis was placed on the Northeast's income level. The final plan recommended for the agricultural sector included a special development program in the Northeast to raise incomes of the non-rice farmers, the poorest of the region's farmers, by promoting crop production patterns to help overcome drought and facilitate the distribution of inputs and knowledge.

The national crop production model has also been used to evaluate export policy implications and how they affect the overall regional distribution of income by type of crop produced. Analyses were also carried out to ascertain appropriate distribution patterns for inputs, especially fertilizer in conjunction with the above programs.

The regional models have been used to study land development options and labor productivity in agriculture. The labor productivity study in the Northeast was designed to determine the relative productivity of labor in agriculture using the present technologies available. The follow up will indicate changes in productivity which could result from the introduction of labor enriching technologies.

DAE continuously has staff and resources involved in monitoring and evaluating the income situation in agriculture. The DAE assisted in the governments program to provide supplemental income to the rural poor after the drought conditions in the Northeast and North during the last crop year.

DAE is participating on a committee from the Prime Minister's office to classify, locate, and describe the economic resources of the nation's lowest income rural families. The program has to date provided income breakdowns for farm type, size and changwat for the nation based on 2518-19 survey and is almost complete for 2519-20. The breakdown here is especially important as the DAE will use these classifications to define the farm units being incorporated in the zone models.

The DAE director and staff serve on ministry committees which deal with the problems of developing programs to raise the income of the rural families. Representation is frequent at the Prime Minister's cabinet level meetings, with recent presentations dealing with rural-urban equity problems and on regional and farm type distribution of poor farm families.

DAE participated in and developed the final recommendations for farm size and resource allocations in the land consolidation program, in programs of resettlement of persons from strategic areas, and in programs

to develop farm plans in settlement areas. This entails the utilization of data and analytical techniques developed under the Sector Analysis Program.

Future work will be based on the incorporation of farm class characteristics in the zone production models to be used for analysis of program implications for farm families. The initial phase will deal with the basic production models and study production sector programs to ensure adequate cash flow for low income families.

A next phase, being developed initially in agroeconomic zone 3, will add the processing and agricultural input sectors to the production model and facilitate analysis of programs to increase rural employment and income among the poorest families in these sectors of the rural economy. Still another phase, presently conceptualized with data needs outlined, revolves around the addition of the government, capital, income distribution and consumption sectors as sectors in the modelling. This will facilitate the tracing of complete effects of programs including impacts on associated industries and service sectors. The attempt will be to determine the specific recipients by magnitude of the income and employment benefits of a government or private sector program, by regional and farm size classifications.

Examples of Income Distribution Analysis

As an example to give more detail, a study to appraise a land consolidation project (Chanasutr, Singburi) was undertaken by the DAE at the request of the IBRD. The study was carried out by the DAE staff with only minimal assistance from the ISU group. The project appraisal specifically considered the repayment capacity of small (potential pre-project income $100 per household per year), medium and large farms each with

two soil classes. The basic linear programming methods developed for regional and national policy analysis were modified to provide specific information about the project area. The estimated net farm income for farms before and after the project (Table 3) included not only income from the own farm but also from wage income received from working for other farms and outside the project area. The study then considered alternative assessments, repayment periods according to the ability of each class of farmers to pay. The information derived from the study was used in making a government decision on cost recovery policy.

The responsibility for appraisal of other projects in other areas of Thailand has been given to the DAE. Currently the DAE staff is working on the appraisal of 4 irrigation projects in the low income Northeast region of Thailand. Formerly project appraisal work was done by foreign consultants. The assumption of the appraisal work directly by the DAE reduces the total loan and hence the debt burden of projects.

Another example where target farm groups are being specifically considered is in the farm type modeling. This effort was underway but received a higher priority when the governors of the provinces made a request to the Minister of Agriculture for province level development plans. The DAE made a commitment to provide such detailed plans as soon as possible. This is a long term task but progress is being made. The methods and preliminary results were discussed by Mr. Boontom Prommani at the second ADC seminar in Cebu City, Philippines. The results shown in Table 4, though still preliminary, demonstrate the differences in income potentials between

Table 3

FARM INCOME PER RAI BY FARM SIZE AND TYPE

	Small		Medium		Large	
Land Type	III	IV	III	IV	III	IV
Before Project	2218	2199	3919	4438	6137	10834
After Project	6279	7629	12472	15453	24611	20742

Source: "Appraisal of the Land Consolidation Project Chainast, Singburi and study on recovery of the cost" Agricultural Economics Research Bulletin No. 108, Oct. 1976. Division of Agricultural Economics, Office of the Under Secretary of State, Ministry of Agriculture and Cooperatives, Bangkok, Thailand.

Table 4. Preliminary Description of Income by Type and Size of Farm in Lopburi Province of Thailand.

Size Rau	Farm Type								
	Rice Farm			Rice and Upland			Upland		
	Population	No. Farms	Potential Income	Population	No. Farms	Potential Income	Population	No. Farms	Potential Income
0-15	12.3	2.4	7.4	0	0		24.3	2.0	6.9
15-30	10.3	2.0	16.0	29.2	3.6	15.8	53.1	2.3	23.3
30+	24.7	4.1	34.0	56.0	8.0	35.4	142.8	8.9	67.2
Total	47.4	8.6		85.2	11.6		220.2	13.1	

Source: Compiled from "Incorporating Farm Level Characteristics in Regional Model, 'The Thailand Case'" by Boontom Prommani. Paper presented at Second Asian Seminar on Sector Analysis, Cebu City Philippines. November 1977.

alternative sizes and types of farms within a particular province. The estimation of more complete data for such models requires additional skills and experience on the part of the DAE staff. Definite progress toward this goal of estimation of such models for all changwats in Thailand is being made. A current priority effort is underway to extend the capability for sub changwat detail to those provinces which have especially low income. Encouragement for selection, identification, and priority assigned to support development efforts in the lowest income changwats and finally amphurs of Thailand has come from the office of the Prime Minister.

A Policy Perspective on Rural Poverty

Tables 5, 6 and 7 give information generated by DAE on incomes of farm families useful in identifying target groups and estimating effects of programs and policies on those in different income groups. As Table 5 shows, the Northeast stands out as the lowest income area with a farm family income of about $300 per year. The lowest income entry in the table is for rainfed paddy farms in the Northeast, which account for over half the farms of the region. The uneven income distribution is illustrated by noting that the two highest entries in the table are for upland farms and fruit and vegetable farms in the Central region, which together make up about 30 percent of the farms in that region and have incomes of $1,000 to $1,000 per year. Table 6 shows the off-farm component of the family incomes and, in comparing with Table 5, brings out the fact that off-farm income typically accounts for about half of farm income, indicating the need to consider farm and nonfarm activities together in assessing program impacts. Table 7 showing income by size of farm for each region indicates that incomes are fairly

Table 5. Net Family Income (Farm & Non-Farm)

	Farm Types													
	Deep Paddy		Irrigated Paddy		Rainfed Paddy		Upland		Fruit and Vegetable		Livestock		Average	
	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent
North	8,780	5.70	8,667	23.14	7,367	28.14	10,037	21.90	14,156	0.95	9,688	19.58	9,070	100
Central	11,993	7.75	13,489	25.85	10,198	26.17	28,706	19.77	21,849	11.31	13,932	9.15	16,505	100
Northeast	5,600	4.33	5,537	4.79	4,665	57.33	13,676	7.49	9,249	0.27	7,256	25.79	6,105	100
South	16,235	0.38	6,119	3.53	7,506	30.31	14,772	0.58	15,675	41.22	10,204	23.97	11,547	100
Total	8,537	4.68	9,761	13.03	6,116	40.37	15,716	12.31	16,945	8.62	8,864	20.99	9,521	100

Table 6. Net Farm Income

	Farm Types													
	Deep Paddy		Irrigated Paddy		Rainfed Paddy		Upland		Fruit and Vegetable		Livestock		Average	
	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent	Income Per House-Hold	Percent
North	4,697	5.70	3,839	23.14	2,551	28.14	3,680	21.90	10,770	0.95	7,580	19.58	4,281	100
Central	5,953	7.75	5,564	25.85	5,930	26.17	7,640	19.77	18,988	11.31	10,074	9.15	8,031	100
Northeast	3,571	4.33	4,045	4.79	3,401	57.33	4,321	7.49	9,216	0.27	4,996	25.79	3,939	100
South	13,507	0.38	3,361	3.53	5,447	30.31	4,196	0.58	6,806	41.22	7,043	23.97	6,340	100
Total	4,740	4.68	4,450	13.03	3,766	40.37	3,964	12.31	9,753	8.62	6,362	20.99	5,109	100

Table 7. Net Family Cash Income (Rai)

	2	2-5.9	6-14.9	15-39.9	30-44.9	45-49.9	60-139.9	140	Average
Central	15,532.79	15,660.31	8,232.49	9,013.35	11,382.00	13,431.92	22,782.71	16,479.74	12,547.19
East	22,006.16	38,576.11	11,019.22	10,981.01	9,306.00	12,495.33	2,242.37	554,051.79	12,528.80
Northeast	9,183.29	4,654.02	3,505.01	13,978.31	5,530.25	6,592.58	10,350.58	21,412.13	6,216.28
North	8,088.95	9,209.24	6,185.22	8,300.45	8,691.08	12,846.52	15,037.10	39,311.67	9,592.86
West	9,920.09	15,620.32	5,735.56	12,204.07	13,683.08	12,673.43	34,123.41	143,903.41	15,739.67
South	18,961.61	33,980.68	9,514.79	8,961.84	9,575.03	21,933.22	20,818.36	187,382.59	11,097.25
Total	10,969.32	8,339.14	5,189.90	7,162.65	8,003.52	11,234.16	18,321.88	52,418.48	9,294.71

constant over many farm size classifications with the most marked exception being for farms of over 140 rai which have notably higher incomes. Particularly at lower sizes, there are important instances of income varying inversely with farm size. This type of information is being processed by income size in identifying target groups more precisely in connection with the work for the Prime Minister on rural poverty mentioned above. Clearly the potential exists for greatly detailed target group identification.

While DAE can be instrumental in finding out who the rural poor are and in keeping track of their progress, many additional and possibly more important roles exist. Any assessment of these roles should flow from the context of rural poverty problems generally. Among several severe problems confronting the mounting of an attack on rural poverty, perhaps the greatest barrier is lack of knowledge of what will be effective. Thus there have been dramatic calls for an attack on the problems which often end in a diffuse set of policies often not followed up as to their effects, running the danger of raising expectations that are not fulfilled. Another barrier is that the institutional and policy setting is often not conducive to non-traditional policies that may be required for effective measures to reduce rural poverty.

The strategies proposed for alleviating rural poverty range from the most general—concerned with economic development of a nation at large—to highly local village development projects. Various strategies may be discussed in turn from highly non-agricultural measures at the national level to localized face to face rural programs.

(A) General Economic Development. The argument that an effective way to help the poor, including the rural poor, is to undertake measures raising the per capita income of the nation at large visualizes opportunities

being generated pervasively which benefit the poor along with others. Three paths may be pointed out through which, it is argued, the rural poor may be benefited. First, with industrialization, rural poor people will be drawn off farms into productive nonfarm jobs. Second, the raising of wages generally in the economy will raise returns to the human factor in farming. Third, as the nation's wealth accumulates, resources will become available for direct income redistribution programs to the rural poor. Against these arguments, counter-arguments are made that the rural poor may be among the last to become involved in the economic development process and that income redistribution programs at best are imperfect in reaching the rural poor. There have been few serious quantitative testings of these arguments.

(B) Measures to Develop Agriculture. These measures, including extension, other dissemination of knowledge, irrigation, land development more generally and other measures, may impact on all farmers. Depending on the country and the nature of the development measures, the "poorest of the poor" may be aided relatively greatly or they may be disadvantaged by being by-passed or subjected to new low-cost competition in farm production. By evaluating individual measures from the point of view of rural poverty, there may be some possibility for choosing measures selectively to have relatively great positive impact on the rural poor. Here a proviso is that the incidence of measures should be taken into account, taking account of any tendencies for benefits to go to land or to be imbedded in product price reductions reducing ultimate benefits to the rural poor. Systematic evaluation of agricultural development measures are rare, but the DAE work being undertaken on rural poverty constitutes a valuable contribution in this direction.

(C) Agricultural price policy and input price policy. These policies are sometimes justified partly on income redistribution grounds. Many of the same considerations in estimating effects on the rural poor just noted for other agricultural development measures apply here. Although it is often pointed out that there is considerable slippage in these policies as devices for redistributing income to the poor because their benefits to farmers tend to be in proportion to a farmer's output, explicit estimation of the effects of these policies on the poor are even rarer than for other agricultural development measures.

(D) Rural infrastructure and rural nonfarm job development. These measures, it is argued, are particularly called for where rural population pressures lead to widespread under-employment. The measures are advocated and undertaken often without any serious quantitative assessment of their contribution to increasing productive employment. Thus their effectiveness relative to other measures remains in doubt. The input-output models being developed by the Agricultural Sector Analysis project will provide part of the means for a serious quantitative assessment. They will be helped further by the social accounts matrix approach and could be further aided by rigorous models of ultimate incidence of effects.

(E) Rural human services including education, health and family planning measures. Some indicators of the effectiveness of these measures exist which have sometimes been applied in serious evaluation. Even though crude, the measures provide a basis for comparing the effectiveness of the human service approach to other approaches, though such comparisons have apparently not been made to any great extent.

(F) Village projects and other face to face measures involving working with the rural poor, which could be classified at greater length. These measures may involve minimum slippage since they are designed explicitly to impact the rural poor. They have a possible advantage of visibility. They are highly intensive of technical assistance manpower so that the number of projects is necessarily limited, and as both a positive effect but a limitation in terms of scale, they may often serve largely a demonstration purpose. Serious evaluations in terms of quantitative impact on income of the rural poor are very rare.

In summary, quantitative assessment of the effectiveness of the alternative strategies in raising incomes of the rural poor have begun but are seriously under-developed. Although a time frame of a generation or more may be involved in some of the measures and various analytical problems must be faced, it would appear possible to undertake serious quantitative evaluations of the strategies.

Turning from the knowledge barrier to institutional barriers, there may be funding barriers. There may be considerable enthusiasm in the abstract for aiding the rural poor, but inertia in policy formation and institution reshaping may have the result that relatively few resources are actually re-allocated from traditional uses. In addition, there may be barriers in the form of inertia in agency redirections and in finding new means of inter-agency cooperation. Thus a rural poverty program may be funded through existing agencies which do not give it high priority or may even undertake traditional non-poverty programs in the name of anti-poverty measures. The evaluation team has no evidence that this has happened in Thailand, but it is a syndrome observed in other countries to a greater or lesser degree.

Potential Further DAE Contributions

This section of the report has brought out that DAE has made important contributions to the alleviation of rural poverty and that serious impediments to effective rural poverty programs exist that originate far beyond DAE. Four possibilities for further DAE effort may be mentioned.

First, the income distribution analysis identifying target groups and how they are impacted in the first instance by various policies can and should continue, and there is every indication of intention within DAE to do so.

Second, the input-output work enabling a full look at how measures affect the rural poor in the context of the local economy in which they live and engage in off-farm work could expand capability to seriously evaluate the variety of specific projects and measures that are considered to help the rural poor. This could greatly help in the intelligent selection of projects, measures and policy proposals put forth in the course of government and legislative activity. As has been noted earlier in this report, modelling for this work will be required drawing on international expertise. The proposal for extension of the project contains provisions for undertaking the required modelling.

Third, in addition to evaluating specific proposals put forth from time to time, a group such as at DAE could undertake a broader quantitative assessment of the promise of alternative major strategies for raising incomes of the rural poor. The major strategies and the state of knowledge about them were discussed above. In addition to the input-output modelling, incidence models and in some cases quantification of migration

and price policy effects and other analytical supplementary analyses would be required. Nonetheless a state of the art assessment could throw much light on realistic possibilities for raising incomes.

Fourth, to mount a more concerted and effective set of policies to raise incomes of the poorest rural people in view of institutional inertia, more focus of efforts may be needed. A device such as a commission charged with recommending an overall strategy could be worth considering. Most desirably, the commission would be mandated by legislation and be appointed by the Prime Minister with a period of perhaps two years to complete its work. The DAE would be the logical research and analytic arm of the commission and would work with the commission in carrying out the broad quantitative assessment of policies outlined in the previous paragraph.

VI. OVERALL ASSESSMENT OF IMPACTS AND SUMMARY EVALUATION

In the opinion of the review team, the project has succeeded in its mission of establishing a high caliber operational capability for applying agricultural economics analysis to government policy problems in an action setting.

Evidence of several kinds supporting this conclusion has been cited in the preceding sections. The methodology of the models has been found to be up to date and generally sound. The models have been used in a variety of ways to aid policy making at the national and local levels, and the uses show every sign of continuing to expand. Many project analyses have concerned rural poverty directly. Most of the activities of the project have impacted rural poverty because of the emphasis on incomes in agriculture and low income regions such as the Northeast. The capability which has been developed has been successfully institutionalized, with Thai human and machine resources able to maintain the models and carry on the policy work after departure of the ISU team.

Because an influence on major policies affecting agriculture is achieved by a project of this kind at a low cost, relatively speaking, it is a cost effective way of promoting agricultural and income distribution objectives, and thus is cost effective in favorably affecting the lives of Thai rural farmers. As an example, the analysis of Fourth Five Year Plan alternatives led to identification and choice of a strategy that was more favorable to raising incomes in the Northeast than other strategies.

If the strategy turns out to be only very partially effective, succeeding in raising the incomes of .5 million farm families by $5 per year, the resulting $2.5 million gain in yearly income in the Northeast would far exceed the costs of the project which even in its development years has apparently not had costs beyond this range. The foregoing illustration is conservative, applying to only one of myriad uses of the models of the project. Possibly, no other activity concerned with development and rural poverty matches the cost-effectiveness of this project. The project is complementary to other kinds of activities concerned with development and rural poverty since it helps in the choice of policies and programs which importantly determine other activities.

Aside from the uses of the models as such, other products of the project are used including the data generated and the background analyses prepared for the models such as the demand and cost of production studies. Among the most important outputs of the project are the insights developed which contribute to building up knowledge about the agricultural economy of the country and which are used almost unconsciously in answering requests not drawing specifically on the models, in framing policy suggestions and in contributing to formal and informal discussions bearing on the country's future. Considering all the uses of the project outputs, both formal and informal, the benefits of the project can be deduced to include benefits resulting from avoidance of policy mistakes that occur when policies are undertaken which are untried and which have not been subjected to prior quantitative assessment. The avoidance of mistaken policies, which without the project would have been undertaken, but which are not considered

seriously once a stock of knowledge about agriculture is built up, raises the cost-effectiveness of the project above that considered above which concerned only formal analysis of specific visible alternatives.

Compared to other possible policy planning approaches, Agricultural Sector Analysis has several unique characteristics. First, being comprehensive, it forces a total and consistent view of agriculture, helping to maximize the likelihood that all important effects will be included and that estimates will be accurate. Second, Agricultural Sector Analysis gives quantitative answers helping to sort out the important from the unimportant effects of policy alternatives and helping to select policies contributing more rather than less to goals. Third, Agricultural Sector Analysis as developed in the project is an operational policy tool. The results are used directly for policy and not primarily for those in the academic community or others who might or might not take the extra step of making the results policy relevant.

Side effects of the present project may be noted. The project has trained people, adding to the intellectual assets of Thailand. It has contributed to the upgrading of an arm of government through its direct and indirect effects on DAE. Finally, the project has added a new component to the agricultural economics profession in Thailand. The by-product of interactions of Agricultural Sector Analysis personnel with other agricultural economists enhances the agricultural economics profession in the nation and contributes to the ultimate wider development of research knowledge about the agricultural economy of the country.

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Appendix A

Materials Prepared for DAE-ISU Project Review

1. National L.P. model
2. National livestock model
3. Regional models
4. Demand, marketing, transportation and nutrition
5. Macro econometric models
6. Farm modelling
7. Support sectors for agriculture
8. Population model
9. Rice buffer stock model
10. Data bank and surveys
11. Policy capabilities supported by the ASA project models

1. NATIONAL CROP MODEL

Mr. Narong Sorthang, Planning Officer

1. General Characteristics

The National Crop Model is one of the class of typical linear programming models. The major thirteen crops occurring in these models are rice, maize, sorghum, mung beans, soy beans, ground nuts, kenaf, cotton, cassava, sugar-cane, tobacco, para rubber and coconuts. Some 40 crops and crop production techniques are included in all. Each of these crops contains detailed classification by varieties, cultivation zone, type of soil, cultivation month, planting method, and fertilization or non-fertilization. For example, rice under code P010126F represents yearly transplanted rice in the zone 1, under the Soil Type 2 (irrigated land) and under fertilization.

The production of each above-mentioned crop obeys the condition that it must be at least not lower than the household demand of the farmers who grow such crops and not beyond the production goal of quantity for domestic consumption plus exports. Whether or not the production goal can be achieved depends on two factors, -- resources constraints and technical constraints. The former includes land, labor and capital while the latter involves area expansion for high-yield crop, and, fertilized area expansion. For example, the high yield rice variety is rice RD, and, the low-yield rice is native variety under the fertilized area at approximately 30%.

Technical constraints in the models are as follows:

1) Planted area for rice RD in the irrigated land.

2) Planted area for rice RD in the rainfed land only.

3) Planted area for double rice crop.

4) Planted area for rice underfertilization.

In calculating the planted areas as mentioned above, firstly the area proportions must be calculated in order to multiply with the planted area e.g. to calculate the planted area for rice RD in the irrigated land: -- the calculation of area for rice RD is based on the criteria that rice RD area proportions under planned year are depended on the rice RD area proportion of the previous year and the number of years since RD rice has been grown. A primary assumption is that the increase in RD rice area in each year increases gradually.

2. Objectives of Crop Model

At the first stage, the National Crop Model was based on 1981 crop model to serve as resources for the Five Year Planning (1977-1981), Volume IV, for the National Economic and Social Development Plan. There are six objectives of the construction of the National Crop Model that can be summarized as follow:

1) To give guidelines for production in order to meet the domestic demand and to achieve export goals.

2) To review the goals of the irrigation projects giving attention to farmers' income, opportunities for employment labour, quantity of expected production and other factors.

3) Review the possibility of extension work on new techniques of production.

4) Study the effect of low cost credit on the income of farmers and the use of labour.

5) Review the effects changes in the rates of birth of population.

6) Estimate the need for capital investment in agriculture.

3. Assumption of Each Plan

To consider possibilities for reaching the above six objectives, the Seven Alternative Plan were constructed using the National Crop Model as follows:

Plan A. Assumes all the goals can be achieved at maximum levels e.g. high quota of export, low rate of population birth (2.1% per annum), highly irrigated land.

Plan B1. Assumes medium level of accomplishment, neither high nor low, e.g. medium rate of export, medium birth rate (2.5% per annum), medium achievement of irrigation project. Thus, the adoption of new techniques and the fertilized area are lower than the outcome in the Plan A.

Plan B2. Resembles Plan B1, with the assumption that the farm crop income per farm family in the Northeast is not lower than 2,000 Baht. Such a standard of income was estimated because in Plan B1 the income of farmers in the Northeast was less than 2,000 Baht per family.

Plan C. Same as Plan A, except that the population birth rate is higher i.e. 2.8% while the birth rate in Plan A is 2.1%.

Plan D. Same as Plan A except that the rate of export is lower than in the Plan A.

Plan E. Same as Plan A except that irrigated land and the planted area of rice RD are assumed to remain at recent levels.

Plan F. Assumes no introduction of new techniques while all the other outcomes are as in Plan A.

4. Improvement for Recursive Linear Programming Model

The National Crop Model was originally built as a static single period model, with both demand and supply included in the model. To plan for any year, the demand of that year must be used, as well as the determinants of supply e.g. resources available and prices for that year. The new recursive model does not rely on demand to determine production directly. Instead, there is a flexible bound on production activities. The flexible bound will determine the maximum and minimum production quantities. The value of the flexible bound can be calculated from an equation indicating that the area to be planted in the following year is a function of planted area in the immediately previous year, the rainfall expected in the following year, and the expected price of product. The expected price is calculated from a market model for each product, which contains a variable representing the expected production obtained from the crop model. The crop model contains, in addition to the flexible bound, the expected price which is taken to be the average price during the previous 3-5 years.

Five-year planning proceeds from year to year beginning with the first year. The crop model predicts the first year production, and the market model then predicts the real price to be appear in the first year. This real price will be processed to find out realized income, the flexible bound and the expected price of the second year that will be applied to the crop model to determine the production in the second year. This process is repeated up to the fifth year.

Because of the close relations between crops and animals, the livestock model is brought in to link with the crop model. In the livestock model, which includes cows and buffaloes, there are beginning-of-year and end-of-year assets. The end-of-year assets of the first year are the beginning-of-year assets of the second year. The year by year calculations for the crop model are accompanied by similar calculations for the livestock model.

The newly introduced procedures just described are referred to as the Recursive Linear Programming Model (RLP). At present, the RLP Model is undergoing validation tests. The test will apply the model to the five year period in the past consisting of 1973, 1974, 1975, 1976 and 1977 and will focus on:

1) Planted area and yield.

2) Quantity of fertilizer for rice.

3) Number of cows and buffaloes.

4) Number of farm tractors.

After this test is completed, the application to years in the future will be carried out.

5. The Application of the Crop Model to the Cultivated Area in Various Zones for Annual Production Goals.

In each year, goals for exporting each crop are to be supplied. The next step will be for MOAC to determine which crops are to be promoted, where are to be promoted, where are suitable locations, and how large are the areas for planting. The answers to these questions have to be come out before the beginning of the farming year, which starts on April 1. The useful information is expected to include the price necessary to cover the cost of production including purchased inputs, minimum returns to labor, amounts of fertilizer which are profitable to farmers for various crops in various zones, the zones most suitable for crop production fertilizer requirement and the most efficient allocation of existing fertilizer stocks. Other information includes credit needs and employment-unemployment.

Results for the 1978/79 Model Plan are presented in the following table:

Comparison export target, and the exports from the model in 1978/1979

(unit: ton)

Crop	Export Target 1978/1979	Export predicted by the model	Shortfall from target
White rice	1,831,706	1,831,706	0
Maize	2,500,000	2,250,000	250,000
Cassava (pellet)	4,184,000	4,184,000	0
Raw Sugar	1,200,000	1,200,000	0
Rubber	500,000	455,000	45,000
Mung bean	120,000	120,000	0
Soy bean	15,000	15,000	0
Kenaf	150,000	129,674	20,326
Cotton	120,000	14,220	105,780
Tobacco (Virginia)	30,000	-530	30,530
Sorghum	239,000	239,000	0
Ground nut	14,000	14,000	0
Caster Seed	60,000	4,512	55,488

2. SUMMARY OF THE NATIONAL CROP AND BOVINE MODEL OF THAILAND

Dr. Koses Manovalailas, Planning Officer

National crop planning for Thailand as originally completed by the ISU-DAE team did not emphasize livestock especially cattle and buffalo. There is a growing concern about the slow rate of growth of cattle and buffalo relative to the future demand for draft power and meat. A basic investigation on production, consumption, and draft power requirements as well as natural resources required to produce the livestock output is necessary for future livestock development planning. It is also necessary to look at livestock side by side with crop production due to their complementary and competitive nature in power supply and resource use. Draft animals provide plowing inputs for crop production, and they also compete with crops and other products for the use of scarce land and labor. The method of the current study is therefore, to incorporate the livestock component in the 1981 national crop model of Thailand so as to allow for crop-livestock linkages. The model will check the productive capacity of the bovine industry assuming a modest change in livestock production techniques. It is also necessary to introduce different types of tractor use because of the competition between animal power and machinery especially on paddy land and upland cultivation.

A national crop and bovine model for Thailand for the year 1981 has been completed. The model requires an estimate in 1981 of the beginning livestock number by type of bovine, age group and sex. Two demographic aggregate bovine models were constructed to simulate 1977-1981 inventory. The basic data used was obtained from a national survey of

bovine between 1974-1976. The models take into account the existing stocks, the calving rate, the young mature animal transfer, domestic disappearance and export of cattle and buffalo by age group and sex. The model has been used to estimate domestic meat consumption consistent with existing inventory data. Future domestic meat consumption is assumed to depend on per capita income and population. The ratio of cattle to buffalo as well as sex disappearances estimated from the demographic bovine models were used as basic data in the national crop and bovine model.

The structure of the national crop and bovine model of Thailand for the year 1981 may be briefly described. Broadly, the model contains crop and bovine sectors. The crop sector contains major crops of Thailand including glutinous and non-glutinous rice, cassava, maize, kenaf, jute, sugarcane, soybean, tobacco, ground nut, sorghum, sesame, cotton seed, watermelon, mulberry, coconut, rubber etc. Detail for these crops includes variety, land class and production technique. The livestock sector contains cattle and water buffalo. The production of poultry, hogs, dairy cows and fisheries is not included at this time. The national crop and bovine model is a spatial linear programming model incorporating 19 producing areas and 4 consuming regions. Each consuming region encompasses several agroeconomic zones or producing areas. Crop products are assembled and shipped from the producing areas to their respective regional shipment points for export to other regions. There are two-way transportation linkages among the 4 consuming regions. For the livestock sector, the transportation linkages take into account the existence of surplus and deficit regions. Determination of surplus and deficit

regions based on regional demand and supply relationships are supported by observed livestock flow data of the Department of Livestock. As a result, the Northeast and North are designated as the livestock surplus region where as the Central Region is a deficit region. The South has been proclaimed a disease free area, with no livestock allowed to enter this area without permission from the Director General of the Livestock Department. The size of livestock shipment from the South to other regions is negligible according to the statistics from the Livestock Department. The South is thus designated as an isolated livestock region in the national model.

The national crop and bovine model of Thailand maximizes export earning of crops, Livestock and the net value of inventory change of livestock. The objective function is maximized subject to a subsistence demand for rice, zone demand for meat, regional non-rice crop demand, given resource availabilities, minimum and maximum crop production levels in each area, income constraints and technology assumed to exist in 1981. Basically, there are five classes of activities in the model; 1) production and inventory activities, including crops and bovine; 2) transfer activities, including transportation of farm commodities between and within regions, transfer of commodities from one use to another and transfer land from one use to another; 3) resource supply activities, including draft power, tractor power and feed supply activities; 4) resource demand activities including farm credit requirement, fertilizer demand and livestock feed demand; 5) farm product export including crops and livestock.

An IBM 370 computer at the Ministry of Commerce, Bangkok was

utilized to compute solution to the 1600 x 4000 equation model. The computer time required was about three hours.

The results of the national crop and bovine model may be summarized into two parts, the crop sector and the livestock sector. With respect to the crop sector the productive capacity of Thai agriculture as specified by the national crop and bovine model is capable of meeting the national target set in 1981. The model considers the use of high yielding varieties, expansion of irrigation area, farm credit, fertilizer etc, by 19 agro-economic zones of Thailand. The results of the model suggest needed adjustment in area and production for major crops in each producing zone. However, the cropping adjustment has to take into account minimum levels of crop production and minimum income requirement as constraints. The model points out the comparative advantage of producing certain crops in certain producing areas. For example, to increase rice production from 12.6 to 20.5 million metric tons paddy, the North and Central regions should be planned to produce about 65 per cent of the total production, an increase of 68 per cent of production from the base year. Likewise, comparative advantages are indicated for the use of land for maize in certain areas in the North, sugarcane in the Central, kenaf in the Northeast and North etc. The results of the model also specify the use of specific resource input for rice and upland crop to meet national production targets.

It is useful to briefly summarize the results for land, labor and capital for crop production. With respect to land use in the wet season, horizontal expansion of land use may not be possible without intrusion into the reserved forests. In the dry season only 26 per cent

of total land is engaged in crop production. Increased production could be obtained through integration of land use with other measures including irrigation, farm credit etc. Labor is a less restrictive factor of production than is land except in the Central region. Seasonal labor is restricted in many producing areas in the Central region where multiple cropping system is commonly practiced. Defining unused labor to include unemployment and underemployment, 49.2 and 77.1 percent of the total labor is unused labor in the wet and dry seasons, respectively. Capital for crops is most needed in rice production both in the wet and dry season rice crops. Total capital requirements for all crops specified in the model come to 17,070 million baht. This capital requirement could not meet without the expansion of farm credit.

In the livestock sector the problem of expansion of cattle and buffalo was investigated through two sets of models. The first model used was the demographic aggregate bovine models of the South and the rest of the regions. The second model used incorporated the livestock component into the national crop model of Thailand. The demographic bovine model was used to estimate and make projection the domestic disappearance and livestock inventory by age group and sex between 1974-1981. The results of the 1978-1981 projections shows that the rate of growth of mature buffalo for both sexes will continue to decline. The growth rate of mature male buffalo is expected to decrease at a faster rate than for females. The rate of decrease of mature male buffalo is projected to be faster than that of the mature male cattle. This may be explained in terms of tractor-buffalo substitution indicated by the national crop and bovine model. Water buffalo account for 71 per cent of the national draft animal power used in land cultivation. The

national crop and bovine model indicates that the substitution of small tractors for water buffalo will continue. There is problem of negative growth rate of mature male buffalo which is most severe in the rice growing regions of the Central, North and Northeast but not the South. Increased consumption of the by-product-buffalo meat together with the tractor-buffalo substitution may explain the depletion of mature male buffalo in these three regions. The results of the 1981 demographic bovine model and the national crop and bovine model both indicate a shortage of mature male cattle in the isolated Southern region. The cattle export target of the South could be fulfilled only at the cost of a reduction of cattle stock of the South or by violating the assumption of zero net smuggling of cattle. Further research and planning relating to the population of water buffalo in the three regions and of cattle in the Southern region appear to be needed.

The results for the model indicate that national land use is less restricting for livestock production than for crop production. About 24.2 million rai or 35 per cent of total public idle land is used for animal grazing. The second most important type of land use is non-irrigated paddy land in the dry season totalling 16.0 million rai. Other types of land used are dry season irrigated paddy land, plantation land, dry season flooded paddy land and woodland. All types of land use are less restrictive for livestock production. Wet season woodland which may be used for both crop and livestock is mostly transferred to crop production, with only small percentage of woodland used for animal grazing. Seasonal labor used for livestock poses no restriction for livestock production according to the model.

It is interesting to note that the export target, consumption, draft power and tractor requirements are met in the presence of decreasing animal stocks. In the long run, if more and more tractors, particularly small tractors, replace draft animals but consumption of draft animal meat continues to rise, more production of animals for meat either buffalo or cattle may be induced. Since water buffalo is draft-oriented while cattle is rather meat-oriented, it is to be expected that the number of draft oriented water buffalo will continue to decline but the number of meat oriented cattle will continue to increase. As the adjustment process takes place in the draft power some farmers may adopt the use of machinery faster than others, with lags in remote areas. If this is the case, policy to slow down the rate of reduction of draft water buffalo (especially in the Northeast, North and Central regions) and promote the bovine meat industry (especially in the Southern region) may be worthy of consideration. Further study relating to cattle and buffalo development in line with the aforementioned discussion is recommended.

3. THE REGIONAL CROP MODEL OF THAILAND

Mr. Praphai Wongmontha, Planning Officer

1. Introduction

The Agricultural Sector Analysis Project of the Division of Agricultural Economics (DAE), Office of the Under-Secretary of State, Ministry of Agriculture and Cooperatives, is now developing the research capability to quantify and evaluate the impact of alternative policies of the Royal Thai government on the agricultural sector. The policy impacts are to be measured as effects on earnings of agricultural resource holders, the capacity of the agricultural sector to produce food and fiber, employment opportunities, and ability to reach the poor. The linear programming model of agricultural production and transportation is the core part of the agricultural sector analysis project in DAE. One stage in building the research capability for analysis and development of agricultural policies is to construct regional linear programming models of agricultural crop production and transportation. When undertaking analysis at the national level and regional levels, it is also often desirable to conduct further analysis at the agro-economic zone level and also at the changwad level.

2. Four Regional Crop Models of Thailand

The national model of crop production takes a region-by-region approach. A series of regional models was developed with internal consistency so that they could be linked together in a national model. Work with zone models was initially developed with internal consistency so that they could be linked together in a regional model. The models

for individual zones are constructed to facilitate checks of validity of data and estimation procedures and to evaluate adequacy of the modeling process to reproduce reality. The zone models provide insights into the constraints or limitations on agricultural production and incomes imposed by geographic locations, population levels and existing institutions and policies, taking account of differences in agricultural and economic characteristics, such as differences in soil type, rainfall, temperature, type of farm and principal income of farmers and the plants that are grown in each region. Generally, the most important crop that is planted in the Central region is non-glutinous rice. The rices (both non-glutinous and glutinous) and some other upland crops are planted in the North region. The glutinous rices, kenaf, cassava and some other upland crops are planted in the Northeast region, and there are many rubber plantations in the southern region. For planning purposes, the 71 changwads have been grouped into 19 agro-economic zones. These 19 economic zones are grouped into 4 regions as follows:

Northeast region includes agro-economic zones 1, 2, 3, 4, and 5

North region includes agro-economic zones 6, 8, 9, and 10

Central region includes agro-economic zones 7, 11, 12, 13 14, 15 and 16

South region includes agro-economic zones 17, 18 and 19

3. Structure of the Regional Linear Programming Models

Models have been constructed for each of the four major regions. The Northern Region Model which is a linear programming, inter-zone competition model with four consuming and producing regions, is a typical example of these regional models. The regional crop model of the North is composed of four consuming and producing regions. These four

consuming and producing regions are agro-economic zones 6, 8, 9 and 10. The seventeen Northern Changwads have been grouped into these 4 agro-economic zones on the basis of soil type, temperature, type of farm and the principle income source of the farmers. The model contains about 500 activities and 416 rows of equations. A schematic representation of the North region model is shown in Figure below. It is designed to measure the supply and demand relationships of each agricultural commodity in the North. In the production component of the regional crop model, the technical production coefficients are defined at the agro-economic zone level. In the model of crop production for the North (and every other regional crop production model), the production of livestock and of most fruits and vegetables do not enter the model directly but are assumed to be maintained at constant per capita consumption and resource use leveles. The activities in the model include one or more production processes in each zone for each commodity on each type of land during each season where production has been observed historically. Separate activities have been defined for the same commodity wherever a distinct production process could be identified that would affect the resource requirements, costs, and (or) field. In addition to the production activities, the model contains separate supporting activities for each zone. These include; subsistence demand (on farm consumption) for selected commodities; marketing activities for each commodity; transportation activities among zones and regions; buying of fertilizers (pure Nitrogen and Phosphorous elements) activities; capital borrowing by month from institutions, and capital transfer activities.

The Regional Crop Model of the North has separate bound sets for each zone which include land by type and month, labor by month,

CROP MODEL IN NORTHERN THAILAND

RESOURCE SUPPLIES			CROP ACTIVITIES				SUBSISTENCE DEMAND AND MARKETING ACTIVITIES								TRANSPORTATION ACTIVITIES										BUYING FERTILIZER ACTIVITIES:								BORROWING ACTIVITY FOR ENTIRE YEAR	TRANSFER CAPITAL ACTIVITIES
			RICE	CORN	POTATO	OTHER	CHICKEN	PORK	BEEF	GOODS	LABOUR	ANIMAL	SEED TO	FARM TO	EXPORT TO BANGKOK				EXPORT TO CENTER TO RES				UNLOAD AGRI CENTER TO RCS				NITROGEN				PHOSPHORUS					
															BOK	BAR	ZO3	ZO4	NOR	ZO2	ZO3	ZO4	NOR	ZO2	ZO3	ZO4	ZO1	ZO2	ZO3	ZO4	ZO1	ZO2	ZO3	ZO4	MAR TO FEB	MAR TO FEB
C_i			$-C_1$	$-C_2$	$-C_3$	$-C_4$	$-C_5$	$-C_6$	$-C_7$	$-C_8$	$-C_9$	$-C_{10}$	$-C_{11}$	$-C_{12}$	C_{13}	C_{14}	C_{15}	C_{16}	$-C_{17}$	$-C_{18}$	$-C_{19}$	$-C_{20}$	C_{21}	C_{22}	C_{23}	C_{24}	$-C_{25}$	$-C_{26}$	$-C_{27}$	$-C_{28}$	$-C_{29}$	$-C_{30}$	$-C_{31}$	$-C_{32}$	-0.12 ... -0.01	0 ... 0
LAND I MAR-FEB	I		{1}	{1}	{1}																													
LAND I MAR-FEB	II		{1}	{1}	{1}	{1}																												
LAND I MAR-FEB	III		{1}	{1}	{1}	{1}																												
LAND II MAR-FEB	II		{1}	{1}	{1}	{1}																												
LABOR MAR-FEB	I		{1}	{1}	{1}	{1}																												
CAPITAL MAR-FEB	I		{2}	{2}	{2}	{2}																												
TRANSFER YIELD	ZO5	I	-Y				1	1							1				1				-1											
	ZO3	II		-Y					1	1						1				1				-1										
	ZO4	III			-Y						1	1					1				1				-1									
	ZIO	III				-Y							1	1				1				1				-1								
RCAS OF SUBSIS-TENCE DEMAND.	ZO6	I	-Y				-1																											
	ZO3	II		-Y					1																									
	ZO7	II			-Y					1																								
	ZIO	II				-Y					1		1																					
ROWS OF FER, N FOR RICE	ZO5	I	N																								-1							
	ZO3	II		N																								-1						
	ZO7	II			N																								-1					
	ZIO	II				N																								-1				
ROWS OF FER, P FOR RICE	ZO6	I	P																												-1			
	ZO8	II		P																											-1			
	ZO9	II			P																											-1		
	ZIO	II				P																											-1	
R. CENTER OF REGION		II																	-1	-1	-1	-1	1	1	1	1								
R. EXPORT TO BANGKOK		II													1	1	1	1																
RD. VAR. LANDS I	WET SEASON	II	1	1	1	1																												
RD. VAR. LANDS II	WET SEASON	II	1	1	1	1																												
RD. VAR. DRY SEASON		II	1	1	1	1																												

capital by month, and capital borrowing by source. In addition to the bound sets for each zone, point demand estimates which were taken from the national model have been added in the form of regional marketing bounds for each selected commodity. These point demand estimate serve as upper limits for on-farm consumption and off-farm marketing, at the prices specified in the model. These restraints force the four zones to compete against one another for a limited region market.

4. Assumptions and Data for Alternative B_2

The Division of Agricultural Economics developed seven plan alternatives to study possibilities for meeting the agricultural development planning objectives of the government. These seven plan alternatives were identified and evaluated for the Fourth Five Year Development Plan (1977-1981) for Agriculture of Thailand. Plan alternative B_2 is the principal plan alternative considered as the most desirable development strategy. The other six plan alternatives (A,B,C,D,E, and F) were illustrative of alternative combinations. Under alternative B_2, demand factors were assumed to reflect "medium" population growth and "medium" levels of exports. An additional assumption of the alternative B_2 is that it specifies an income policy objective. The solution to alternative B_2, indicates the distribution of crop production by region and land type required to meet specific minimum regional income levels per farm in the Northeast which is the lowest income region. The minimum levels specified were at least equal to those of B.E 2516.

The production coefficients which have been used in the model were revised from the coefficient data for 1971-76 using the General

Farm Survey of 1973-74. The prices of the commodities which have been used in the model were the average farm prices of 1973-1975, except for those of non-glutinous and glutinous rice that the support prices were used.

5. Solution Results of Regional Model for the North

To discuss results for the North, 28 activities entered the B_2 solution for this region. The most important activity in terms of total land use is rice (non-glutinous and glutinous-rice) which used 13.03 million rai and the least amount of land is used by jute, which used only 100 rai in the region. Following rice, the most total land is used by maize (feed), mungbean, sorghum, soybean, and cotton. The leading user of each land type are as follows: Land type I, rice (glutinous and non-glutinous) at 2.5 million rai; Land type II rice (glutinous and non-glutinous) at 3.7 million rai; Land type III rice (glutinous and non-glutinous) 6 million rai; and Land type IV maize (feed) at 5.4 million rai. Of the total 19.2 million rai land months available in the region, 24.9 million rai are utilized in the B_2 solution.

Total labor utilization in the region is about 31 per cent of total manhours available. Rice used the greatest quantity of labor input at 1,126.13 million hours and jute the least at 17 thousand hours. Following rice, the most labor is used by maize (feed), tobacco, mungbean, sorghum, and cotton.

Total capital use from all sources was 2,517.326 million baht with 16.9 per cent derived from farm sources. Rice used the largest amount of capital, followed by maize (feed), mungbeans, soybeans, sorghum, garlic, and tobacco.

Total net revenue for the region is estimated in the solution at 16,084.592 million baht. The most important crop is rice, which contributes 10,633.521 million baht or 66.1 per cent of the total, followed by maize (feed), tobacco, mungbeans, soybeans, sorghum and cotton which contribute 15.9, 7.1, 4.7, 1.4, 1.3 and 1.1 per cent respectively.

6. Some Policies for Agricultural Development Planning

The results of the analysis for the use of agricultural resources (land, labor, and capital) in the North region have shown that the use of land types II, III and IV (including multiple cropping) exceeded 100 per cent and only land type I is used 100 per cent. But there are some months (1-3 months) that each land type is not used for planting. Therefore, to use all types of land efficiently in order to increase more production and income for farmers in the North. The policy makers for the agricultural development planning should set up firstly the policy on the system of cropping pattern to the farmers by introducing new plants that can be grown and harvested in short period (2-3 months).

The second policy that should be made for the agricultural development planning is the policy on the increase in labor use in the North region. The total labor used for crop production in the North region is about 31 percent of the total available labor. Sixty-nine per cent of the total available labor for crop production are not used. Therefore, the government should suggest the farmers use more labor for their income increase. They can use more labor in two ways in order to get more income. Firstly, they might use labor available for the plants that can be grown and harvested in short period or they might use the labor available for the livestock and other animals raising.

Secondly, they might move the rest of labor available for crop production of agricultural sector to use in non-agricultural sector. But before moving the labor in agricultural sector to the non-agricultural sector, the total amount of labor that can be used in non-agricultural sector should be examined and considered carefully.

The third policy that should be mentioned here is that the policy on the agricultural credit for the farmers in the North region. The percentage use of capital to the capital available is about 593 percent. This means that the North region does not have enough capital for crop production. In fact, the capital is one of the most important input among all of the agricultural inputs. If the farmers do not have enough capital, the full production will not be achieved. Therefore, in order to produce more and also to increase more income of the farmers in the North region, the sufficient agricultural credit supply should be available and expanded to the majority of farmers. Furthermore, this agricultural credit under reasonable rate of interest should go to the farmers whenever they need.

7. Comments on the Present Work and Prospects for Future Applications

7.1 Present work dealing with th modeling of regional agricultural planning includes the followin :

7.1.1 The improvement and revision of data. Improvements and revisions have been carried out by using the latest data of the General Farm Survey of DAE and also the latest data from the other surveys of the government agencies, for example, the data of the survey on agricultural population of National Statistical Office and data from the Department of Irrigation. These update data can be used to estimate

new coefficients in the specific area correctly and accurately. These improvement and revision of update data are now under way along with the National modeling, regional and farm modeling of the agricultural planning sector analysis of DAE.

7.1.2 Work dealing with agricultural policies. At present, the Agricultural Planning for the Region and Farm Levels Section is now studying and conducting the analysis on the responses of farmers to policies for agricultural development. Those applications are the following:

7.1.2.1 Study of the policy for the improvement of the lowest wage rate. This study is being conducted in order to ascertain the movement of the farm labor if the wage rates in non-agricultural sector are changed.

7.1.2.2 Study on the policy for the fertilizer used and the price of fertilizer.

7.1.2.3 Study on the policy for the irrigation.

7.1.2.4 Study on agricultural inputs.

7.1.2.5 Study on the use of land in agricultural production.

7.1.2.6 Study on the policy for the prices of agricultural commodities with emphasis on agricultural marketing.

8. The Improvement of the Regional Crop Models

The Agricultural Planning for the Region and Farm Levels Section is now studying intensively the farm model in each changwad, giving attention to the structure of the model and the response of the farmers in each changwad. The details on the demand of some important crops for example, rice, are also being studied at the region, changwad

and farm levels.

The original coefficients of the regional model are being revised and improved correctly in order to be consistent with the farm model, the data from the General Farm Survey in BE 2518-19 of the Division of Agricultural Economics. Progress to date has included computerization of the data of the 2518-19 General Farm Survey and data checks on consistency for the Northeast region. Also, a document has been prepared by the regional group outlining the model structure and the computer progress and calculation procedures for the updated coefficient generation. It is planned to finish the Northeast model in the next few months and complete the remaining three models by the end of the year.

With the improved coefficient generation capability and data sources, the models will have an increase over all reliability. The models will give greater spatial detail as production is identified at the Changwad levels and for the smaller zone models production is further disaggregated to represent a set of farm classes by changwad. These farms will reflect size, type, and ownership difference, and policy analysis will be able to differentiate these farm classes as target groups for program benefit and cost determination.

4A. COMMODITY DEMAND ANALYSIS

Wayne D. Ellingson

Commodity demand analysis is a process of quantifying the structural and behavioral relationships of commodity markets. In particular, commodity models explain or quantify how the interactions of demands (both domestic and foreign) with available supply to determine a market clearing price.

The process of model estimation consists of three basic steps. The first step is to study the organization and structure of the commodity market by collecting data and information about the market under study. The second step is to specify the structure of the commodity market by mathematical equations. The final step is to estimate the structural parameters of the specified equations. In this last step, statistical or econometric techniques are used to obtain the estimated parameter values.

Applications of Commodity Models

Commodity models have been used by the Division of Agricultural Economics (DAE) in two basic ways. One use is as "stand alone" models for policy analysis. By using the software programs developed by the Computation Center of DAE for the IBM 1130 Computer, reduced form or impact multiplier analysis can be performed on the commodity models. For models that are linear in both the parameters and the variables the reduced form compueter package (1) can be used. For models that are linear in the parameters but non-linear in the variables Gauss-Seidel techniques (2) are needed to determine the impact of the multipliers.

Using these techniques the commodity models can be simulated

either over the historic observation period usually for model validation purposes or predicted values in the future years can be obtained for policy analysis. This method can provide the policy decision maker with detailed information about the possible effects of various policy instruments. Later in this paper, an example of how this type of analysis was performed by DAE using the rice model.

A second area in which DAE has utilized commodity demand models has been in the development of the market sector in the linkage between the agricultural sector programming model (ASA) and the national macro econometric model (MM). In the early stages of this sector analysis project the importance of being able to quantify the interactions between the agricultural and non-agricultural sectors of Thailand was recognized. With this idea in mind, a macro econmetric model of the national economy was developed. A description of this model is provided by Stephenson and Itharattana (3).

Two versions of the macro model have been estimated. A forty-five equation model which is linear in both the parameters and variables and a fifty-five equation model which is linear in the parameters but non-linear in the variables. In both versions the definition of variables follow closely those used by the National Economic and Social Development Board of Thailand in the national income accounts.

Efforts are underway to complete the linkage between the agricultural sector model and the macro econometric model. A key element of this linkage is the existence of a market sector consisting of commodity demand models that would determine the domestic and foreign demands, farm and wholesale prices based on the outputs from the agricultural sector planning model. The results from the market sector would determine

the values of some of the predetermined variables in the macro econometric model. Likewise, the prices obtained would be used in determining the flexibility constraints for the next iteration of the recursive programming model. For a more complete description of the methodology used in the linkage process see Stoecker, Nicol, and Sriplung (4).

Progress of Commodity Demand Models

At the present time commodity models have been completed and the results published for kenaf (5), Mungbean (6), soybeans (7), and cotton (8). Estimations of the maize model is done and a report has been written but is waiting to be published. It should be pointed out that even though results have been published, the models are re-estimated each year as a new observation becomes available. This is necessary because of the relatively short time series available for each commodity model.

Preliminary models have been constructed for rice, sugar, and rubber. Work has been started on the dairy products and cassava in terms of preparing balance sheets and specifications of structural equations but no estimation has been accomplished yet.

Problems encountered in demand analysis

The most difficult problem encountered in developing commodity models has been data limitations. In most cases these data limitations consists of lack of times series data for key variables. In other cases existing data might be of questionable reliability.

Although it is impossible to give any hard and fast rules about data problems that would be true for all commodities, a few general observations can be made. Probably the most reliable data used in

commodity models is the trade data. A rather long time series exists and except for cases where smuggling exits to avoid Customs taxes or duties the error is probably small.

Price and production data are next in order of reliability, although they vary among commodities. More recent production data is judged to be less subject to error as statistical survey techniques have been used to estimate crop production. Price data for commodities that are subject to government ceiling or controlled levels are sometimes subject to more error than non-regulated commodities.

The most severe data problems exist in determining domestic utilization after the commodity leaves the farm gate. For most commodities only very sketchy information is available about quantity of processing of agricultural commodities.

Publications such as Industrial Statistics by the Ministry of Industry (9) and Manufacturing in Thailand by the Business Information and Research Ltd. (10) are helpful but not complete enough yet to be fully effective. As DAE makes progress in formulating regional input-output models and integrated linear programming and social account models more complete data will be available about agricultural processing industries.

Policy Analysis Using the Rice Demand Model

Each year the government of Thailand is faced with the task of determining an optimal trade policy in terms of the level of rice exports. If exports are allowed to get too high, the rise in domestic price could threaten political stability. If a restrictive trade policy is adopted foreign exchange earnings are lost. Policy instruments to control the level of exports has traditionally been the level of rice

premium but in recent years the rice reserve requirement and quotas have become important.

Last year Thailand experienced a very severe drought. The most severely effected areas were the Northeast and parts of the North. Glutinous rice and maize production were especially hard hit. Compounding the problems were that rice exports for the calendar year 2520 B.E. were at record high levels and carryover stock was lower than normal.

After preliminary estimates of rice production were made by the Statistics Section of DAE, Dr. Somnuk supervised the simulation of the rice market to determine the effects of the drought and alternative export targets. This simulation was accomplished by performing reduced form analysis on the rice demand model. Domestic demand, FOB price, rice premium rates, and export targets were specified at alternative levels. Thirty-six possible combinations were considered. The interactions of the Bangkok wholesale price of rice and the revenue derived from exports were studied. The results of this simulation were presented to the Minister of Agriculture along with recommendations for export targets for the year.

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4B. TRANSPORTATION-STORAGE-PROCESSING MODEL FOR RICE

Mr. Chammon Watana, Planning Officer

1. Introduction

Rice is a major economic crop of the country as a staple food of the population, with several thousand million baht export earnings obtained from rice each year. Great efforts have been made by the government to see that the rice growers can sell their products and that consumers can buy cereal food at reasonable prices. The conflicts of objectives have caused many difficulties and problems.

2. Objectives and Scope of Study.

2.1 Objectives

2.1.1 Survey and collect data on storage, processing and transportation of rice.

2.1.2 Study the structure of rice marketing.

2.1.3 Construct the TSP Model.

2.1.4 Find out the economic locations of storage and rice mills in order to minimize the costs of storage, processing and transportation including the study on price stabilization, buffer stock, rice consumption, estimation and export allotments from each locality.

2.2 Scope of Study

The study of transporation, storage and processing of rice covers the all areas of agro-economic zones 1-19. In this primary report, attention will be focussed on rice marketing in Zone 3 for the purpose of estimating maximum profits from transportation, storage and

processing or milling.

3. Zone 3 TSP Model

The farmers who grow rice in each Changwad of the agro-economic Zone 3 keep rice for sufficient home consumption throughout the year. The balance is sold out to the paddy merchants who resell the same to the rice mills. The miniature rice mills operate for the farmers while the large-scale rice mills produce white rice and send it to wholesale dealers. The latter in turn dispose of the rice to retailers, the last marketing point being urban consumers. From rice balance sheets, it is found that Changwad Khonkaen did not have sufficient local supply of rice (1976/1977) for sonsumption and had to inport rice. The other three Changwads, -- Kalasin, Mahasarakham and Roi-Et, could produce rice beyond local demand and therefore sold the surplus to Changwad Khonkaen.

4. Summary comparison of Model Experimentation and of Data Collected from Agro-Economic Zone 3 Survey.

It is apparent that the model should give outcomes resembling the data complied from the DAE I-O survey if some constraints in the model are not involved e.g. free export of paddy rice out of the area and miniature rice mills allowed to mill rice not only for farmers but also for other consumers. The model could be rectified to reflect the same flow of rice to the channels of trade surveyed by the DAE. For instance, it is found that the large-scaled rice mills mill rice for retail dealers, wholesale merchants and local consumers and also for export out of the area. But, from the experimental model, the large-scaled rice mills mill rice for wholesale dealers and also export out of the area while the retailers will receive the rice from the farmers to resell to the consumers. However, problems might follow from changing

the model i.e. when the large-scaled rice mills sell rice to the wholesellers, retailers and consumers directly. There must be data to control or to determine the large-scaled rice mills also sell rice to other sources.

4C. NUTRITION PROJECT .

Mrs. Anchalee Urarknl

Economics Research Branch

Preface

In the process of national development planning, activities are often planned without policy co-ordination with other related fields. For example, some planners may concentrate on the increase in income from exports. Simultaneously, the national plan for nutrition will give full efforts to alleviate malnutrition food among poorer groups of the population. Because the national resources are limited, the production for export is competitive of the use of produce for domestic consumption. The Division of Agricultural Economics which has the responsibility of designing agricultural development plans and the Institute of Nutritional Research of Mahidol University which is responsible for preparing the National Nutrition plan have great concern for the importance of agricultural development planning in relation to the standard of nutrition of the Thai people. These two institutions have worked together in setting up a special project called "Integrated Agricultural and Nutritional Planning and Policy Analysis in Thailand" with the request for assistance and support from the Agency for International Development. In the course of this project the nutritional planners and the agricultural planners will work together in collecting and analyzing data on agriculture, economic life, nutrition and health conditions of a nationwide farm family sample. The available data will be processed as components of the national production model using linear programming methods under the supervision of the DAE staff.

The results of this study will be used in the preparation of next national economic and social development plan.

Objectives of Study

1) To study the agricultural production conditions, economic conditions, nutritional conditions, general sanitation and health including farm family environments in various locations of all changwads.
2) To process the data from the Item 1) as components in the construction of agricultural production model by Changwad, Zone, and at the national level.
3) Establish policies to be integrated with the national economic and social development plan.

Method of Study

The Division of Agricultural Economics is conducting fundamental study through purposive sampling of farm families. The study covers income elasticity of demand for food, per-capita consumption, level of nutrition intake, and least cost diet model with and without consumption preference. The survey includes farm bookkeeping so that the farmers can keep daily records on income and expenditures for one year period. It also coyers food consumption by weighing every kind of foodstuff before preparing, weighing of finished food eaten by each member of family within one day. Such measurements by food weighing are conducted on three occasions during a year in order to eliminate the

influence of seasons that effect food consumption. It is hoped that this project will be in first operation in October, 1978 and completed in September, 1981.

The first phase of the project will focus on collecting of data on food consumption, family income and expenditures, and nutritional conditions of villagers in various areas where the primary surveys had been completed before.

The second phase will concentrate on the construction of production models by having the eating habits of individuals and nutritional conditions as variables in planning for production at farm level, Changwad and Zone levels respectively, followed by constructing the national production model.

The method of two-stage sampling will be used. Family samples at the amphur level in every changwad will be selected. There will be a sample of 20,000 from the selected areas all over the kingdom. From the sample, a series of field surveys will be conducted:

1) General Farm Survey: The interviews collect data on general agricultural facts including social conditions and village environments. All 20,000 in the sample will be covered.

2) Survey on nutritional conditions and fundamental sanitation of one family of every six families: The interviews will focus on family conditions such as statistics on birth and mortality of children (son and daughter), frequency of food consumption i.e. various kinds, and environmental sanitation.

3) Nutritional and Agricultural Secondary Survey: One third of the total sample will be interviewed comprehensively on capital and

extra returns, one half of these will be asked about food consumption by all members of family throughout the past 24 hour period. The field work will include weighing of food, physical weighing, height measuring, and detailed questions concerning pre-school groups. This nutritional survey of the same family will be repeated twice during the rainy season and in the winter season.

The overall survey project will be conducted twice during 1979 and 1980. After that, the data will be analyzed, the construction of production model will be processed, and the policy recommendations will be submitted for preparing the agricultural development outlines to be included in the national economic and social development plan.

5A. MACRO-ECONOMETRIC ANALYSIS OF ECONOMIC ACTIVITY IN THAILAND 1962-1974

by Dr. James A. Stephenson

Mrs. Kajonwan Itharattana

Objectives

The ultimate purpose of the macro-econometric modeling effort is to link an econometric model of the nonagricultural sector with a linear programming model of Thai agriculture being developed in the project. This paper, however, does not reflect this linking process, which is considered in the next paper. The present paper presents two stand-alone models which treat the agricultural sector in a fairly aggregative manner and will be used in the linking.

Methodology

Model I is a 45-equation model, which was constructed specifically as linear in both parameters and variables. It is a completely "real" model, in that there is no consideration of monetary sector and price levels. The model has 36 behavioral equations and nine identities. The behavioral equations consist of seven general groups of equations:

1. Private Personal Consumption
2. Government Expenditure Equation
3. Export Equation
4. Import Equation
5. Gross Fixed Capital Formation equation
6. Output equation
7. Income Distribution equation.

The definition of variables and the method of aggregating

variables were chosen to match the definition of variables used by NESDB in the national accounts.

The equations inthe model are estimated by ordinary Least Squares, using annual data for the period 1962-1974. Two-stage Least Squares cannot be used directly because of the small number of time series observations. An alternative here would be to use principal components to estimate the first stage regression, but at present, there is no principal components program operational at DAE, and so we have stayed with Ordinary Least Squares.

Model II is a 55-equation model, which remains linear in the parameters but allows for nonlinearities in the variables. It varies from Model I in the following ways:

1) The private consumption expenditure equations are now specified in per capita figures rather than in levels;

2) Three of the four import equations are specified in per capita terms rather than in levels;

3) The gross fixed capital formation equations have been disaggregated from two to seven equations;

4) Six of the seven output equations are specified in a modified Cobb-Douglas production function form and the seventh in an output per worker form;

5) A fairly simple monetary and price sector has been added to monetize the model and to capture the effects of changes on the real sector of model.

The government expenditure, export and income distribution equations remain unchanged from Model I.

Model II is likewise a self-contained model, which attempts to correct some of the deficiencies in Model I. It is very similar in overall structure to that of Model I but has the additional flexibility of following nonlinearities in the variables allow us to ask some further economic questions in terms of the effects of particular variables.

5B. LINKAGE BETWEEN THE MACRO-ECONOMETRIC MODEL AND THE RECURSIVE NATIONAL LP MODEL

Miss Yaovares Banduknl, Planning Officer

Objectives

The main objective of the particular planning model whose structure is discussed here is to link the agricultural sector parameters from the recursive linear programming model of the agricultural sector with the macro-econometric model which reflects changes in the total economy.

The linkage is being developed to allow those in policy making positions to relate the effects of changes in one sector (in this case agriculture) to the remaining sectors of the economy. It is also also desirable to know the impacts of changes in the nonagricultural sectors on the agricultural sector.

Methodology

The linkage between the macro model and the agricultural model is recursive in two ways. First the linkage is recursive in that variables in the current year depend on variables in previous years. Secondly, the linkage is recursive within each year in that certain macro variables are predetermined with respect to the solution of the agricultural sector model, as for example consumer incomes, and agricultural and non-agricultural population. In turn the levels of agricultural output become predetermined and influence the solution of the remaining macro variables.

The linkage of the programming model and the macro model occurs in three steps.

1. Annual update

   a. Update Policy instrument based on previous results

   b. Update population projection, farm and non-farm. The results of the separate demographic models will be used in this step.

   c. Update Imports and domestic production of inputs used in agricultural production

   d. Update demand equations for population changes, PDY-1, previous consumption levels

   e. Determine non-agricultural employment

2. Agricultural Sector Model

The recursive linear programming technique is used to estimate the quantity supplied of each agricultural commodity in each of 19 agro-economic zones. The behavioral assumption is that farmers maximize expected profits subject to previous production levels, resource supplies, capital availability from farm and non-farm sources, household consumption considerations and supplies of non-farm inputs. Currently, the crop and bovine production model with zone level detail are being prepared for the linkage.

Steps within the Agricultural Model

1. Determine output of agricultural products exogenous to the recursive linear programming model (RLP), for example fruits, vegetables, fishing, swine and poultry production.

2. Determine remaining land, labor, capital supplies available for use in the RLP of crop and bovine production.

3. Set flexibility coefficients for RLP.

4. Solve RLP, sum for agricultural output, employment, and the use of resources such as fertilizer, machines, seeds, etc.

5. Use agricultural outputs as predetermined variables in econometric commodity models to determine realized wholesale price, domestic consumption, exports.

6. Calculate farm gate price and farm income, expected price for the following year.

7. Determine value added from agricultural processing.

8. Calculate value added from agricultural purchases from non-agricultural sector.

3. Linking with the model of total economy

The linkage between agricultural sector model and the macro model is completed by solving remaining macro econometric model equations where the agriculture related variables are predetermined variables in these remaining macro econometric model equations.

Remaining items:

1. Consumption of non-agricultural commodities
2. Government expenditures
3. Output of non-agricultural commodities
4. Exports of non-agricultural commodities
5. Gross domestic product, national income
6. Distribution of national income, personal disposal income
7. Investment, depreciation, capital stock

The macro-econometric model receives agricultural and agricultural related final consumption levels, value added estimates, exports,

imports and farm income estimates from Agricultural sector model. The macro model uses the predetermined agricultural variables in determining non-agricultural consumption, value added, exports and imports. The estimates of gross domestic product, national income, and personal disposal income are also determined in the macro model.

The second version of the macro model which is being used for the linkage, contains 55-equations including nine accounting identities. The data base for the model extends from 1962-1975.

The linkage will retain the essential structure of the macro model but will substitute disaggregate programming models of agricultural crops and livestock production processing marketing and transportation for all or part of the relevant macro equations.

The combined macro-agricultural production model will be recursive in two senses. It is recursive in the traditional sense that current year variables are independent in part on their values in previous year. However, within each year the models are recursive in the sense that the agricultural model depends on macro equation to set or partially determine domestic demand for agricultural product exports, labor supply and other factors which affect agricultural inputs and outputs. The outputs from the agricultural model then become predetermined variables which are used to solve the remaining equations of the macro model. The current period results of the combined macro linear programming system are then used to update the agricultural and macro model for the following year.

Aims:

1. Influence of export expansion and inport substitution

policies on farm income and the balance of payment

2. Effect of Agricultural price policies on the cost of living

3. Ability of economy to provide employment for growing population

4. The effect of Agricultural development policies on the non-agricultural sector and total economy as related through:

   a. The level of farm income

   b. The level of agricultural employment

   c. Changes in investment in agriculture and related agriculture industries

   d. Changes in purchases of inputs by agriculture from non-agricultural sector

5. Annual update to the Five-Year Development Plan

6. FARM LEVEL MODELS

Mr. Boontham Phommanee, Planning Officer

1. Introduction

In general development planning is required when existing conditions do not meet theneeds of people in the country. Thailand's current agricultural conditions do not meet theneeds of Thai farmers as reflected in many factors such as high population growth, low income of farmers, high unemployment among agricultural workers, low agricultural productivity, limited agricultural land and reluctance of farmers to adopt new technology, etc. To solve these problems, studies and analysis of alternative agricultural development plans are needed. The goals for agricultural development planning should help the farmers to increase their income and improve the income distribution among Thailand's farmers themselves and between farmers and thenon-farm population and to increase employment opportunities. The Division of Agricultural Economics, Office of the Under-Secretary of State, Ministry of Agriculture and Cooperatives is developing and expanding its analytical capability. The national model was constructed to study the aforementioned objectives. Later, REgional models of agricultural production were constructed to give more detail on producing region, consuming region, and demand and supply response for agricultural commodity and interaction between that region and the remaining regions of the country. These models would maximize profit under constraints at the zone level. To fully investigate the effect of agricultural development policies including the effects expressed among the farmer groups and to generate information on the

distributional effects of simulated policies, the existing national, regional and zone level models need to be expanded. These models are designed to provide more aggregated information and are not well suited for distributional analysis. Farm level models are being constructed to indicate the advantage and disadvantage of different farm groups. It will benefit the planner to know how much each group of farmers could produce at the changwad level which is more specific than the regional model. For consistency between the national, regional and farm level models, farm level models should be developed so they can be linked with these models. The series of regional models were developed with internal consistency so they could be linked together in the national model. Also, a series of zone models was initially developed with internal consistency so that they could be linked together in a regional model. The present effort is to develop changwad models which can be linked together in a zone and which contain a farm level detail capable of reflecting the distributional effects of policy on the various farm groups as delineated.

2. Methodology for Selecting Farm Types, Sizes and Generating the Technology Coefficients is based on general farm survey data of 1975.

Farm type is accomplished by grouping the holding of the farms that have the same land characteristics together. Farmers who have the majority of their land useable for deep flood paddy are classified as deep flood paddy farms, irrigated paddy as irrigated paddy farms, rainfed paddy as rainfed paddy farms and for upland are classified as upland crops farms. The fifth type of farm produces only fruit trees. And the sixth is livestock farm. The frequency distribution of net income

from farming from the GFS in 1975 was the major criteria in dividing farm by size. For each farm type, the farms are grouped into a frequency distribution of eight classes. The classes which dominate the distribution are added to give the medium far size. The small far size is the sum of those groups below the medium size and the groups above the medium size are aggregated to the large size of farm. To create a basis for this model system, farms have been divided by six types, three sizes and three land owernship categories. This gives a total of 54 possible type-size-ownership classes. For calculating the coefficients to represent the farm characteristic data from the two general farm surveys (1975, 1976) and supplementary data on soil type and rainfall are being used. Each of the farm observations from those surveys will be combined using a system of dummy variables to reflect size, type, irrigation, year, and changwad characteristics. Using this method at a detail sufficient to give farm characteristics creates the input data for the farm modeling system.

3. Structure for the Farm Models

For planning purposes, the 71 changwads have been grouped into 19 agro-economic zones. These agro-economic zones from the spatial components of the national agricultural sector analysis model. Present efforts are to disaggregate these 19 zones into 71 changwads as the spatial component for the four regional planning models presently in use in DAE. The farm level modeling program will differentiate farm characteristics within these changwads Linear Programming model with monthly detail on land, labor and capital use are being constructed for every changwad. The changwad models are linked to the solution of national

model through the regional prices determined for the crops in the national model. The farm level models are solved as a profit maximixing model subject to the resources available the fixed demand of rice for farm consumption and themarket prices specified.

Resource Constraints

Land constraints in the model are estimated by type and size of farm for each changwad. Labor constraints in each size and type of farm are obtained from DAE general farm survey in 1975. The basic labor supply is defined as the number of the economically active population 14 years of age and over. Estimates of the total agricultural labor supply were calculated by multiplying the population economically active in agriculture by the length of the average working day (8 hours) and number of days in a month to obtain the total month supply. Capital resources by size and type of farm for each changwad were obtained from DAE, GFS, of farm income and expenses in 1975.

The fixed on farm demands is analogous to the motivation of a subsistence farmer who wants to maximize his off-farm cash sales after first ensuring that there will be sufficient production to meet family consumption needs.

Variable Cost

The farm component of variable cost for each producing activity is the sum of purchased inputs from the non-farm sector plus the value of farm supplied inputs coming from other farm sectors, including:

fertilizer

pesticide

fuel, oil, repairs

hired machinery

value of animal inputs

manure

food for workers

miscellaneous

4. Present and Further Work

Continuing work in farm modeling in DAE will emphasize the relationships and interaction of the local farm units. More study will be completed on defining unique farm type and size units. Capital availability, labor sufficiency, and crop-livestock relationships will be considered along with the quantity and type of land in defining type and size of farms. Resource interactions among the farm for inputs will be more fully modeled. This is especially critical in areas of fertilizer, capital and hired labor competition among the farm types and sizes.

Estimating the appropriate production coefficients for each of the farm types and sizes will be completed simultineously with the on going program (SUPER CARP) to develop a new coefficient estimating system for the national and regional models.

In this manner, consistency of definition and aggregation procedures can more readily be maintained.

As these zone models incorporating the farm classes are completed, hopefully early fall for the first zones, they will provide the DAE with the capability to expand their resource, output, input, and income and price analysis to reflect the direct impacts on the specified farm classes. This capability represents the initial steps in expanding the model's

spatial, and analytical capability in response to greater and more frequent requests for analysis from the changwad planners. Also, the farm class delineation will facilitate the reporting of relative farm impacts resulting from specific agricultural development policies.

Some of this expertise is already being used as the DAE farm policy staff respond to problems in farm system development in the governments land settlement program in the strategic areas of the Northeast. More of this type of support will be provided based on a sound analytical background as these farm class models are completed at the zone levels and some of their more critical features incorporated into the regional and national modeling systems.

King's Project on Agricultural Development in Prachin Buri Province

The Development Planning Project in this plain area near the hills or mountains of eastern Thailand was developed many years ago. The objectives were attacking the communist terrorists and taking over the areas that were controlled by the terrorists. This project was less fruitful because as the troop moved outof theses areas, the areas came under the control of the terrorists again. With the most capability and genius of the King, the package program on agricultural development has been suggested. A report of the high rank advisor of the king (a privy counsellor), the Deputy Ministry of Agriculture and Cooperatives, a Deputy Under Secretary of State, the Director of the Fishery Department, the Deputy Director of Irrigation Department, and the Deputy Director of Cooperatives Department, explained the economic disadvantage of the farmers in Ta phraya, Sakae and Wattananakern Districts, Prachin Buri Province. Those areas are subverted by the Red Khmer terrorists. This causes uncertainty for the farmers and reduces their earning possibilities. The geographic of that areas is less suitable for them. Also, they found lack of water for consumption and cultivation. They are still working illegally on land which is in the national forest area.

To support the king's idea, the Agricultural Development project, a specified area in Prachin Buri Province has been created by the Ministry of Agriculture and Cooperatives. This project cooperates with some Department of the Ministry of Interior, Office of the Prime Minister, the Ministry of Public Health, the Ministry of Military, and all departments of the Ministry of Agriculture and Cooperatives. The objectives of this

project is to increase income of the farmers through irrigation development, land development, technical know-how development, Cooperatives development and handicraft development. For the stability and security of the nation, initiation, motivation, human relation, group cooperation, group effort, self-defense should be created among them through training by military group and interior group. It will be said that the project is analysed in two categories. The first objective is to motive the people from the opponent group. When they come in the government group, the government should do something for them through development.

The steps are as follows:

1. To motivate the farmers through training in self-defense, group cooperation, behavior control and group effort.

2. Irrigation projects were created to construct dams, canals, ditch for supplying water to the farmers for consumption and cultivation. They go along with cooperative village settlement projects.

3. Unsuitable forest land but good crop land should be allocated to them for growing crops and livestock.

4. Market organization and credit institution will be created to facilitate them in producing and marketing.

5. Technical know-how in agriculture will be domonstrated for them in the cooperative village center.

6. Cooperative village center including collective rice storage, livestock building, handicraft training building, silk building, and demonstration area for growing annual and perrenial crops, are created. This center will be the place of training in different fields for them.

The DAE is involved in this project as the secretary of this project committee is in charge of insuring the project goes efficiently along the line through group discussion among the central committee and rural committee of different department people, reporting the problem to the high rank authority to make decisions, suggesting DAE's 'dea and experience on farm management and farm development planning to the committee and the high rank authority, reporting the progress of the project to the Ministry every month through investigating the area project (Ta Phraya, Sra Kao and Wattananakorn District, Prachin Buri) and committee meeting at the specific military unit, Wattananakern district prachin buri every month.

The project covers four districts, the one at Krongsai, Amphur Wattananakorn is a crucial military point and the project allows only the war verteran and the retired military people to settle this area for others, districts allow the land less farmers to hold land for growing crops and livestock.

7A. SUPPORT SECTORS FOR AGRICULTURE

Mr. Kasem Sirienkhodum

Economics Research Branch

The input-output pilot project of the DAE was conducted primarily in Zone 3, changwat Khon-Kaen, Mahasarkarm, Roi-Et, and Kalasin. Three methods of sampling survey were introduced -- (1) Two Stage Stratified Random SAmpling was used to collect data from the farmers; (2) Systematic random sampling was used for marketing and processing industries if the frames could be identified; (3) If the frames could be identified, purposive sampling was used. The study of input-outpin in Zone 3 covered 19 Sectors: glutinous rice, non-glutinous rice, Kenaf, Cassava, Small rice mills, Large rice mills, Kenaf balers, Cassava chip mills, Cassava pellet mills, Cassava flour mills, Rice buyers, Kenaf buyers, Cassava buyers, Rice wholesalers, Rice retailers, Cassava chip dealers, Fertilizer wholesalers, Fertilizer retailers and Transportation.

Ayter the completion of this poilot project study in the agro-economic Zone 3, the DAE intends to expand study to regional and national levels. At present, DAE is working on the survey evaluation of 12 zones in the Central and Northeastern regions: Zones 1, 2, 4, 5, 6, 7, 11, 12, 13, 14, 15 and 16 respectively. The studies in the remaining Northern and Souther regions will be conducted in the later years. The DAE Statistics Center has the facilities to develop and carry out the required surveys. To this point, the authorization has only been received to conduct the necessary survey for the agricultural sector. Because of the limitation of the budget appropriation, therefore, the DAE selected the input suppliers and all output marketing and processing industries in

connection with seven major crops: rice, maize, kenaf, sugar-cane, soybeans, ground nut and rubber.

The study in the Zone 3 covers not only the I-O but also an experimental study of the link between linear programming model and input-output model. By developing the industry accounts for the input and product marketing sectors in a manner that maintains a quantity identification with the normal I-O value of the transactions, a link between the production sector and the other sectors can be developed in a linear programming framework. The input and product marketing sectors replace part of the distribution system associated with the L.P. production sector. This type of linkage can be put together at the regional, Zone, or national level. The national level model can also be developed with regional differentiation of the technical coefficients by using a system of linked regional data sets.

Expanding the analytical scope of the policy models to include more than the agricultural production sector allows for a corresponding increase in the policy evaluation criteria and impact analysis. This type of interaction can occur in either or both the input distribution or output marketing and processing sectors. It is possible that a policy calling for a rapid increase in the production of a given commodity may be limited in the short run, by marketing capactiy or timely availability of inputs rather than the more conventional production possibility restraints such as land, labor, capital and production technology.

By including the input and output sectors in the analytical models, a better estimate of employment and income impacts can be obtained, especially if regional programs are considered and the models are capable of

regional differentiation. From this input-output analysis, we will be able to use the semi-input output method of Tinbergen as a means to evaluate the growth potential of a project in terms of its effect on the total national economy. This procedure of using the semi-input output table can also be used to evaluate new projects to compare their feasibility against present sector allocations of benefits (value added) and costs (capital).

The next project to be implemented is the expansion of the model by integrating the system of regional input-output and social accounts for agricultural policy analysis. The accounts are expanded into a system of social accounts which include, not only the agricultural and related production relationships within the extended rural community, but also the consumption patterns, the factor input requirement, the tax and other policy provisions affecting productive activity in the sub-region, the institutional arrangement, the saving and investment relationships, and the flow of imports and exports between each industry and sector in the sub-region and the rest of the nation. A demonstration system has been designed and implemented as an initial test of feasibility and usefulness in Zone 3.

7B. INCORPORATING RURAL DEVELOPMENT PARAMETERS IN THE DAE SECTOR ANALYSIS CAPABILITY

Kenneth Nichol and Sumnuk Sinphing

The DAE models of the agricultral crop production sector are, because of their formulation, best suited to the evaluation of policies which reflect changes in production patterns and the subsequent impact on producer incomes and agricultural employment. These models include the major crops both annuals and perennials on an endogenous basis. Inputs, resource use, and output levels for the remaining agricultural production activities, mostly livestock, are fixed in the structure of the model.

Spatially the models are built at three alternative levels. The national model includes 19 production zones based on the agro-economic zones of Thailand and four commodity marketing regions based on the economic division and trade patterns of Thailand. The regional models each encompass one of the marketing regions from the national model and allow much more detail in the resource use and production alternatives given the limited computer solution capacity. Similarly, the zone models based on the agro-economic zones allow more detail in resource use definition and production trade-offs.

Presently, DAE is carrying out research to expand the capability of the models. Livestock is being added to the national model with cattle and buffalo completed. Greater spatial detail is being added to the national and regional models with production being edfined at the changwat level and commodity market clearing at the zone levels (regional models). In the zone models production is being disaggreaged to the changwats similar to the regional models with the added detail of specifying

characteristic farms. The characteristics which define a farm class reflect a combination of type, size, and ownership.

Additional research is being conducted to create a system of input-output tables at the zone level based on a detailed presentation of the agricultural sector and a very aggregated interaction in the non-agricultural sector. The agricultural sector in this analysis includes the indsutries responsible for the supply of inputs to agriculture such as fertilizer, seed, and retail or wholesale fuel and oil; industries which process and distribute the agricultural commodities; and the agricultural production sector.

On a trial basis, the I-O model for Zone 3 (changwats Khon Kaen, Kalasin, Maha Sarakham and Roioet) has been lined to the LP production model based on a 27 sector division of the economy. This allows for the flexibility of the LP in the selection of the technology in the agricultural production sector while incorporating the input and processing sectors of the I-O frame work. This presents a model where the I-O input and processing sectors are represented by fixed technology activities in the LP with the objective function being an aggregate of the appropriate value added components of the I-O for a profit maximization formulation of the LP or an aggregation of the input values for a cost minimization formulation.

The present I-O program will define a 44 sector matrix for each of the zones. The 44 sectors include a detailed breakdown of the agricultural sector (production, processing and input service) and a much more aggregated level in the non-agricultural industries. This sector classification does not represent a disproportionate representation for agriculture

as for most of the zones, except Bangkok and a few other, agriculture, and its support industries are the most important economic sectors in the zone.

The 44 sector classification focuses on crop production in agriculture with one aggregate livestock production sector. Slaughtering is included in the manufacturing sector and livestock marketing is part of the wholesale and retail trade sector. Initially, this classification will be used but later work may pursue a division of the livestock sector and a separation of its support services from the overall manufacturing and retail and wholesale trade sectors. This would allow for flexibility in the livestock sector as it becomes more important as a possible tool to raise income levels of the small land holders.

The models outlined above provide the Thai policy analysist with a system capable of analyzing directly the impacts of policy instruments affecting agricultural production or processing from the stand point of the resource use, product output, farm level income, non-farm income resource value to agriculture, and product marginal cost pricing. With this system agricultural impacts can be determined for resource development, input subsidy and output price of quantity changes. However, he impact is only traceable directly to the agriculture sector as delineated in the particular model (possibly as specific as farm class).

It would be desirable to trace the policy impact through to the household, government, and other farm income impacts resulting from the change in the agricultural sectors production system. Also, as one sector changes its production pattern it changes its demand for goods and services from the other sectors. The changes occurring in these sectors also directly affect income and subsequently through the income change or

the direct expansion of their output have an indirect effect to change the demand in agriculture again.

There exists a model formulation which is capable of handling this complete impact analysis for government policy evaluations. Traditional I-O models have been modified to make their value added and demand sectors endogenous. The value added sector indicated the income recipient of a policy and this subsequently follows through to the demand sector which traces the income effect back through to the production sector via incomes effect on demand. As a policy changes the income of a particular sector there is a change in the demand for particular goods based on the income recipients income elasticity for each of the producing sector goods. This follow through can have a significant impact on the final analysis of a given policy. Models with this "closed Economy" linkage are generally referred to as Social Accounts Models (SAMs).

Maki during a TDY with the DAE has prepared an outline of how the present I-O work can be expanded into a SAM and has outlined the resulting types of analysis which can be completed. A copy of this report in tentative format is available for review in the DAE.

In brief, the steps required to expand the I-O to a SAM start with the classification of appropriate sectors. Eight sector classes are recommended including production, consumption, employment, tax, income, institutions, capital and rest of the world. Each of these classes are divided into appropriate sectors to accomodate the major division of differentable activities by sector. For agricultural policy analysis, the classes need be divided to reflect agricultural issues and interactions, expecially inthe production class. Maki has outlined these interactions by

class in table 3.1, reproduced here as figure 1.

INcluded in the production account are the production distribution, and service sectors of the economy, Figure 2. From the basic I-O framework, these are represented in the transactions matrix. The consumption account includes personal and government consumption of products. The employment account accumulates the labor value added and transfers it to the income account. The tax account shows the flow of tax value added to the institutions. The income account shows the disbursement to resource owners income from the resources utilized and transfers this to demand through the institutions. The institutions account allows for the income payments to be transferred to consumption, tax, other institutions and capital accounts. That is, it transfers income from production and consumption to the economic units. The capital account transfer savings into investment (private capital formation). The rest of the world account provides for flows to and from he rest of the world. This can be international for a national SAM or disaggregated to an international and rest of nation components for a regional model.

Using the SAM

The reason for building this type of model is to show the total effect on the economy of the policy being considered in the agricultural sector and on the governments cost of operation. Some of the indicators available include:

1. Output, employment, and income multipliers derived from the base I-O table. These show industry by industry changes associated with a policy.
2. Measurement of the social and economic costs and benefit using the approach of Tinbergen in the semi-input--output method, or a complete model analysis using the extended

FIGURE 1

PAYING ACCOUNT

Receiving Account	Production	Consumption	Employment	Tax	Income	Institution	Capital	Rest of World	Total
Production	T1.1	T1.2					T1.7	T1.8	T1.
Consumption						T2.6			T2.
Employemtn	T3.1	T3.2							T3.
Tax	T4.1	T4.2				T4.6	T4.7	T4.8	T4.
Income	T5.1	T5.2	T5.3				T5.7	T5.8	T5.
Institutions				T6.4	T6.5	T6.6	T6.7	T6.8	T6.
Capital	T7.1	T7.2				T7.6	T7.7	T7.8	T7.
Rest of World	T8.1	T8.2				T8.6	T8.7	T8.8	T8.
Total	T.1	T.2	T.3	T.4	T.5	T.6	T.7	T.8	T

I-O method.

3. Measuring alternative program investment requirements to allow for complete benefit and cost determination when evaluating and ranking investment alternatives.
4. If extended to a multi-regional basis, can give regional delineation of benefits and comparative regional development strategies. Linking the SAM to the ASA-LP model.

The SAM discussed above reflects value terms in all of the interactions between sector similar to the regular I-O framework. Such model provide very useful tools for aggregate level impacts which are not greatly restrained by fixed resource bases. When conducting the analysis on a very limited regional basis, some means should be adopted to control the expansion or contraction of a sector in line with its resource availability. Two options are available, use the upper bounds procedure to constrain the matrix as is done for I-O models when used for project analysis, of attempt to incorporate a defined set of resource restraints in a tandom fashion to the SAM. This will allow for multiple restraints on the system which can be solved using LP techniques rather than the coventional I-O matrix inversion routines.

Maki has defined the produce DAE should follow in designing a conventional SAM and made reference to the possibility of using the linked LP-I framework as the production technology base for agriculture. When combining the conventional SAM and the optimization characteristics of the LP, the solution of an objective function becomes critical. Minimizing the cost of muting specified output levels subject to the restraints including, if appropriate, a government development investment budget. A second and possibly more appropriate objective is to minimize government development

investment subject to presperfied levels of output and growth in several development indicators.

This system like in I-O has a fixed price assumption or a price quantity relationship which maintains the fixed value of the technology coefficients. With the linked LP for resource use controls, the model can serve the policy analyst in the same applications outlined for the conventional SAM with the added adjustment to resources allowed by the LP's restraint set. This part of the model can increase the flexibility of selecting multiple development projects utilizing, in a competetive manner, the resavice of the economy.

Outline of the Propsed SAM-LP link

The regular SAM matrix incorporating the eight sector classes has been outlined, Figure 1. Linking this to the LP model will not modify the major structural characteristics of the matrix except to no longer make it square. Within the production sector, T1.1 the agricultural sector will be re-defined to include an LP sector of resource restraints and alternative production technologies. The resources defined as restraints will generally not interact with any of the other columns across the matrix unless other sectors inthe production class also compete for their use or they can be consumed directly int the consumption or capital sectors. Resources generally will not interact with the rest of the world except if working capital is a restraint and an option exists to sell this out of the zone. Most of the T1.2, T1.7 and T1.8 interactions will be with the predicts of the production class sectors, such as competition for the commodities. Labor will be restrained by an effective definition of the employment sectors and all production sectors will compete for the labor

force. Similarily, the capital input, working and investment can be accurately controlled on a competetive basis in the capital class sectors. The major use for the resource restrictions will be for land competition and possibly water, both representatives of stock resources rather than flow resources which are incorporated in the body of the SAM matrix. Additional defined restraints will control the production sectors within limits of technology adoption or resource shifts reflecting non-economic factors.

The production sector across the table reflects the production techniques (inputs) foı producing seach sectors output. With the LP linked the single sector activity representing each agricultural production possibility will become expanded to reflect many production processes (columns) within each sector. Solution of the system selects which of the processes or combination of the processes will represent the sectors interaction with he rest of the economy. Each activity representing a sector will interact with the resource base (LP) and other production sectors in T1.1, with the labor (employment) sector in T3.1 and similarly for the rest of the sectors in he production purchases columns.

The degree of definition outlined int he production sector LP being incorporated into the SAM will reflect the trade offs between the detail of the regional specification of the model and the degree of uniqueness of farms by size, type, and ownership patterns, figure 3. It is proposed that the spatial detail within the zones be initially limited to changwats and the larger zones may be subdivided or changwats combined. The farm classes defined within the changwats will reflect size categories based on gross sales to reflect interaction with the market and give indications of cash flow. Size defined in this manner will allow for consistency with the prime

ministers' division of size by income group. The type classifications will also correspond with the breakdown for the income study. Types will include deep paddy farms, regular paddy farms, irrigated paddy farms, upland farms, fruit farms and livestock farms. A farm is classified as livestock if it receives more than 50 percent of its gross sales from livestock. If not a livestock farm, then the farm is assigned to the crop category reflecting the majority of its land and is not based on income source. This breakdown will provide a proudction sector interaction which separates the farms and changwats for interactions specific to their spatial or class designation but maintains a competature frame work in the common markets.

The employment sector class will also have to be divided into target groups to reflect the work alternatives of the labor force, figure 3. Division of employment will reflect the on farm labor supplies by farm class with all farms by changwat competing for the hired labor supply. Small farms and low income farms will have the option to hire out their labor through the changwat labor pool.

Within the capital class sectors sufficient detail will need to be developed to distinguish capital sources for the various farm classes and to allow for capital transfers as occurs on an actual basis. The remaining sectors will be affected as the production, employment, and capital sectors interact with them but should not require any changes in the sector definitions themselves.

Following through this septem impacts on the farm sector by farm class can be distinguished. As can the employment by sufficient detail to trade excess supplies and develop programs to alleviate this surplus. The value added (income) and institutions sectors allow a breakdown of

households to trace income changes to specific target groups.

The first of these zone level models are being developed in agro-economic Zone 3. Many tests of data, model flexibility and methodology for implementing policy options need to be studied and tested in this model. As it is completed the remaining zones will be selected in turn and similar models built for them. This program could require up to three years to complete. If appropriate development could be completed in the next ten years, this system could form a major analytical tool for the governments fifth five-year plan, as well as be available for the year to year planning which is being implemented and acted on given the present less detailed analytical techniques.

	Production	Consumption	Employment	Tax	Value A	Institution	Capital	Rest of World	Total
Production	Payments for intermediate inputs	Payments for Consumable					Payments for inventory change or capital product.	Payments for exports	Total Income of the production sector
Consumption						Payment for consumable			Total receipts for sales of consumption goods
Employment	Payments for labor inputs	Payments for prof. clerical sales services							Total income by employment sector
Tax	Payment of taxes	Payment of sales tax				Payment for property business tax Inc. tax	Payment for tax on capital	Payments for exping, Sales taxes	Total income to tax account
Income	Payments to profit	Payments for business govt.	Payment to wage salary or self-employed household				Payment to govt bus value	Payments household wages and of salaries from re of	Total income to value added sectors
Institution				payments to govern ment	Payments to inst , govt, household	Payments to to prop inc household inc govt income	Payments to accomu lator	Payments from abroad for accomu or property income	Total income to sector representing consumable purchase
Capital	Payments tax capital formation	Payment for capital formation				Payment to saving, bond, loans, equity	Payment to invest ing change capital formation con act & Devel	Payment for accumulate of inv charge rivate cap community	Total value of assets formal
Rest of World	Payments for imports	Payments for imports			Payments to R of W accumul.	Payments to R of W accumul.	Payment for import of cop. goods	Payments for accumulation of prodn in R. of W	Total Payment from economy to R of W

	Production	Consumption	Employment	Tax	Value A	Institution	Capital	Rest of World	Total
Total	Total outlay of prodn sector	Total outlay of Consptn sector	Total transfer of wage to income	total disburse of tax to government level	total value added disburse ment to inst & R. of W.	Total outlay of inst for Consumption, tax	Total expend for capital formation	Total payment for Rest of World	T

Figure 2. Flow patterns of the SAM Production, Income and Consumption Model

				C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	Total
	Non Farm Sector		C1	T1.1	T2.1	T3.1						T9.1					T14.1	T15.1	T16.1	T17.1	T1
Production	Farm Sector	Farm Class 1	C2		T2.2																T2
	Rest-ment	Farm Class 2	C3			T3.3															T3
	Farm Outputs		C4	T1.4	T2.4	T3.4						T9.4								T17.4	T4
Employ-ment	Farm Employment	F.C 1	C5		T2.5																T5
		F.C. 2	C6			T3.6															T6
		Hired labor	C7		T2.7	T3.7															T7
	Non Farm Employment by Sector		C8	T1.8								T9.8									T8
Consumption by Sector			C9													T13.9					T9
Tax by Sector			C10	T1.10	T2.10	T3.10						T9.10				T13.10	T14.10	T15.10	T16.10	T17.10	T10
Income	Farm		C11		T2.11	T3.11		T5.11	T6.11	T7.11								T15.11	T16.11	T17.11	T11
	Non Farm		C12	T1.12							T8.12						T14.12			T17.12	T12
Institutions			C13										T10.13	T11.13	T12.13	T13.13	T14.13	T15.13	T16.13	T17.13	T13
Capital	Non Farm Sector		C14									T9.14				T13.14	T14.14			T17.14	T14
	Farm Capital	Private Comme.	C15		T2.15	T3.15												T15.15		T17.15	T15
			C16		T2.16	T3.16													T16.16	T17.16	T16
Rest of World	In Country International		C17	T1.17	T2.17	T3.17						T9.17				T13.17	T14.17	T15.17	T16.17		T17
Total			Tot	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T

Figure 3. Interactions in the SAM production Income, and consumption model with from class divisions.

8. DEMOGRAPHIC MODEL

Mr. Vinar Taryarthieng, Planning Officer

1. Objective

Figures on agricultural and non-agricultural population by changwad since 1970 have not been estimated by any agency. The Working Group on Population Projections consisting of the National Statistical Office, Office of the National Economic and Social Development Board and the Institute of Demography of Chulalongkorn University, have conducted a study of population projection through the year 2010, but the outcome is only estimates by region without agricultural and non-agricultural classification.

Data on both agricultural and non-agricultural population are required for construction of crop and livestock models and for demand projections of major crops nad livestock commodities.

2. Methodology

The Division of Agricultural Economics and the ISU Team have worked together in building a simple demographic model based on 1970 Population Census and the 1970 birth and death statistics from Ministry of Public Health. In the model, the population by changwad depends on the rate of birth, death, migration of the residents classified by cohorts, divided into 15 age groups, the same as the number of Working Groups on Population Projections: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69 and over 70 years of age. The general model is formulated as follows:

$$(POP)^{t}_{sae} = (POP)^{t-1}_{sae} + (BTH)^{t}_{sce} - (DTH)^{t}_{sae} \pm (MGR)^{t}_{sae}$$

where $(POP)^{t}_{sae}$ is the estimated population of sex "s", age "a", and sector "e".

$(BTH)^{t}_{sce}$ is the estimated births of sex "s", by age cohort "c" of mother in sector "e".

$(DTH)^{t}_{sae}$ is the stimated deaths of sex "s", age "a", and sector "e".

$(MGR)^{t}_{sae}$ is the estimated migration of sex "s", age "a", and sector "e".

The above models represent the general form of the calculations. The methods for each cohort are as follows:

Age 0-4

$$(POP)^{t}_{sae} = (POP)^{t-1}_{sae} + (BTH)^{t}_{sce} - (AGO)^{t}_{sae} - (DTH)^{t}_{sae}$$

where $(POP)^{t}$ is the estimate of population of province by sex "s", age "a", and sector "e".

$(AGO)^{t}_{sae}$ is the estimate of aging out of population to 5-9 age cohort in the province.

The age 0-4 will depend on the rate of birth, death and aging out to 5-9 years of cohort.

Age 5-9, 10-14, -- 65-69

$$(POP)^{t}_{sae} = (POP)^{t-1}_{sae} + (AGI)^{t}_{sae} - (AGO)^{t}_{sae} + (MGRI)^{t}_{sae} - (MGRO)^{t}_{sae} - (DTH)^{t}_{sae}$$

where $(POP)^{t}$ is the new estimated population of province by sex "s", age "a", and sector "e".

$(AGO)^{t}_{sae}$ is the estimated of aging out from age cohort

$(MGRI)^{t}_{sae}$ is the estimated of migration into the age cohort

$(MGRO)^{t}_{sae}$ is the estimated of migration out of the age cohort

$(DTH)^{t}_{sae}$ is the estimated of death in that province

Age 70 and over

$$(POP)^{t}_{sae} = (POP)^{t-1}_{sae} + (AGRI)^{t}_{sae} + (MGRI)^{t}_{sae} - (MGRO)^{t}_{sae} - (DTH)^{t}_{sae}$$

In this age group there is no aging out because it is the last age cohort.

3. Results

The outcome of the projection of population for the whole kingdom in 1979 is lower than the figure estimated by the Working Group on Population Projections at medium fertility rate about 0.21% and is higher than the low fertility rate about 0.55% (the figure of the Working Group on Population Projection in medium and low fertility rates are 46.493 and 46.142 million people, respectively). The population projection in 1979 by sector, sex and group of age in the kingdom are as follows:

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This model is a pilot project assuming a rate of constant birth, mortality and migration in each changwad as calculated from the year 1970 which is not being perfectly accurate. It is desirable to develop a new model for more accuracy e.g. instead of using the one-year rates of birth and death, several years statistics should be applied to the new process possibly using pooled regression analysis. Consideration should be given to the migration of population according to social, income and education characteristics.

9. ASEAN RICE SECURITY RESERVES

(A SIMULATION APPROACH)

Dr. Somporn Hannpongphum, Planning Officer

World food problems have induced countries around the world to concentrate more on how to protect the world from possible catastrophe arising out of food shortages. Four major factors namely, population, increases in the prices of oil and its products, natural calamities, and depletion of world food stocks have been held responsible for current problems. The World Food Council which was created to establish food security made a number of proposals, one of which was to create world food reserves.

All five member countries of the Association of South East Asian Nations (ASEAN) namely Indonesia, Malaysia, the Philippines, Singapore and Thailand have expressed their positive view on the establishment of a food security reserve system within the region. Being the main staple of the ASEAN people, rice has been unanimously selected as the first food item to start the regional food security program with. Having been the region's leading producer and exporter of rice, Thailand was asked to lead other countries of teh ASEAN in a study to shed more light on how to implement the program. With close cooperation of the Iowa State University Sector Analysis Team in Thailand, the present study was carried out to partially fulfill this need.

With time series data relating to rice productions, consumption and trade as well as population of all member countries of the ASEAN and per capita domestic disappearances, 14 econometric equations (5 population

equations, 4 rice production equations, 4 net imports of rice equations and 1 Thai-Others export equation) were arrived at. A computer program was written allowing stochastic simulation of a hypothetical rice security scheme of the ASEAN be conducted. With a set of parameters; namely, beginning Thailand private rice stocks of 1,320,000 tons; beginning regional rice buffer stocks of 0 and 250,000 tons; maximum Thai private stock of 1,500,000 tons; maximum buffer stocks of 0, 50,000, 100,000, 150,000, 200,000 and 250,000 tons; releasing percentages of buffer stock of 70, 80 and 90; ASEAN preference percentage of 90 and minimum Thai rice exports to non-ASEAN countries of 0, 100,000 and 200,00 tons the model was run with 200 replications of a six year duration. Results of the program were expressed in terms of country rice productions, net imports from rests of the world, Thai rice exports to non-ASEAN countries, per capita domestic disappearances, probabilities of meeting ASEAN import preferences, probabilities of meeting minimum Thai-Others exports, probabilities that both the Thai private stocks and the ASEAN buffer stocks become zero and probabilities that both reach their maximum. Among all the variables of interest, the effects of beginning buffer stock, sizes of the buffer stock, releasing percentages of the buffer stock and minimum Thai-Others exports on the probabilities of meeting the ASEAN import preferences were traced out.

Results of the study show that the beginning buffer stock of 250,000 tons when compared with that of zero tons tends to increase the probabilities of meeting ASEAN import preferences by a greater magnitude in Year 3 of the simulation than in Year 6. This calls for a supplemental cost study which could relate the cost of starting the food program with a specified amount of rice stocks and thus increasing the chances of meeting the preferences.

The relevant maximum size of the buffer stock found in the study was 50,000 tons. Possible reasons for this low requirement for a buffer stock are that besides rice from the buffer stock, the model also allows the ASEAN countries to have access to the Thai private stocks and rice exports from rest of the world.

Release percentages of the buffer stock were found insignificant in the study. It is believed that their effects are evened out from years to years of the study.

Increases in minimum Thai rice exports to other countries besides the ASEAN were found to reduce the probabilities of meeting ASEAN import preferences by 1 to 2 percent for every 100,000 tons. How much should this minimum Thai rice export be, depends on how much of such export Thailand feels necessary to maintain for the sake of its trading and political relationship with others.

Finally, needed revisions for the improvement of this ASEAN rice security reserves model include more reliable data from the participating countries, the inclusion of the role of price in the demand and supply analysis and the consideration of other country stocks besides Thailand.

10. STATISTICAL CENTER'S ACTIVITIES IN CONNECTION WITH COMPUTER MACHINES

Mr. Vinia Hirunsri, Statistical Center

1. General Study

This service is to compute the surveyed agricultural data on planted areas, harvested areas and yields of all kinds of crops, production of livestock and of aquatic animals. It also includes other agricultural data such as income, expenditures of farmers, renting and holding of lands, capital and production inputs, feed demands of livestock raisers. These basic data are provided for government agencies and will be used to analyze problems for policy making and agricultural development planning.

The general survey has steps of implementation as follows:

1.1 Sampling of villages to conduct 1977/78 Economic Conditions of Farm Family Surveys: 3,024 villages.

1.2 Sampling of farms in the village samples by 16%: approximately 48,384 farms.

1.3 Prepare Questionnaire Form with Instructions and methods of surveying and compiling.

1.4 Pretest the Survey Form in order to search out obstacles and difficulties.

1.5 Train the staff, field survey workers in order to understand the survey form and the method of enumerating the samplings.

1.6 Conduct the survey in the assigned field areas to enumerate the farm families in the village samples, the detail information of villages, do farm family sampling and interview the farmers under the assigned period.

1.7 Compliling and finalizing the data at the DAE to be complete

within the assigned period.

1.8 Analyze the outcome of the survey for accuracy and possibility of data.

1.9 Arrange printing of survey report for publicity.

2. Specific survey.

This is a single survey on agricultural data by specific major economic crop for export e.g. yearly rice, maize, kenaff, soy beans, sugar canes, cassava, etc. These data will be used particularly to determine the policy on agricultural commodities and foreign trade.

The operations can be summarized as follows:

2.1 Interview and collect data on farming, planted areas, harvested areas, yields and other necessary information from the farmers who own the farm samples. Such data will be useful to the estimation of planted areas and yields.

2.2 Measure the planted areas and crop yields. This includes the measuring of planted areas, damaged areas from the farm samples, from the interviews. It also includes the recording of actually collected yields from the farm samples in order to use such data as adjusting factors with the data compiled from the interviews. Such data will be helpful in obtaining the planted areas which are mostly close to the reality.

2.3 Yield Testing Plots, including the collecting of data on the growth of crop in the sample plots by sampling the areas of farm samples as described in the Item 2.2. Then, set up two sub-plots with an area of approximately five square meter each in order to collect the data as to be yield components such as number of holes, trees, flowers or ears, pods, granules, height and production of the crop. Such collecting is divided by

period of time of the growth of crop e.g. time at blooming or developing ears; period prior to start seeding, period of being seed or ears, and after harvesting, in order to use those data to find out the coefficients of yield components. This will be useful for pre-estimating of yields before harvesting.

2.4 Area Frame Sampling. This method needs to have aerial photographs to determine the area frames and sampling in the farm production areas in various locations as in Item 1 and 2.

The stages of processing of General Survey, Specific Survey, and Rice Stock Surve are:

1. Coding - Fill the questionnaire with ID farm codes, check if the number of questionnaires is correct or not, and check the details of every item in the questionnaire.

2. Punch data and verify data - After checking the coded questionnaire, punch the card; after punching recheck the card to see if the same is punched correctly in correspont to the questionnaire or not. These steps are the primary checking of data prior to passing to computer running.

3. Sort Data with Card Sorting Machine - This stage is to arrange ID farm in proper orders from Changwad, Amphoe, Strata, Village and Farm respectively.

4. Edit data with program - Before running the computer machine, it is a must to check the correctness of items in the questionnaire. This is called "Program check data". A;ter checking the data correctly, the next step is to check the sequences to see if the farm ID is correct and correspond to the file earlier set up or not, anf if there are any errors, done by the coder or not, of if there are any errors done by the card puncher

or not.

5. Run the computer machine(s) - T!ke the program that applied to each section and run the computer machine(s). Collect the results from the punching and apply them to the data bank.

6. Preparation of Survey Report - At the completion of final processing, prepare the report, present the survey outcome in various patterns or methods to the interested sources that need to use such data and to learn the major results.

3. Data Bank

To provide the DAE accessibility to the results of the past surveys, data storage and retrieval system has been developed on the IBM 1130 computer. The currently general farm survey results are maintained in the system at the Changwad level. If desired, specific survey results can be coded to the system in the future (also at the Changwad level). The results can be recalled from the system by a user and aggregated together and/or accumulated to zone, region, or kingdom totals as desired.

Raw data from the surveys has not been maintained on the IBM 1130 system because of storage limitations. For each item stored the following information can be obtained:

1. Estimated population total
2. Estimated standard error of the population total
3. Estimated coefficient of Variation
4. Percentage of farms in the population reporting (estimated)
5. Estimated mean of all farms in the population (includes zero responses)
6. Estimated mean for farms reporting the item (does not

include zero responses)

7. Estimated number of farms in the population having the item.

Revision and updating capabilities have been developed as part of the system. This capability can be utilized to replace erroneous entries, update with revised estimates, etc.

Data disk description:

The 1600 sectors of the data disk are allocated as follows:

1.	IBM Monitor system	8
2.	Fixed Area Dictionary	8
3.	File 200	2
4.	File 300	24
5.	File 400	5
6.	File 1000	1553
	Total	1600

Data disk identification numbers are assigned consecutively from 101 up for primary data disks. Secondary or backup disks (copies of the primary disk) are assigned the same identification number as the disk they backup except for changing the first digit to a seven. Thus, the file names on a primary disk and its backup are identical. To date, primary data disk identification numbers assigned are:

1.	1101	not used	
2.	1102	general farm survey	1973/74
3.	1103	general farm survey	1973/74
4.	1104	general farm survey	1975/76
5.	1105	general farm survey	1976/77
6.	1106	general farm survey	1975/76

Back up disk information numbers assigned are:

1. 7101 not used
2. 7102 back up for 1102
3. 7103 back up for 1103

General Survey Changwad Summaries

The document defines what data items have been summarized for the general Farm survey of 1973/74. Each item that has been summzried by one of the survey programs in included in tables this documents. Each item that had data for at least on changwad has been assigned a data bank storage identification (ID) number which is listed in the tables. If an item was summarized for which there was not data, an entry of N/A is made in the table.

A summary of existing and practicable programs is shown below:

1. Nationwide Program on General Surveys of Economic Conditions Computation .... 113 programs.
2. Program On Specific Economic Crops Under List Frame Survey and Area Frame Survey Computation ..... 21 programs.
3. Program On Surveys of Rice Stock Belong To Farmers, Rice Stock Belong to Miniature Rice Mills, Rice Stock Belong To Middlesized Rice Mills, and Rice Stock Belong to White Rice Dealers, Computation.....16 programs.
4. Second Rice Crop Survey Computation.....11 programs.
5. Program On Economics Analyses Computation.....159 programs.
6. Program On Economic Survey Data Bank Computation..... .....16 programs.
7. Program On Linear Programming Data Analysis Computation..... .....15 programs.

8. Other Programs.....4 programs.

During the years from 1974 to 1977, the computer machines at the DAE had been used by each branch of the DAE. The most services were given to the Statistical Center and the Planning Branch. The Statistical Center had received the computation services for general surveys, specific surveys and Data Bank. The planning Branch had received the computation services for linear programming to find solutions at zone and regional levels of crops and livestock. In operating the computer machine(s) of the DAE, it was found that the Planning Branch had spent maximum time by running the linear programming jobs with abundant equations. This is because the IBM 1130(16K) machine could not be used with such jobs. The statistical Center used the IBM 370 machine in the processing of original programs changing. The CPU time in 1976 was more than the CPU time in 1977 because the DAE staff used the computer IBM 370 at DAE in 1977.

4. Computer Training and Study by DAE Staff

The computer training program is held every year. Also, the DAE had assigned a number of staff members to receive computer training, particularly the operation of IBM 370 machine at the IBM Office in Bangkok. The DAE has the policy to make a request for the purchase of larger size of computer machine (IBM 1130-16 K.). In again addition, the staff members of the DAE had attended the training at the National Statistical operations.

5. Program Activities under progress

Program on Farm Income.

Program on computation of coefficient obtained from the general surveys.

Revision and amendment of programs under operation of IBM 370 machine.

Organize filing system for the overall programs

6. Other Activities

Assignments on computer program designs for other branches of the DAE e.g. Income distribution Computation Program, Input-Output Model Computation Program, Population Model Computation Program.

11. POLICY CAPABILITIES SUPPORTED BY THE ASA PROJECT MODELS

Mr. Narrong Chuptokob, Chief Planning Officer

The scope of authorities, functions and responsibilities of the Division of Agricultural Economics (DAE) cover diverse areas of activities. They include surveys on agricultural data; economic and social data, studies and analyses on production economics, marketing and prices, and farm management. This Division is also responsible for the study, analysis and follow-up of agricultural economics problems as well as the policy guidelines, long-range and short-range agricultrual development plans in order to submit to the Ministry of Agriculture and Cooperatives (MOAC).

Under such vast areas of functions and responsibilities as to be the sources of data collection and compilation, the center for studies, analysis and research on the overall agricultural economics areas, therefore, this Division has played important roles in connection with policy and agricultural development planning at the national level.

Evidently, the Division of Agricultural Economics (DAE) has participated in several committees' functions for agricultural development programs both of policy and operational levels. It also acts as secretariat functions in preparing data, giving recommendations, reviewing problems, and seeking measures of solving agricultural economics of crops and livestock. From time to time, these include the following-up of production situation of marketing and prices of major economic crops in order to identify problems and to give suggestions to the Ministry on the appropriate measures of problem-solving.

The major functions and responsibilities of the Division of Agricultural Economics (DAE) can be summarized as follows:

1. Routine assignments in connection with agricultural development:

   1.1 Prepare outline of Agricultural Development Plan, Volume IV, to submit to the Ministry of Agriculture and Cooperatives and the Office of National Economic and Social Development Board.

   1.2 Prepare outline of Annual Agricultural Development Plan in accordance with the annual export goals of the Ministry of Commerce to submit to the MOAC.

   1.3 Prepare rice export policy to submit to the MOAC and the Ministry of Commerce within November of every year.

   1.4 Prepare export policy for other economic crops to submit to the MOAC and the Ministry of Commerce every year.

   1.5 Analyze agricultural economics situations, summarize problems and give recommendations to the MOAC every six-month period.

   1.6 Follow-up production and marketing situation and prices of fertilizers and of other economic crops, summarize problems and give recommendations on problem solving to the MOAC.

2. As Sub-committee or Secretary to review policies on agricultural development for specific crops of 1978.

   2.1 Prepare data and review sugar-cane area locations in accordance with the government's policy to decrease the sugar-cane planted area to three MiC. Rai along with 21 MiC.

Ton of yield.

2.2 Prepare data and review cassava area locations in compliance with the actual market situation.

2.3 Prepare data and review standardization and measures on price mainteance for mung beans (black species and shining species).

2.4 Review and prepare soil nourishment (conservation) project for cassava farms.

2.5 Review policy on permission for the establishment of Cassava Products Plants.

3. As Committees for Reviewing Agricultural Development Policies at Ministerial Level for 1978.

The DAE is member of the following committees:

3.1 Income Distribution Study Committee

3.2 Agricultural Irrigation Development Committee

3.3 Research and Extension Coordinating Committee

3.4 Export Development Committee

3.5 Livestock Raising Promotion For Export Committee

3.6 National Agricultural Research Coordinating Committee

3.7 Cotton Crop Development Committee

3.8 Upper Chao Phaya Basin, Phase 2, Agricultural Irrigation Development Project Coordinating Committee.

Examples of recommendations which have been approved as being 1978 Government's Policies:

Policy on Rice Export

The Division of Agricultural Economics (DAE) had submitted to the

MOAC the results of the study and analysis of rice quantity to be exported during the year on the basis of several alternatives. The Ministry had reviewed and selected an alternative that suites the situation and had informed the Ministry of Commerce and the Deputy Prime Minister in charge of Economic affairs i.e. in 1978, the total quantity of rice export should be 1.2 MiC Ton of plain white rice. Under this quota, the price of in-country paddy will be higher than the previous year price by approximately 200 Baht per Kwien. In addition, because the double rice crop farming survey can prove the higher yield than the early-year estimation, the DAE therefore, had processed the analysis once again and gave new recommendations that the plain white rice export quota can climb up little over 1.2 MiC Ton. At present, the Ministry of Commerce has set up the export goal suggested by the DAE as being a criteria of rice export permission.

Policy on Fertilizer

Fertilizer is an essential input of production enabling the crop yield to achieve the goal, especially rice when the suitable land for rice farming is limited. Owing to the government's announcement on the increase in fertilizers premiums (rice fertilizers-5 for mulas) by 20% in order to help the local industry and as a result that the prices of rice fertilizers have also climbed up that might also bring about the shortage of local supply because of the insufficient capacity of the fertilization mixture plants, therefore, the DAE had conducted the analysis on the consequences of the increased price of fertilizers and the local supply shortage that will apparently affect the national production. The Ministry of Agriculture and Cooperatives (MOAC) had then brought this problem into the discussion of the Board of Investment Promotion.

The BOI had forwarded the DAE report to the Council of Ministers with the recommendations on the repeal of 20% special premium charge which has been abrogated eventually.

Policy on Sugar-cane Area Locations

Because the sugar-cane yield at the present time is beyond the domestic demand and in excess of sugar export market, therefore, the Ministry of Industry in the cabinet meeting had made a proposal for the decrease of sugar-cane planted areas and of the yield down to 21 MiC Ton. Also, the request for cooperation in this declination scheme was made through the Ministry of Agriculture and Cooperatives (MOAC). The Division of Agricultural Economics (DAE) was assigned to conduct a survey and analysis of the overall situation to determine the practical measures on such areas decrease i.e. which locations and how much of the areas to be affected by such decrease. The DAE's analysis processing from the crop models at national level for agricultural development plan had shown that the decrease in the sugar-cane planted areas should be in the economic zones 8, 12 and 15 while at the same time the promotion of alternative crops in these zones should be introduced such as maize, cotton, soy-beans, pine-apples, castor bean and fruit-trees plus the extension of livestock raising, cows and buffaloes, of which all of these proposals over approved by the cabinet.

From the above mentioned examples, it is evident that the Division of Agricultural Economics has its roles in giving recommendation to the responsible hierarchies on the policy guidelines for national agricultural development which reflects both the government administrations and the functional committees at various levels.

AC 0205/11481

Ministry of Agriculture
and Cooperatives

June 2, 1978

Re. The Report of Second Rice Crop

To. The Prime Minister

Attached The Report of Second Rice Crop for Crop Year 1978-1979

The Division of Agricultural Economics has sent to the Ministry of Agriculture and Cooperatives the report of the second rice crop for the year 1978-1979 as developed from a survey taken during 1 to 25 of May 1978. The results of the survey are as follow:

1) 1978 second rice crop production was estimated at 1.586 million ton paddy. This is greater than the beginning of the year forcast of about 1 million ton paddy or by 50 percent.

2) area planted for second rice crop was estimated at 2.979 million rais, 21 million rais greater than the beginning of the year foreast.

3) The average yield per rai was estimated at 53.2 tungs, also higher than the beginning of the year forcast of about 50 tungs per rai.

4) About 97 percent of the planted area of the second crop were fertilized.

5) About 99.88 percent of the production were nonglutinous rice. The rest was glutinous rice.

A very important reason why the second rice crop yield was more than the target was that the Ministry of Agriculture and Cooperatives permitted the purchase of more water pumps. These helped farmers apply more water and expand planted area. In the mean time, the government provided 25,000 tons of fertilizer at a low price. This was sufficient for the farmer's demand. At the same time, the farmers used RD. varieties for their planting which permitted the good yield. Also, the Governner's participated to promote the second rice crop project.

Because of more rice production than we expected, we can export more rice. At least 1.2 million ton of milled rice more than our first target. How much should we export? This will depend upon foreign and domestic demand.

However, second rice crop will be more important in the future. Good area planted for second rice crop is very limitted. It is important to accelerate second rice crop so we could have more rice production. In the following year, we should accelerate more irregation project and develop more watersheds so we can expand planting area of second rice crop. At present, we have only a few areas in the North, North East and in the South where second crop rice can recieve sufficient water.

Sincerely yours

Prida Karnasut
Minister

URGENT
No. SP 0107/9303

Secretariate of the Prime Minister

June 28, 1978

Subject Report on the Second Crop Rice Survey 1978
To Minister of Agriculture and Cooperatives
Ref. AC 0205/11431 dated June 2, 1978

According to the reference letter, the Ministry of Agriculture and Co-operatives submitted the report on the second crop rice survey 1978 to the Prime Minister, Secretariate of the Prime Minister has forwarded to the Prime Minister. He thanked you to the concerned offices and ordered to submit that report to the cabinet. The Secretariate of the Prime Minister has already informed to the Secretariate of the Cabinet.

Sincerely yours,

(Signed) Maechai Huchupan

Deputy Secretary General for Political Affair,
In Charge of the Secretary General

Division of Internal Policy
Tel. 218-4400

URGENT
No. SC 0202/12703 Secretariate of the Cabinet

July 12, 1978

Subject Report on the Second Crop Rice Survey 1978
To Minister of Agriculture and Cooperatives
Ref. AC 0205/11431 dated June 2, 1978

According to your ministry's report on the second crop rice survey 1978 submitted to the Prime Minister. He saw it and ordered to submit the report to the cabinet. The Secretariate of the Cabinet has informed the result on the second crop rice survey 1973 to the cabinet.

Sincerely yours,

(Signed) Pribun Thongnit
Deputy Secretary General,
In Charge of the
Secretary General to the Cabinet

Council of the Minister's Meeting Division
Tel. 281-2220

URGENT

No. MI 0206/2204 Ministry of Industry

5 April 1978

Subject. Joint Approach to Sugar-Cane Production Control

To. Under Secretary of State, Ministry of Agriculture and Cooperatives

REF. Document No. MI 0206/316 Dated 17 January 1978

As the obove mentioned document informing the resolution of the Board of Sugar production and Distribution Policy of 23 December 1977 that Thailand has obligation to perform on national sugar agreement's regulation of 1977 that is to control sugar-cane production, in other words, not to produce more than at present. And asked the Ministry of Agriculture and Cooperatives to persuade farmers to grow other substituted crops.

I have learned that the working group has been established within the Ministry of Agriculture and Cooperatives to consider this issue. Again the Sugar-Cane production control for next crop year will be considered by the Board in the coming 3/1978 meeting on 14 April 1978. If you have futhure information please let us know.

With best regards,

Sincerely yours,

(Signed) Vimon Viriyarith
Under Secretary of State, Ministry of Industry

URGENT

Ministry of Agriculture &

No. AC 0204/12762

Cooperatives

June 16, 1978

Subject. Use of Farmer Aid Fund for Bank of Agriculture and Cooperatives Loan

To. Prime Minister

Enc. 1. Table Showing Planted Area and Sugar-Cane (manufacturing) Production by Agro-economic zone and Major Changwads of 1968/69 - 1977/78
2. List of Restricted sugar growing zones, Planted area and Primary Sugar-Cane quota for Factories in 1978-79
3. Fifth/1978 Farmer Aid Committee Meeting Report

It is obvious that sugar-cane planted area is expanded considerably, there was 2.44 million rai in 1975/76 crop year then increased to 3.45 million rai in 1977/78. A matter of reduction of planted area coping with 1978/79 production target of about 21 million tons as of national sugar-cane agreement is neccessary to introluce some measures in order to persuade the farmers to switch to other crops. The Ministry of Agriculture and Cooperatives has met among representatives from concerned organizations such as Ministries of Interior, Commerce, Sugar Institute, Bank of Agriculture and Agricultural Cooperatives, Department of Agricultural Extension, Technical Department, Department of Land Development and Division of Agricultural Economics to consult with this issue using the analysis of the Division of Agricultural Economics and Sugar Institute (see document 1 & 2). The criteria is that if base on sugar production target of 21 million tons, the area planted requirement should not exceed 3.0 million rai. The decrease of 4.5 million rai from 1977/78 crop year is concerned, the area planted should be reduced in the Agro-economic zones 8, 12, and 15. The area in Agro-economic zone 8 includes Changwads Kamphaeng Phet, Tak, Phichit and Phitsanulok, Agro-economic zone 12 includes Changwads Kanchanabri, Prachuap Khiri Khan, Phetchaburi and Ratchaburi, Agro-economic zone 15 includes Changwads Chonburi and Rayong. The alternative crops to be substituted are rice, cotton, soybeans, pine-apple, castor seed, furit tree and other cash crops what ever suitable in the area. Also livestock should be promoted such as beef cattle and buffalo, dairy cow and buffalo and fish. The step is to use the farmer aid fund, through the Bank of Agriculture, lending on a special low interest rate to farmers in order to ease new suitable crops and livestock career. The amount of fund for this purpose should not exceed 100 million Baht without interest charge to the Bank for a period of ten years.

It has been realized that even this step has to take time but its effect will rest on reducing sugar-cane planted area in the years ahead. Also it is the way to solve sugar-cane farmers' problem. The Fifth/1978 Farmer Aid Committee meeting of 29 May 1978 has agreed upon this process by approving in principle of using farmer aid fund amount to 100 million Baht, through the Bank of Agriculture as a loan without interest for ten years, for whose farmers in the three agro-economic zones borrowing at interest rate of 5% per annum within 10 years. This 5% interest will cover all expenses include bad debt to the Bank, the meeting agreed, it is appropriate. The control on sugar-cane planted area reduction will be on the hands of the Ministry of Agriculture and the Bank by setting up working group to work in detail. The working group is a representative from the Ministry of Agriculture and Cooperatives, Ministry of Interior, Ministry of Commerce, Department of National Account, Sugar Institute and the Bank of Agriculture and Agricultural Cooperatives.

This proposal had been submitted to the Board of National Sugar Policy on 31 May 1978, it has been agreed.

So please consider and submit to the cabinet to approve the amount of 100 million Baht farmer aid fund for the above stated purpose.

With best regards,

(Signed) Tamnong Singkalavanich
Deputy Minister,
Deputy in charge of Minister of
Agriculture and Cooperatives

SP 0202/12444

Secretatriat to the Prime Minister

July 6, 1978

Re. Asking the Permission to Let the Farmers and Bank for Agriculture and Cooperatives Borrow from Agricultural Fund.

To. Minister of Agriculture and Cooperatives

Reference MO..C 0204/12762 dated June 16, 1978

The Ministry of Agriculture and Cooperatives has asked the Cabinet's approval to allow the Bank for Agriculture and Cooperatives to withdraw 100 million baht from agricultural fund interest free for a period of 10 years to finance production shifts by the sugar cane farmers. This money will be used in three Agricultural Economics Zones to assist the sugar cane farmers in shifting to the production of alternative crops, livestock, or fish farmming instead of planting sugar cane. Once the shifts are accomplished in the three target zones any remaining fund will be used for the some purpose in other province where sugar cane produce are in difficulty.

The Cabinet met on the 4th of July, 1978 and agreed :

1. to allow the Ministry of Agriculture and cooperatives to implement this program with money from the agricultural fund.

2. that the goal of reducing area planted to sugar cane is appropriate and should be carried out.

The Ministry of Finance and The Budget Bureau have been informed of this program and will cooperate in the funding arrangement.

Sincerely yours

Plung Meechul
Secretarit to the Cabinet

Work Guidelines

Work and stages of work in the Office of Agricultural Economics can be described as follows:-

Center of Agricultural Statistics: Its function and responsibility are to compile data which is classified into 2 categories; firstly, data concerning all production of major crops are to be collected and submitted to the government within certain time period, i.e. estimated rice production has to be reported by November each year in order to augment the nation's export plan. Other crops such as maize, kenaf, cassava also are processed likewise. Secondly, data concerning the economic status of farmers is obtained by annual survey. This data will be served as data base required by the Division of Agricultural Economic Research and the Division of Agricultural Economic Development policy and planning for futher agricultural business and development policy and planning analyses.

Division of Agricultural Economic Research, besides obtaining basic data from the Center of Agricultural Statistics for analyses, also collects some specific data in order to carry out the agricultural economic research, such as production costs of crops and livestock, uses of factors of production, land rent, farm management and agricultural business analyses including market system, local commodity prices and export of all kind of farm commodities, for supporting agricultural economic analysis and policy guidelines. Division of Agricultural Economic Development policy and Planning uses data from the Center of Agricultural Statistics and Division of Agricultural Economic Research to run agricultural development models in order to find out the

alternative plans and policies then submit to the Board to decide for implementation. After the Board, of Agriculture and Cooperatives Development policy and planning has decided the plan, this plan will be introduced to concerned departments and identified by the Division of Agricultural Development policy and planning for implementation. The Division of Regional Agricultural Economic Administration will carry out the identification process to the concerned divisions which implement in the local area, also do the manitoring and evaluation works. If there is any problem it will be studies, then submit with reccommendation to the Board for futher action.

In this process, the Division of Regional Agricultural Economic Administration also has 5 Centers of Regional Agricultural Economics covering all the 19 Agro-economic zones in coordination to the local administration projects which cover provincial, Amphoe and district levels. This system is a mean of wide-range agricultural development policy and planning analysis in which the linkage of top-down is realized, also during the implementation phase the monitoring and evaulation are included as well, perhaps, anything goes wrong it will be solved correctly and immediatly. Moreover, the effects will reach farmers dirrectly which is the main objective of raising farmers' income.

Office of the Secretary: Its function is to serve as a coordinator among divisions in the Office of Agricultural Economics. It is expected that, through the system, all departments in the Ministry of Agriculture and Cooperatives and other concerned ministries will work well and create working linkages to be beneficial to Thai agricultural Development.

List of Activities Involud by the Director

1. Rice Reserve Committee
2. National Agricultural Research Administration Committee
3. Administration Committee on Chao-Phaya Irrigated Agriculture Development Projects (Stage II)
4. Sub-Committee on Policy and Population Planning
5. Cotton Development Committee
6. Committee on Thai-Japanese Joint Approach
7. Casava Problem Committee
8. Committee on Land Assessment Under Land Reform for Agriculture Law
9. Committee on Compititive Examination for Study Abroad on Government Scholarship
10. Committee on Exporters' Problems
11. Local Seminar Committee on Low Income Farmers' Problems
12. Paddy Price Support Committee
13. Board of Commodity price control
14. Commodity Standard Committee
15. Improved Productivity Committee
16. Appeal Committee to Measure 41 of Land Reform for Agriculture Law B.E. 2518
17. Sub-Committee on Joint Approach to Farm Establishment and Quota Allotment
18. Japanese Market Demand Study Sub-Committee
19. Sub-Committee on International Sugar Agreement Regulation Problems
20. Committee on Livestock Development for Export Project
21. Broad of Administration on Reserch and Extension

Future Direction For Policy Analysis in the DAE

The future policy analysis within the MOAC must provide answers or alternatives for both the emergency very short run issues as well as the long run five and ten year development plans. The policy analysis capability must be responsive to issues from the Kingdom level down to the poorest amphur. More exactly, the types of policy analysis required in the future may consist of the following.

1. Short tem research in which answers to emergency questions must be provided within a number of hours. Much of this research is related to price and export policy for specific commodities.
2. Long run capacity questions which deal with the ability of Thailand to provide food and employment for a growing future population.
3. The issues of income distribution between rural-urban sectors, between regions within the rural sector as well as within particular regions of the rural sector.
4. In depth analysis of the direct and indirect impacts of specific development projects on target population groups at the changwat or even subchangwat level. This effort would be cooperative with other agencies and departments. In some cases the design of the project would be carried out by the DAE but in many the actual design of the projects would be by the agency most directly involved. The final analysis in all cases is expected to be by the Office of Agricultural Economics.
5. Measuring the total effect of all agricultural and agricultural related projects during a development plan. This includes an

analysis of the time sequence or resources requirements both monetary and physical of the projects in the development plan. The analysis would include consideration of the time sequence in which outputs from completed projects and available along with the input requirments for projects being developed. The total effect must include an assessment of direct plus indirect benifits which go to different rural income groups.

The central policy problems which must be faced by every government in Thailand are concerned with income levels, income distribution, employment, cost of liging and the balance of payments.

The five year developmental plans must deal with each of these issues simultaneously. Additional investment is required to increase future employment. But the amount of investment and thus the ability of the Government to alter an adverse income and employment situation is limited by the allowable balance of payments deficit, the rise in the cost of living, and by its ability to identify viable development opportunities which provide benefits to specific income groups.

The policy analysis capability developed within the Ministry of Agriculture and Cooperatives emphasises the role of the agricultural sector in meeting both national and local development requirements. The position of the rural poor will continue to recieve special attention in project selection and project monitoring.

The pending proposal that DAE be evaluated to an office would place the responsibility for seeing that projects which are selected are of benifit to the targeted groups in Thailand. Under the reorganization the final analysis for projects to be selected and the follow up

of implemented projects would be by the Office of Agricultural Economics. Coordination with other agencies would be through both Central Committees and fied staff.

The pending reorganization within MOAC will allow the policy analysis capability developed within the Ministry of Agriculture to be directly used to insure that all projects selected by the MOAC are consistent with both Kingdom wide goals and localized needs. At the Kingdom level, the total impact of the development program must be measured against the repayment capacity of Thailand, the effect on the balance of payments, and the effect on the cost of living. The localized considerations include the amount of benefits recieved by specific low income groups in terms of direct plus indirect income and employment opportunities, the use and availability of local resources etc. The future policy analysis work in the DAE must also be responsive to demands for short term emergency research where answers may be required within a matter of hours.

Many of the policies and resulting development projects proposed will deal with issues of import substitution. The resources required for an import substitution policy may compete with required for expansion of maintenance of current exports. Both imports and exports affect the balance of payments but each policy may have different requirements for raw material imports employment of low income groups, and for requirements of scarce government technical personal.

A particular example which will be considered in the near future is cotton. The exact decision on how to approach this issue has not yet been reached but the analysis could proceed in the manner so that policy makers who may be concerned primarily with balance of payments

concerns can be made aware of how a proposed solution at the national level may affect the status of poor farmer groups inside and outside a project area.

A major investment strategy of previous development plans has resulted in the establishment of a major textile industry in Thailand with textiles now being exported abroad. However, imports of raw cotton have increased in proportion to production of cotton textiles. Imports of cotton lint now represent a substantial import item. The policy issue which requires analysis is the feasibility of increasing domestic cotton production to reduce the consumption of imported cotton used in the production of textiles for domestic use and exports. The arithmetic of the policy analysis should weigh any reduction in cotton lint imports against increased imports of pesticide, processing machinery, and the opportunity cost of allocating additional extension personnel to cotton production. The reduction in export earnings form alternative crops such as maize which may grow the same land must also be considered. Thus the policy analysis must not only consider the viability of increasing domestic cotton production but also the opportunity cost of resources and other crops and livestock replaced by expanded cotton production. The choice of alternative production locations for such a project should consider the income levels of potential cotton producers as well as the land ownership system required to implement the production system.

Such an analysis would draw upon and add to components of research which are already completed. For example, an econometric model of the cotton market has been completed which provides information on cotton imports, Cotton-textile price prediction, mill consumption of cotton

lint, and output of cotton textiles. The evaluation of the import substitution policy at the national level, would use the linkage between the macroeconometric model and the programming models to measure the impact on total investment, net change in the balance of payments, total income and employment. The programming models with subregion detail would be used to analyze not only competitive position of alternative cotton production techniques with other crops. The appended I/O social accounting techniques would provide a measurement of the direct plus indirect benefits or consequences to such groups as landless laborers and small farmers, and large farmers.

Appendix B

Thailand Sector Analysis Program Publications.

CONTENTS

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. 3 Feb. 1977

3. Annual Report : Agricultural Sector Analysis in Thailand, FY-1977 (Draft)

B. Conference Papers.

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

4. Research Strategies For National Agricultural Planning in Thailand. By D.E and ISU Team. (Lee Blakeslee, Arthur Stoecker, Keith Rogers) (The Food and Agricultural Organization Sector Analysis Seminar, Bangkok, Thailand, 9-21 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 Thongchai Petcharatana.

11. Agricultural Statistics Center by Laurence Kinyon. (The Agricultural Development Council Seminar on Agricultural Development Planning in Thailand, Bangkok, Thailand, 29-30 1975)

12. A report on the IDC 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.

17. Income Elasticity of Demand for Foods by
Prasit Supradit.

18. Agricultural Demand Analysis by
Thonchai 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 Analyses. by
Charles F. Framingham, A. L. Stoecker, K. Khatikarn, S. Sriplung and E.O. Heady CARD 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 Vongmonta and Herbert H. Fullerton.

25. Livest[illegible]and Rice Transportation, Storage and Processing Models by
Chamleng 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.

C. Data and Survey Reports.

1975-76

29. Soybean Survey Report by
Agricultural Statistics Center, Agricultural Statistics Bulletin No. 50

1973/74

30. 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 Economic Crops by
Production 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

1974/75

36. 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 Rice Production in Chaiburi 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)

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 Representatives of ASEAN Countries in DJAKATA, Indonesia, 20 August 1976.

48. Micro 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.

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No. 1 Center for Agricultural and Rural Development. "Annual Report: Agricultural Sector Analysis in Thailand." February 1977.

No. 2 Stephenson, James A. and Kajonwan Itharattana. "Macroeconometric Analysis of Economic Activity in Thailand, 1962-1974." March 1977.

No. 3 Framingham, Charles F. et al. "Agricultural Development Planning in Thailand: Some Supporting Analysis," March 1977.

No. 4 Blakeslee, Leroy and Thongchai Petcharatana. "Kenaf Demand in Thailand." June 1977.

No. 5 Center for Agricultural and Rural Development. "Third Annual Report: Agricultural Sector Analysis in Thailand." June 1977.

No. 6 Center for Agricultural and Rural Development. "Singapore Symposium: Agricultural Sector Analysis in Thailand." July 1977.

No. 7 Rogers, Keith and Pradit Itharattana. "Agricultural Supply Response in Northeast Thailand: Production, Resources, Income, and Policy Implications." October 1977.

No. 8 Digsatar, Bahram et al. "Consumer Demand for Food Commodities in Thailand." March 1978.

Forthcoming

No. 9 Faber, Doeke C. "A Study of The Supply Response of Rice in Thailand." Forthcoming. (Final Editing Stage)

No.10 Center for Agricultural and Rural Development. "Fourth Annual Report: Agricultural Sector Analysis in Thailand." Forthcoming. (Final Editing Stage)

DAE Publications List

Statistical Materials

Series No.	Series No. (In the past)	Publication Year (B.E.)	Title	Remarks
1	1	2497	Agricultural Statistics of Thailand B.E. 2496 (1953)	
2	2	2498	Agricultural Statistics of Thailand B.E. 2497 (1954)	
3	3	2499	Agricultural Statistics of Thailand B.E. 2498 (1955)	
4	4	2500	Agricultural Statistics of Thailand B.E. 2499 (1956)	
5	5	2501	Agricultural Statistics of Thailand B.E. 2500 (1957)	
6	6	2503	Agricultural Statistics of Thailand B.E. 2501 (1958)	
7	7	2505	Agricultural Statistics of Thailand B.E. 2502 (1959)	
8	8	2506	Agricultural Statistics of Thailand B.E. 2503 (1960)	
9	9	2506	Land Utilization of Thailand B.E. 2504 (1961)	
10	10	2507	Agricultural Statistics of Thailand B.E. 2504 (1961)	
11	11	2508	Agricultural Statistics of Thailand B.E. 2506 (1963)	
12	12	2509	Agricultural Statistics of Thailand B.E. 2507 (1964)	
13	13	2509	Thailand Agricultural Statistics in Brief.	
14	14	2510	Thailand Agricultural Statistics B.E. 2508 (1965)	
15	15	2511	Thailand Agricultural Statistics B.E. 2509 (1966)	
16	16	2511	Land Utilization of Thailand B.E. 2508 (1965)	

17	17	2513	Thailand Agricultural Statistics B.E. 2510 (1967)
18	18	2514	Report on a survey of Swine, Chicken and Duck of Thailand B.E. 2513 (1970)
19	19	2515	Agricultural Statistics of Thailand B.E. 2511-2513 (1968-1970)
20	20	2515	Monthly & Yearly Commodities Agricultural Price. B.E. 2500-2513 (1957-1970)
21	21	2515	Agricultural Statistics Price B.E. 2514 (1971)
22	22	2515	Measurement for sale by farmers.
23	23	2516	Major Agricultural data of Thailand
24	24	2516	Land Use of Thailand. B.E. 2514 (1971)
25	25	2516	Agricultural Statistics of Thailand B.E. 2514-2516 (1971-1973)
26	26	2516	Agricultural Commodity Price B.E. 2515 (1972)
27	27	2517	Agricultural Commodity Price B.E. 2516 (1973)
28	28	2517	Fertilization Statistics of Thailand
29	29	2517	Primary data on livestock production
30	30	2518	Report of Yearly Rice Crop B.E. 2516/17 (1973/74)
31	31	2518	Major Agricultural Statistics of Thailand
32	32	2518	Fertilization Statistics of Thailand
33	33	2518	Thailand Agricultural Statistics in Brief
34	34	2518	Primary Report on Area Frame Sampling Test in Saraburi & Lopburi Provinces B.E. 2517/18 (1974/75)
35	35	2518	Report on Yearly Rice Crop B.E. 2518/19 (1975/76)
36	36	2518	Primary Report on a survey of Yearly Rice Crop. B.E. 2517/18 (1974/75)
37	37	2518	Monthly Agricultural Commodity Statistical Price. B.E. 2517 (1974)
38	38	2518	Report on Kenaf Survey. B.E.2517/18 (1974/75)
39	39	2518	Agricultural Commodity Price B.E. 2508-2517 (1965-1974)

40	40	2518	Prelimary Report on Second Rice Crop B.E. 2517 (1974)
84	84(1)	2518	Economic Data related to Agriculture
41	41	2519	Agricultural Statistics of Thailand B.E. 2517/18 (1974/75)
42	42	2519	Land Use in Thailand. B.E. 2516 (1973)
43	43	2519	Report on Second Rice Crop. B.E.2519 (1976)
44	44	2519	Agricultural Commodity Price. B.E.2518(1975)
45	45	2519	Report on Cassava Survey. B.E. 2518 (1975)
46	46	2519	References on Kenaf Production and Trade.
47	47	2519	Report on Planted Area and Production of Cotton. B.E. 2518/19 (1975/76)
48	48	2519	Reprot on Planted Area and Production of Maize. B.E. 2518/19 (1975/76)
49	49	2519	Report on Livestock Production. B.E. 2516/17 (1973/74)
50	50	2519	Report on Soy bean Survey. B.E. 2518/19 (1975/76)
51	51	2519	Report on Sugar Cane. B.E. 2518/19 (1975/76)
52	52	2519	Report on Sorghum. B.E. 2518/19 (1975/76)
53	53	2519	Report on Mungbean. B.E. 2518/19 (1975/76)
54	54	2519	Agricultural Statistic of Thailand B.E. 2518/19 (1975/76)
55	55	2520	Report on Livestock Quantity. B.E. 2518, 2519 (1975, 1976)
56	56	2520	Thailand Agricultural Statistics in Brief B.E. 2519/20 (1976/77)
57		2520	Land Use in Thailand. B.E. 2518 (1975)
58		2520	Report on Soy beans's Survey B.E. 2519/20 (1976/77)
59		2520	Report on Sugar-Cane's Survey
60		2520	Report on Cassava's Survey
61		2520	Report on Kenaf's Survey. B.E.2519/20 (1976/77)
62		2520	Report on a survey of corn for animal feed
63		2520	Report on Planted Area and Production of Yearly Rice Crop. B.E.2519/20 (1976/77)

64		2520	Graphs showing planted areas, yields, exports of major economic crops of Thailand. B.E. 2510-2519 (1967-1976)	
65		2520	Report on Sorghum Survey B.E. 2519/20 (1976/77)	

Marketing Materials

1	.2	2500	Report of the Study of the Thai Agriculture Commodity in the Hong Kong Market
2	15	2506	Lecture on the Agriculture Marketing Course
3	17	2507	Marketing Margins and Marketing Channels of Major Agri. Commodities and Livestock in the Northeastern Region of Thailand 1963-1964
4	19	2508	Report of the study on Silk Production and Marketing in the Northeast of Thailand 1965
5	21	2510	Report of the Study on Market News System in the Northeast 1965
6	26	2511	Marketing of Chicken in 11 Provinces in the Central Region of Thailand 1968
7	28	2512	Report of the Prelimnary study on the Thai Natural Rubber
8	29	2512	Report of the Prelimnary study on the Thai Cassava
9	33	2512	Report of the study on Price Paid and Price Received by Farmers 2509-2512
10	38	2513	Report of the Prelimnary study on the Thai Maize
11	39	2513	Report of the study on Marketing of Farm Products in the Upper part of Chao Phaya of Thailand 2512
12	40	2513	Report of the study on development of Thai Banana
13	42	2514	Report of the study on Rice and Shrimp
14	47	2515	Report of the study on Cassava, Buffalo Trade, Natural Rubber, Cotton, Sorghum and Castor Seed
15	48	2515	Analysis of the movement of Wholesale Price of Major Commodity in Thailand
16	51	2515	Report of the Study on Production, Marketing and Price of Natural Rubber Production 1970 (Part I)
17	62	2515	Report of the study on Marketing Board
18	63	2515	Report of the study on Marketing Board in Australia
19	68	2515	Report of the study on Production, Marketing and Price, Thailand 1970

20	71	2516	Report of the study on Natural Rubber situation
21	72	2516	Report of the study on Production, Marketing and Price of Cassava, Thailand 1971
22	73	2516	Report of the study on Marketing of vegetable and Fruit in Bangkok Market
23	75	2517	Report of the study on Trade, Farmer's Problem and Government subsidy of Rice
24	76	2517	Report of study on Production and Trade of Kenaf 1975
25	77	2517	Report of the study on Production and Trade of Grape, Thailand
26	82	2518	Special data on Rice for Products and Trade Decision Policy Making
27	85	2518	Report of the study on Trade, Farmer's Problem and Government subsidy of Rice 2517-2518
28	86	2518	Report of the study on Marketing of Coconut and Coconut Products
29	89	2518	Report on Kenaf Situation of Thailand
30	95	2518	Report of the study on Trade, Farmers Problem and Government subsidy of Maize
31	98	2519	Report of the study on Selling Pattern of Major Commodities
32	102	2519	Report of the study on Selling Pattern, Planting period and haveating period of Major Commodity in Thailand
33	103	2519	Report of the study on Marketing of Major Commodity and Livestock in the North of Thailand, 1972
34	104	2519	Report on the study of Production, Marketing and Price of Shrimp, Thailand B.E. 2515-16
35	94	2518	Special data on Rice B.E. 2519
36	112	2519	Special data on Rice B.E. 2520
37	115	2520	Report of the study on Production, Trade of Kenaf for Decision making
38		2520	Report of the study on Potential Foreign Market of Major Agricultural Commodities

.39		2520	Report of the study on Price guarantee and Price support Program of the effect on pricing and Farm's income
40		2520	Analysis of Demand for Soya bean
41		2520	Analysis of Demand for Mung bean
42		2520	Report of the study on Marketing and Price of Soya bean and Groundnut in Thailand 1972
43		2520	Analysis of Farm Product Sector in Foreign Market 1976
44		2520	Analysis of Demand for Cotton and Cotton Products
45		2520	Analysis of the income elasticity for foods on the DAE staff member
46		2520	Report of the study of Production and Marketing of Garlic in 1976/77

Agricultural Production Materials

1	4	2501	The Survey on The Industry of salted Pratu 2499
2	6	2501	The efficing of middle size Industry on salted Pratu
3	7	2501	Report of the survey on the economics condition of farmers in Changwat Nakorn Pathom B.E 2498-2499
4	8	2502	Report of the study on egg marketing 14 provinces B.E 2501
5	9	2502	Report of the study on Farmer's debt and Rice Marketing in Central Region, Thailand 2500-2501
6	16	2507	The study of socio-economic of farmers in Changwat Roi-et, Mahasarakam and Kalasin B.E 2506
7	18	2507	Report of the study on Cotton Production of Thailand
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9	23	2510	Least Cost Rations Corn And Sorghum As substitutes of Bran For Growing Chicks
10	25	2511	Potentials in the Economic Development of Thailand's Agriculture
12	34	2512	Report of the study on Socio-Economic of Farmers in Demonstration Project in Changwat Chainat B.E 2511
13	35	2512	A Study on Rice Production and Consumption in Thailand
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18	79	2518	Report of the survey result on Farmer's Debt in Thailand Crop year 2514/15
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23	96	2519	Cost Production on Rice
24	100	2519	Cost of Production on Major Commodity
25	105	2519	Report of the study on chicken production, Changwat Chachoengsao
26	1 06	2519	Cost of Rice Production for Secondary Crop B.E 2519
27	107	2519	Report of the study on Production, Marketing and optimum investment in Cassava Industry
28	109	2519	Report of the study on Costs, Production, Returns and optimum replantation on Durian farm, Changwat Chanburi Crop year 2518
29	1 10	2519	Report of the study on Costs, Production, Returns and optimum replantation on Coffee Farm, Changwat Nakornsithammaj
30	111	2519	Report of the study on Costs, Production, Returns and optimum replantation on Coconut replantation farm, Changwat Chumpern
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32		2520	Report of the Time Motion Study on Activity of Farmers, Changwat Lopburi
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42		2520	Report of the study on Fraduk Production of [illegible]and B.E 2519
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6	24	2511	The Optimum Size of Cotton Farms in the Mukdaharn Self-Help and Settlement, Changwat Nakorn Phanom, Thailand.
7	27	2512	Prelimnary Report on The Economic of Ground water use for Farming at Ban Nakah Village, Changwat Udon Thani.
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9	31	2512	Basic data for farm management.
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17	87	2518	Characteristics of Farming in North Eastern of Thailand
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20	101	2519	Report on a study of ground water use in growing crops after rice harvesting period Tambon Chinamai, Amphur Inburi, Changwat Singburi B.E. 2517-18.
21		2520	Return to investment of ground water use for farming at Ban Nakah, Changwat Udon Thani.
22		2520	Report of the study on the productivity and factors of farming in irrigated project Lumnoamoun, Changwat Sakol nakorn Crop year 2518-19
23		2520	Crop labo r time and motion study of selected crops at Amphur In-Buri, Changwat Singburi 1976-77
24		2520	Report on A Study of Farm Planning in Irrigated Area at Aumphoe Lumpao, Changwat Kalasin
25		2520	Report on A Study on Swine Business of the Farm Planning Project in Nakah Village, Aumphur Muang, Changwat Udon Thani
26		2520	Report on Farm Planning in Irrigated Area, Naopoong, Nongwai, Changwat Khonkaen
27		2521	Report of the Study on groundwater using rice farm in the Farm Planing Projects, Nakah Village, Changwat Udon Thani
28		2521	Report of the Study on Return to investment of Groundwater for agricultural purpose in farming project, Koolung Village, Tambon Banpan, Aumphur Muang, Changwat Lumpun B-E 2521
29		2521	Report of the Study on Broiler Contract Farming B-E 2520
30		2521	Report of the Study on Socio-Economics of Farmers in Cropping Pattern Project, Changwat Ubon Rathani B.E 2520
31		2521	Report of the Study on Socio-Economics of Farmers in Cropping Pattern Project, Changwat Nakornrajsima B.E 2520
32		2521	Report of the Study on Socio-Economics of Farmers in Cropping Pattern Project North Eastern of Thailand B.E 2520
33		2521	Report of the Study on Socio-Economics of Farmers in Cropping Pattern Project, Pong Rue Village, Aumphur Pasang, Changwat Lumpun B.E 2520

34		2521	Report of the Study on Cropping pattern in the land leveling project, Inburi, Changwat Singburi Crop year 2519/20

Agricultural Planning Materials

1	41	2514	Economic Development Planning
2	54	2515	Accelerated Cattle Production and Trade Plan
3	55	2515	Accelerated Maize Production and Trade Plan
4	56	2515	Accelerated Coconut Production and Trade Plan
5	57	2515	Accelerated Soy beans Production and Trade Plan
6	58	2515	Accelerated Shrimp Production and Trade Plan
7	59	2515	Accelerated Silk Production and Trade Plan
8	61	2515	Agro-Economic Zones for Agricultural Extension
9	65	2515	Agro-Economic Zones and The Agricultural Development Planning
10	78	2518	Evaluation Return to investment of Land Consolidation at Changsut Aumphur Banglajun , Changwat Singburi
11	83	2518	Characteristic of Farm B.E. 2516-2517
12	93	2518	Sugar-Cane and Sugar Production Situation
13	97	2518	Distribution of Agricultural Land Holding B.E. 2517
14	99	2519	Study Report on Rice Farming and Income B.E. 2519
15	108	2519	The Additional Studies on "Appraisal of the Land Consolidation Project, Chanasut, Singburi and Study on Recovery of the Cost"
16	114	2519	Thailand's Fourth Five-Year Agricultural Development Plan B.E. 2520-2524 Guidelines
17		2520	National Crop Model of Thailand
18		2520	Linear Programming Model
19		2520	Agricultural Sector Analysis in Thailand (ADC Seminar in Singapore, November 8-11, 1976)
20		2520	Agricultural Project Analysis
21		2520	Fourth Five-Year Plan for Agricultural Development Guideline and Implementation
22		2520	Economic Analysis of QP Adaptation Guidelines
23		2520	Research work on recovery of the land consolidation, Chanasut, Singburi B.E 2518-2519

Miscellaneous

1	1	2498	Report on Economic Situation of Agricultural Land Holding B.E. 2496
2	5	2501	MOAC Recommendations B.E. 2500
3	11	2504	Report on Survey Result of Social and Economic Status of Fishermen at Kliengkai Canal, Changwat Nakornsawan B.E. 2500-2501
4	14	2505	MOAC Brief Program Activities in Northern Region of Thailand
5	36	2502	Rice Economy of Thailand
6	45	2515	Wheat
7	49	2515	Domestic Rice Demand
8	53	2515	Economic Impact of Green Revolution
9		2521	Increase in Second Rice Crop Production Under Emergency B.E. 2520/21

ISU-DAE Agricultural Development Planning
Its International Relationship and Recognition

The joint effort of MOAC's Division of Agricultural Economics and the Sector Analysis Team from Iowa State University which has been in operation since 1973 has all along been widely recognized both internally and internationally.

The January 1978 ASEAN Workshop on the Study of Supply and Demand for Food and Other SDrategic Commodities in Jakarta also gave much recognition on how the Thai agricultural development planners fused all appropriate policy variables with the national crop model in arriving at future outlook on supply and demand for the country's major crop product

The presentation of a Regional Rice Security Reserves Model by the Thai Delegation in the ASEAN Working Group on Rice Security Reserves Bangkok during 16-21 February, 1978 also was one among other internation contributions of technicians from DAE. This food security reserve effor of the ASEAN was recognized by the May, 1978 World Food Security Confere in Rome and the latest World Food Council Meeting in Mexico. To reitera the following proposal was submitted by the delegation of Thailand and supported by the delegations of Indonesia and the Philippines. "The Cou recommended that the establishment of appropriate food reserves on regio or subregional basis and such international assitance as necessary".

To add more probability to the possibility of having the experi like DAE, all ASEAN delegations in the ASEAN-US Meeting on Agricultural Development Cooperation unanimously recommended that an ASEAN Agricultur Development Planning Center be established in Thailand.

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