

AGENCY FOR INTERNATIONAL DEVELOPMENT
 WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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1. SUBJECT CLASSIFICATION	A. PRIMARY	Food production and nutrition	AA00-0000-G704
	B. SECONDARY	General--Korea Republic	

2. TITLE AND SUBTITLE
 Korean agricultural sector simulation and Korean agricultural planning project; review team report

3. AUTHOR(S)
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4. DOCUMENT DATE 1976	5. NUMBER OF PAGES 66p.	6. ARC NUMBER ARC
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7. REFERENCE ORGANIZATION NAME AND ADDRESS
 Tolley

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)
 (Review of Mich. State Univ. KASS and KAPP proj. 931053600 [contract AID/csd-2975])

9. ABSTRACT

10. CONTROL NUMBER PN-AA6-521	11. PRICE OF DOCUMENT
12. DESCRIPTORS Models sector analysis Agricultural economics Simulation Project evaluation Korea Rep.	13. PROJECT NUMBER 298003500
	14. CONTRACT NUMBER AID/asia-C-1157
	15. TYPE OF DOCUMENT

KOREA

PN-AGG-521

FILE

REVIEW TEAM REPORT

on

Korean Agricultural Sector Simulation

and

Korean Agricultural Planning Project

Based on Activities of the Team
In Korea March 6-13, 1976

In Fulfillment of

Contract Number AID/ASIA-C-1157

REPORT OF KASS/KAPP REVIEW TEAM

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I. INTRODUCTION

KASS

The project that provided for agricultural sector model development in Korea began in 1971 (Contract AID/csd-2975 with Michigan State University). It followed the completion of a project in 1970 that had supported the development but not utilization of a computerized systems simulation model of agriculture in Nigeria (Contract AID/csd-1557 with Michigan State University).

The objective of the project that began in 1971 in Korea was to further develop and apply the systems simulation approach to agricultural policy and planning problems in developing countries. The selection of Korea as the site for further developing and applying the simulation modeling technique was facilitated by the interest of the Korean government in improving the performance of the agricultural sector and of the USAID mission in an agricultural sector analysis that would identify priority areas for sector loans and grants by AID. The project was titled the Korea Agricultural Sector Simulation Study, or KASS.

Beginning in mid-1971, Michigan State University personnel and Korean technicians worked on an agricultural sector analysis report and an investment priorities study. The two studies were completed in a 12-month period (Rossmiller, G. E. et al., Korean Agricultural Sector Analysis and Recommended Development Strategies 1971-1986, 1972 and Ferris, J. N. et al., Investment Priorities in the Korean Agricultural Sector, 1972). These studies provided a synthesis of quantitative

and qualitative knowledge about the structure and operation of the agricultural sector and made recommendations for policy choices and investment priorities. They were the basis for several policy and investment decisions by the Korean government and USAID.

During the 1971-72 period, a prototype simulation model was developed. It was primarily an accounting model designed to process data and generate projections of production, yields, prices, and other important economic variables in the agricultural sector. This initial version of the model, through its accounting routines, was useful in the completion of the reports but did not address all the behavioral characteristics of the sector. The KASS team then turned their attention to improvement and expansion of the computerized systems simulation model.

During the model development phase -- roughly from October 1972 to December 1975 -- activities under the project concentrated on model development with relatively little effort at utilization.

KAPP

Beginning in mid-1975, a complementary utilization phase involving application of the KASS analytical capabilities to policy analysis and planning in Korea was begun. Early KASS effort dealing with the organization of the Korean Ministry of Agriculture and Fisheries (MAF) had identified organizational and functional constraints to effective planning and policy making in the Ministry. As a consequence, a project was developed under USAID funding for MSU to provide technical assistance to MAF in four specific areas: agricultural policy analysis, agricultural

outlook, project evaluation, and agricultural statistics. This project was titled the Korean Agricultural Planning Project, or KAPP.

While KASS was designed to generate analysis and information inputs for decision making, KAPP was designed to help policy makers formulate problems and utilize analytical results to select among alternative solutions. Thus, KAPP was expected to create linkages between MAF officials and the work of the KASS unit, enabling KASS to interact with decision makers and provide timely and credible information relevant to their problems.

Purpose of this Review

The present report presents the views of the joint American-Korean review team that was assembled in Korea during the period March 7 - 13, 1976 to examine the institutionalization of the analytical capability represented within the KASS and KAPP projects for decision-making purposes and to explore replicability and potential use elsewhere in the developing world.

The team was asked specifically to

- a. Ascertain the uses and usefulness of the analytical capability developed by the KASS Division, NALRI for providing analytical input to decision processes in agricultural sector policy, program and project planning by the ROKG.
- b. Assess the degree of institutionalization in the ROKG of this capability, including staffing, budget, facilities, and organization.

- c. Identify those remaining constraints, linkages, and other activities that would facilitate further utilization of the analytical capacity.
- d. Assess the potential for replicability and use elsewhere in the developing world.

To carry out its assignment, the review team examined the experience in Korea in developing an analytical capacity at the national government level for planning agricultural sector development and providing information to decision-makers on the consequences of alternative choices of policies, programs and projects. Its focus was on the usefulness of an analytical capability in Korea rather than on the technical characteristics of models that have been developed. The review team viewed models as tools and primarily concerned itself with the capability for using, adapting and improving models and other quantitative approaches for the analysis of a wide variety of agricultural planning and policy problems.

Review Procedures

The American members of the team were:

George S. Tolley, University of Chicago (Co-Chairman)

Rex Daly, U.S. Department of Agriculture

Lehman Fletcher, Brookings Institution

Warren Johnston, University of California at Davis

Richard Phillips, Kansas State University

Fletcher E. Riggs, U.S. Agency for International Development

The Korean members of the team were:

Hahn, Man Jun, Planning and Management, MAF (Co-Chairman)

Ahn, Choong Y., Choong Ang University

Choi, Byung Hang, National Agricultural Co-operatives
Federation

Kim, Jae Ik, Economic Planning Board

Lu, Dong Bae, Planning Bureau, MAF

Moon, Pal Yong, Korea Development Institute

Pak, Ki Hak, Yonsei University

Rhee, Beong Sah, Korea Development Institute

Yoo, Jong Tack, International Co-operation Office, MAF

Prior to the week devoted to the review in Korea, the team members reviewed the documents listed in Table 1 to become familiar with written project outputs.

While in Korea, the review team devoted a part of its time to counselling with members of the KASS and KAPP staffs and their Korean counterparts, in order to obtain further information on the history and status of model development, on applications that have been made to policy and planning and on possible needs for improvement. In this connection, members of the review team talked with Kim, Dong Hi, Director of NAERI and Kim, Dong Min, Chief of the Agricultural Sector Analysis Division of NAERI, and other NAERI staff members, as well as MSU, KASS/KAPP personnel including G. Edward Rossmiller, Michael H. Abkin, David W. Culver, Richard D. Duvick, Forest J. Gibson, Martin E. Hanrathy, Gary R. Ingoaldson and Alan R. Thodey.

Table 1. Project Outputs Studied by Review Team

PAPER OR ARTICLES	AUTHOR	DATE
1. Grain Management Program Simulation Model - Status Report	F. J. Gibson	7/73
2. Analysis of Short-Term Grain Policy Alternatives	Grain Policy Task Force	7/21/74
3. A National Economy Sector Model Linkage Korean Agriculture Non-Agricultural - KASS Working Paper # 74-7	Michael Abkin	12/31/74
4. The National Agricultural Cooperative Federation - An Appraisal - KASS Special Report #1		
5. Rural Infrastructure - KASS Special Report #2	SangGee Kim/Libby	1972
6. An Analysis of New Land Development in Korea - KASS Special Report #3		1972
7. An Analysis of Supply Response in Major Agricultural Commodities in Korea - Special Report #4	Ferris/Suh	1972
8. Agricultural Research & Guidance - KASS Special Report #5	Chung/Miller/Rossmiller	1972
9. Population, Migration & Agricultural Labor Supply - KASS Special Report #6	Beegle/Carroll/Hathaway/Kim	1972
10. Organization and Performance of Agricultural Marketing Systems in Korea - KASS Special Report #7	Shaffer/Song/Suh/Shu	1972
11. Crop Production Data & Relationships - KASS Special Report #8	Kim/Kim/Wright	1972
12. User's Manual for the Korean Agricultural Simulation - KASS Special Report #9		1972
13. A Macro Model of Economic Growth & Income Distribution - An Application of Systems Simulation in the Korean Case - KASS Special Report #10	Kim	1973
14.* Investment Priorities in the Korean Agricultural Sector - Korean Agricultural Sector Study Team	Study Team	1972
15.* Korean Agricultural Sector Analysis & Recommended Development Strategies 1971 - 1985	Study Team	1972
16. Preliminary User's Guide to the Recursive Linear Programming Resources Allocation Component of the Korean Agricultural Sector Model	de Haen	5/73
17.* Developing an Analytical Capacity for Planning Agricultural Sector Development	Rossmiller	7/75

(Table 1 Cont.) PAPERS OR ARTICLES

	AUTHOR	DATE
18. Global Modeling of Food & Agriculture: Background to a Possible Approach - Staff Paper	Rossmiller/Johnson/Honradty	8/75
19.* Briefing Charts on the KASS Project - KASS Issue Paper #9	Staff	5/75
20. Approaches to Modeling Off-Farm Migration - KASS Working Paper 74-5	Slobado/Correll	12/74
21. A Proposal for Economic Evaluation of 66 Small and Medium Scale Irrigation Projects in Korea	Duvick/Ro/Kang	
22. Study Proposal for Economic Evaluation & Operation and Maintenance Plan of USAID Loaned Project Areas		
23. Korean Agricultural Project - Administrative Planning Project May 19, 1974 - Dec. 31, 1974	Rossmiller	12/31/74
24. Estimating Future Capital & Labor Needs for ADC to meet Korea's Demand for Rice	Duvick/Kim/Bae	1/75
25. Analysis of Fertilizer Policy in the ROK and Suggested Changes - KAPP Discussion Paper #2	Mangum/Lee	2/75
26. The Importance of Reducing Price Risk as a Policy Objective - KAPP Discussion Paper #3	Mangum/Lee	1/75
27. Improving Market Performance in Korean Agriculture - KAPP Discussion Paper #6	Mangum/Lee	11/75
28. Analysis of Alternative Purchase Prices for Rice in the Republic of Korea	Grains Policy Task Force	9/74
29. The Korean Agricultural Statistics & Data System: Review and Recommendations	KAPP Task Force	8/20/74
30. Model Documentation; Annual grain Price Policy Analyzer	Thodey/Abkin/Gibson/Ingvaldson	
31. Suggestions for an Expanded Program of Agricultural Situation and Outlook in Korea - KAPP Disc. Paper #8	David Culver	
32. PERT Analysis - Korean Crop Breeding Project - KASS Issue Paper #11	Martin Hanratty	
33.* Population and Food in Korea - Facts and Analyses	Sung Hoon Kim/Dong Mim Kim	
<u>Arlie House</u>		
1. Evaluation of the Korean Agricultural Sector Simulation Model		
1. Utilizing a System Model for Policy Analysis	Rossmiller	3/74

(Table 1 Cont.)

PAPERS OR ARTICLES	AUTHOR	DATE
2. Infrastructure to Support Systems Modeling as A Continuous & Transferable Process: The Computer Library for Agricultural Systems Simulation	Abkin	3/74
3. General Systems Simulation Models for Sector Analysis	Johnson	3/74
4. Basic Systems Theory & Concepts Underlying Construction of the Korean Simulation Model with Implications for Future Work	Manetsch	3/74
5. The General Systems Analysis Approach for Agricultural Sector Analysis: Ability to Handle Various Contributing Techniques	de Haen	5/72
6. A Review of the KASS Simulation Model	Jorgen Randers	3/14/74
7. Evaluation Report - MSU Livestock Sector Models	Wilfred Candler	3/74
8. The NAERI/MSU Agricultural Sector Simulation : An Evaluation	Alan M. Strout	
9. Evaluation of the Demographic Component Korean Agricultural Sector Study	John E. Craig, Jr.	3/15/74
10. The Recursive Linear Programming Resource Allocation Component of the Korean Agricultural Sector Study: A Review		
11. Evaluation of the Grain Management Program Simulation Model	Richard Phillip/Paul L. Kelley	

Most of the time of the review team was devoted to counselling with users and potential users. The aim of this counselling was to obtain user views on the value of the work and on possible needs for improvement.

To consider usefulness from the point of view of the Economic Planning Board, the team met with Minister Nam, Duck Woo; Kang, Kyong Shik, Director of Economic Planning Bureau; Lee, Huyng Koo, Chief of First Investment Division; and others. The team also met with Kim, Man Je, President of the Korea Development Institute.

To ascertain MAF user needs, interviews were held with Minister Choi, Gak Kyu; Vice Minister Choo, Sung Kyu; Assistant Vice Minister Bae, Kyu Song; Lee, Huae Young, Director of Food Bureau; Lee, Byung Kee, Director of Farmland Bureau; Song, Chan Won, Chief of Livestock Division, Livestock Bureau; Kim, Sung Ho, Chief of Land Administration Division, Farmland Bureau; and others.

Among officials interviewed at other agencies were Kwan, Yong Shik, President of the Agricultural Development Corporation (ADC); Kim, Jong Bae, Chief of Agricultural Economics Section at ADC; and Kim, In Hwan, Director General of Office of Rural Development.

After formulating its major findings and recommendations, the team had a closing meeting with officials of the Korean government for an oral presentation of the results and exchange of views. The present report records the results of the review team's efforts in final form.

II. THE KOREAN AGRICULTURAL SECTOR MODEL

History and Status of the Korean Agricultural Sector Model (KASM)

The Korean Agricultural Sector Model (KASM) is a major analytical tool and integrating device of the KASS project. Work on KASM was initiated in Fall, 1971. The preliminary version of the model (KASM 1) was primarily an accounting model developed to facilitate timely completion of the sector analysis. Completion of the initial agricultural sector analysis project on schedule was aided by the concurrent development and use of KASM 1 providing guidance on data collection priorities and freeing analysts from the burden of hand calculations.

KASM 1 is diagrammed in Figure 1. The computerized parts of the model are shown on the boxes enclosed in solid lines. In addition to the commodity, sectoral, regional and national accounting mechanisms, analytical components were included on farm consumption, non-farm consumption and population and migration. The dotted boxes represent "model components" which were not computerized at that time.

Following completion of the sector study in 1972, the emphasis shifted to filling in the dotted lines of Figure 1 and moving towards the eventual system to be embodied in KASM 3 (Figure 2). Developments in KASM 2 accomplished to date and those remaining to be done include:

1. Internalization of consumer and producer prices in the demand-price-foreign trade component. This component solves a system of simultaneous equations for prices and consumption while maintaining a consumption expenditure constraint. Imports/exports are residuals.

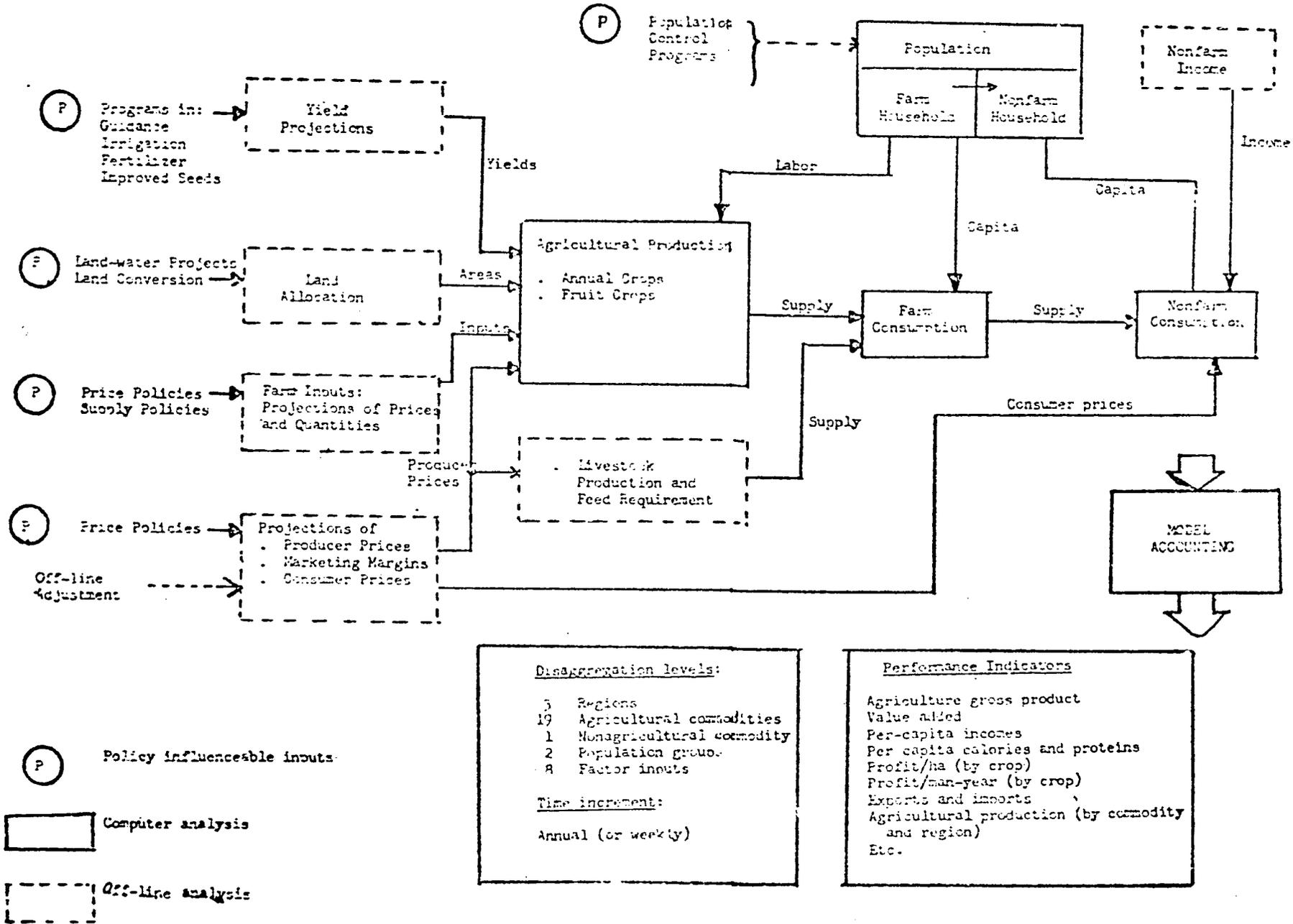


FIGURE 1

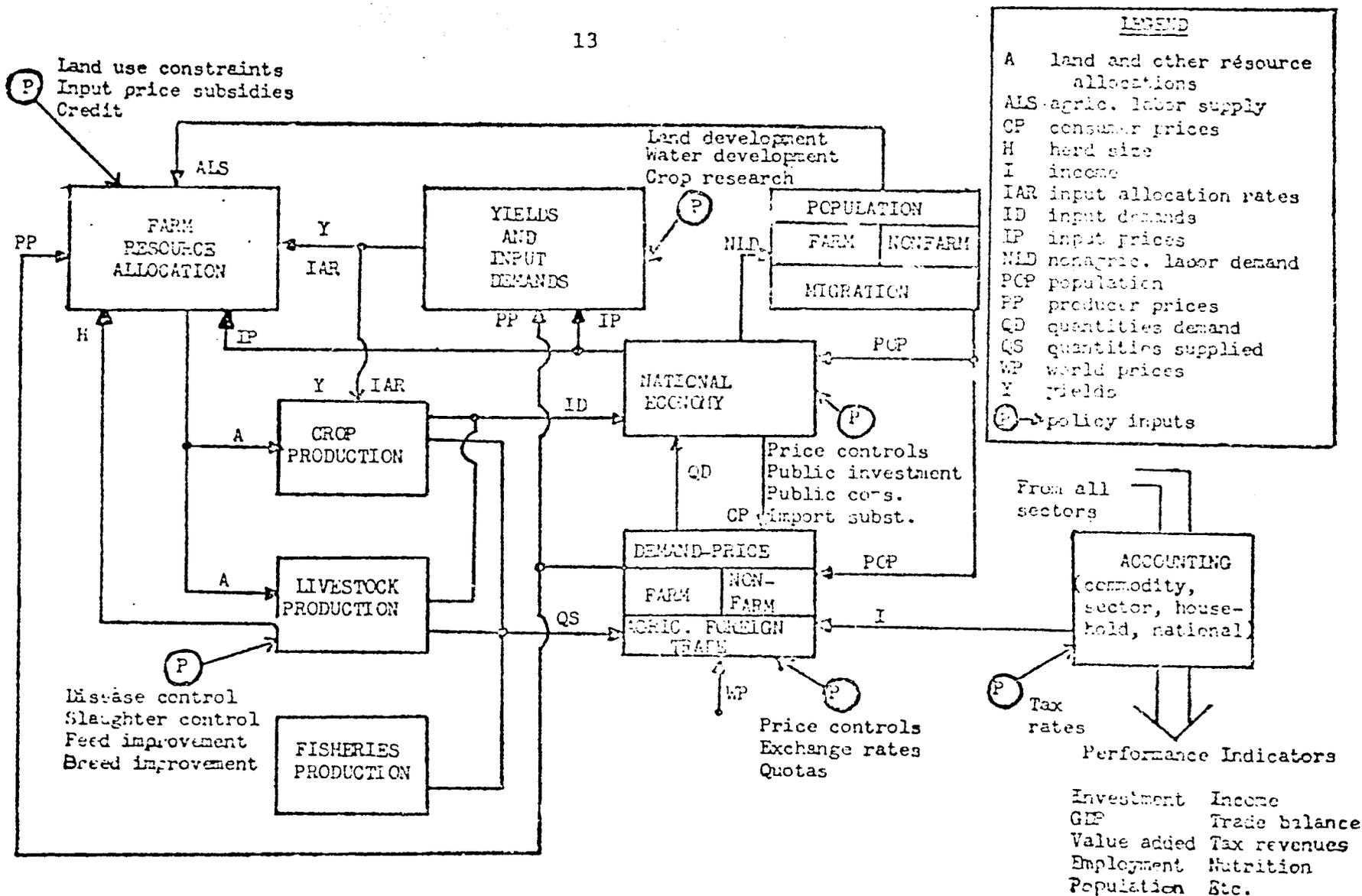


FIGURE 2
THE KOREAN AGRICULTURAL SECTOR MODEL

2. Internalization of land allocation decisions in the farm resource allocation component, which uses a recursive linear programming (RLP) model to allocate land, labor and capital to crop and livestock production activities. (Dr. Lee, Jeung-Han, contract researcher at NAERI, participated in the design of this model and currently has responsibility for its continued development and use.)

3. Internalization of yields and input application rates using a production function model to project the consequences of public investment in land and water development and in crop improvement research and extension. This component has been developed and is currently running independently of KASM in a testing phase. There remains further testing, parameterization and linkage to KASM. (Dr. Lee, Jeung-Han developed this model for his Ph.D. dissertation research at MSU and is responsible for its continued development and use).

4. Internalization of linkages between the agricultural and non-agricultural sectors, including demands for and price indices of consumer goods and agricultural inputs and non-agricultural labor demands. This national economy model (NECON) is centered around a 16-sector input-output model of the Korean economy. (Hwang, Hong-Do, Senior Researcher at NAERI, participated in NECON's early development and will be responsible for its continued development and use.)

5. Development of a set of livestock production submodels apart from the livestock-related activities and constraints now embodied in the RLP model. (Ahn, Chang-Bok of NAERI will be responsible for research, modeling and policy analysis of this subsector.)

Accomplishments to Date Using the KASM Model

Major applications of KASM in planning and policy analysis have been as follows.

- (a) In 1972, projections were made of consequences of four alternative sector development strategies for the main KASS report. Also in 1972, projections were made of consequences of alternative agricultural research strategies for the investment priority study. This study led ultimately to the Agricultural Research Loan (AID to ROKG).
- (b) In 1973, projections were made with the KASM model for preliminary work on the Fourth Five Year Development Plan by MAF. The projections raised questions about consistency in the guidelines for the Plan handed down by EPB concerning population growth, growth rate in GNP, rural and urban incomes and grain self-sufficiency. A report was prepared for MAF, and the results were given in KASS Issue Paper 4 written by H. H. Suh, NAERI and B.S. Ryu, MAF.
- (c) In 1975, projections were made with the model for use in the country position paper, Population and Food in Korea by S. H. Kim of Chonnam University and D. M. Kim of NAERI, prepared for the FAO/IAAE/UNFPA conference in Rome in December 1975.

The remaining applications to be noted all concern recent KASS involvement in Korea's Fourth Five-Year Plan.

- (d) John Sloboda and Kim Dong-Min made projections for the Plan with the KASS population model of farm and non-farm populations consistent with EPB's projection of total population. The projections were also designed to be consistent with reasonable assumptions about age-sex specific death rates, migration rates and age-specific fertility rates. The results were presented by Kim Dong-Min at a meeting of MAF's high-level Policy Advisory Council. It was learned later that Kim Joo-Ho (then Planning Bureau Director) compared the KASS projections with official projections made by MAF's Statistics Bureau and with hand calculations he did himself. He concluded the KASS projections were the most reasonable and founded on good analysis, and decided to adopt them as MAF's official projections for the Fourth Five-Year Plan.
- (e) The Livestock Bureau of MAF requested, through KAPP, that the KASS model be used to assist in work on livestock for the Fourth Five-Year Plan. A working team was set up consisting of Fred Mangum and Lee Nai-Soo of KAPP, Mike Abkin of KASS, Min Byung-Ryul of NAERI's Production Division, Song Chan-Won and Yoon Chul-Joon of MAF's Livestock Division.

The Livestock Bureau cooperated in defining the policy issues, evaluating the livestock data, defining the

policy runs to be made, and analyzing the results. The Livestock Bureau accepted the KASS consumption projections and used them in the plan with some modification. On the supply side, the dynamics of the model projected turning points and cycles or declines in the herd sizes, while, traditionally, planning projections are monotonically increasing. Although the Livestock Bureau did not accept the supply results for the Five-Year Plan, interest was expressed in using them at other times for policy analysis. Follow up is now underway.

- (f) An inter-bureau team in MAF (including Jo Il-Ho, then of the Saemaul Division) making trade projections requested through KAPP that KASS use KASM for a trade analysis. A basic KASM projection of consumption, production and imports/exports was provided and was used by the trade projection team. Kim Dong-Min of NAERI, Mike Abkin of KASS, Fred Mangum of KAPP designed and presented the analysis.
- (g) When the individual bureaus submitted their plans to the central MAF Planning Bureau for overall coordination of agricultural plans for the Fourth Five-Year Plan, the working committee charged with coordinating requested that the KASS model be used to make consumption projections of all commodities, particularly examining food grain self-sufficiency. Hwang Ilong-Do, Senior

researcher in NAERI's Sector Analysis Division, was on that committee and worked with Mike Abkin in making and interpreting the projections. Food Bureau consumption projections were used as policy targets, and a series of KASM runs were made to examine the efficacy of alternative price policies in achieving those targets. The main objectives were to substitute expected surpluses of rice and barley for wheat (to reduce import requirements) and to increase farm income. The results, compared to the policy projections, have appeared in draft plan documents.

- (h) David Culver and Richard Duvick of KAPP and Mike Abkin of KASS were asked by Director-General Hahm to review and comment on the final draft of MAF's plan for agriculture in the Fourth Five-Year Plan before its presentation to the Minister. Lee, Dong-Bai (chief of the Overall Planning Division) presented the whole plan, with the assistance of Hwang, Hong-Do of NAERI over a 3-day period. Conclusions and recommendations were written up and submitted to Mr. Hahm.

Members of the KASS and KAPP teams expressed the opinions that the above experiences in applying KASM have reaffirmed that model development, model use and institutionalization go hand in hand. In the process of using the model, model development progressed in the form of

improved data and structure and in the case of livestock, guidance for further modeling work. Institutionalization was also furthered in that Koreans at NAERI and in MAF became more familiar with the model, its structure and data requirements, and how to use and improve it; and, through the use of it, credibility in the model and the approach was enhanced.

Non-Model Accomplishments

A good deal of the MSU team work has not been directly tied to model output. Much of the analysis used the models but went beyond the model output in using a variety of information and data sources and in synthesizing such information. Examples of results at least partially attributable to such work include:

1. Major changes in the administrative structure of collecting and reporting agricultural statistics.
2. Negotiation of an AID loan for completion of 66 small scale irrigation projects.
3. Negotiation of the KAPP grant from AID to MAF
4. Contributed to decision to seek short season wheat variety.
5. General upgrading of stature, credibility, and professionalism of NAERI.
6. Increased appreciation by decision makers of usefulness of analytical input to the decision process.

Recommendations

The accomplishments to date demonstrate that the KASM model can be applied usefully. The software documentation needed for transfer of the

models to other personnel is provided for in the intensive period provided for this task during April, May and June of this year. The needs for personnel in Korea to carry on the use of KASM, after termination of the MSU KASS and KAPP projects, is dealt with in considering overall personnel needs elsewhere in this report.

Our recommendations for KASM are concerned with how to more fully enhance the degree of use of the KASM model, as a whole and in parts.

Recommendation 1

To broaden the application of KASM to policy and analysis questions, the capability, and the likelihood of use, of each individual submodels of KASM should be strengthened, through

- (a) Assigning responsibility for each of the submodels to specific individuals in NAERI, each individual to be charged with having knowledge of the subject matter, operation, capacities and limitations of the submodel assigned to him, and additionally to be charged with seeking out and working with subject matter specialists inside and outside NAERI on policy and analysis questions for which the submodel is useful.
- (b) For each of the submodels, identifying units and individuals with subject matter specialities within MAF, other ministries and elsewhere (e.g. KDI) to which the submodel can contribute.
- (c) Providing for an instruction from high levels within the Korean Government that the individuals in NAERI responsible for submodels and the potential users outside NAERI be mandated to work cooperatively in the application of the submodels to policy and analysis questions.

Regarding the foregoing recommendation, Table 2 shows the major submodels which make up KASM and the user units in MAF to whose subject matter each submodel is applicable. This table indicates the type of

Table 2
Implementation of the
Korean Agricultural Sector Model (KASM):
Personnel and Users

Model and Submodel	Responsible Researcher/Analyst	User Agencies
Sector Model--in its entirety or combinations of submodels	Team of Kim Dong-Min, systems scientist and others responsible for submodels used	<u>MAF</u> Planning Bureau Livestock Bureau Farmland Bureau Production Bureau Food Bureau Office of Rural Development NAERI NACF <u>EPB</u> Economic Planning Bureau -- 1st Investment Division <u>KDI</u> <u>Blue House</u>
Demand-Price-Foreign Trade Component	Hwang Hong-Do Kim Dong-Min	<u>MAF</u> Planning Bureau Food Bureau NAERI NACF AFDC
Livestock Production Submodels	Ahn Chang-Bok Min Byung-Ryul	<u>MAF</u> Planning Bureau Livestock Bureau Office of Rural Development NAERI NACF AFDC

Table 2 (Cont.)

Model Submodel	Responsible Researcher/Analyst	User Agencies
Resource Allocation Submodel	Lee Jeung-Han Kim Sang-Gee	<u>MAF</u> Production Bureau Farmland Bureau Office of Rural Development NAERI ADC
Yield/Input-Demand Submodel	Lee Jeung-Han Kim Yong-Shik	<u>MAF</u> Production Bureau Planning Bureau Office of Rural Development NAERI ADC
Population Submodel	Kim Dong-Min	<u>MAF</u> Planning Bureau Food Bureau NAERI <u>EPB</u> <u>KDI</u> <u>KIFP</u> <u>Blue House</u>
National Economy Submodel	Whang Hong-Do Park Sung-Joo Kim Yong-Shik	<u>MAF</u> Planning Bureau <u>EPB</u> <u>KDI</u>

linkages which should be considered in carrying out the foregoing recommendation. The table was prepared by Mr. Kim, Dong Min and Dr. Abkin in response to the recommendation.

There are additional needs to provide for communication and further refinement of KASM after KASS and KAPP phase out. These needs are expressed in the two following recommendations.

Recommendation 2

After the American counterparts of KASS/KAPP phase out from Korea, there is a need to hold regularly seminars and/or workshops on modeling activities between Korean Institutions and MSU or other U.S. institutions, and among Asians. These cross-communications must be aimed to augment the utilization capabilities of the models. There is also a need to establish formal channels to exchange research publications in this regard.

Recommendation 3

Under the umbrella of the sector macro-models, there is a need to research additional micro economic behavior at the farm, marketing system, and consumer levels. In order to make effective use of the kinds of models developed under the KASS program micro studies should be conducted to answer specific micro questions, and these should be linked to the fine-tuning process of the sector models.

The remaining recommendations for KASM concern specific opportunities to apply the model. The Livestock Bureau is interested in further development of the livestock sub-sector model and desires to cooperate with NAERI staff in this development.

Recommendation 4

The KASS/KAPP Review Team recommends that NAERI provide appropriate and sufficient staff to work with the Livestock Bureau staff in further refinements and extensions of the analysis of livestock development in Korea.

A request was made by EPB for runs of KASM to consider the effects of alternative agricultural investment programs. As the results are needed for closely timed decisions on Fourth Five-Year Plan targets, we assume the request is being met promptly and with full cooperation and communication.

Recommendation 5

The work on agricultural investment programs requested by EPB should be completed as soon as possible and in a manner conducive to further cooperation. The same recommendation applies to future requests of this kind widening the application of KASM and other analytical capabilities.

III. LAND AND WATER DEVELOPMENT

History and Status of KASS/KAPP Land and Water Activities

A member of the KAPP team, Richard Duvick, has subject matter responsibility in land and water, working closely with the Agricultural Development Corporation (ADC). While drawing on KASM results, this activity is sufficiently distinct and important to warrant separate consideration.

The role of resource development has been recognized in KASS reports from the outset. The earliest sector study (Rossmiller, G.E., et al., Korean Agricultural Sector Analysis and Environmental Development Strategies, 1971-1986, 1972) described the nature of the resource base and development programs. The early investment study (Ferris, John N., et al., Investment Priorities in the Korean Agricultural Sector, 1972) reported relatively high priorities for resource development -- of eight possible areas of activity, irrigation ranked third, drainage ranked fourth, and upland development last-- as well as initial studies in each of the above development area. Table 3 gives selected background statistics pertaining to land and water including levels of investment. Rather substantial development expenditures are noted since 1969, both in absolute amounts and as a proportion of total MAF expenditures.

Our interviews with Korean officials and staff revealed considerable appreciation for KASS/KAPP activity. Their comments are summarized at the beginning of the next section. In general, recent KAPP effort is most outstanding in their minds, although it is apparent that the use of

Table 3. Land and Water Development Activities, Expenditures and MAF's Total Project Expenditures.

Year	Activities			Total L & WD	Total MAF	A/B
	Irrigation	Consoli- dation	Slopeland Reclamation	Expendi- tures	Investment & Loans	
	1,000 hectares	(A)	(B)	—
			 million won		
1965	20	18	37	4,958	18,023	0.275
1966	28	19	22	7,721	30,579	0.252
1967	15	23	17	8,741	36,769	0.236
1968	2	16	13	9,268	51,992	0.178
1969	202	14	8	24,266	80,744	0.301
1970	70	15	3	18,993	86,597	0.219
1971	14	27	1	19,542	113,799	0.172
1972	7	21	1	25,606	120,941	0.212
1973	11	22	1	34,853	129,827	0.268
1974	15	20	5	41,494	170,846	0.243

Source : 1) Yearbook of Land and Water Development Statistics, 1975; MAF & ADC
 2) Investment and Loan Planning for Agriculture and Fisheries; 1975; MAF

KASM, or selected submodels, has future usefulness particularly to the policy agency, the Farmland Bureau under the Assistant Minister for Land and Agricultural Production. Demand, population, yields/inputs and farm resource allocation sub-models have potential for assessing physical resource requirements. Technical capability to provide future service must be assured if their potential is to be realized.

Our interviews with representatives of the Agricultural Development Corporation at Anyang revealed important dimensions of the KAPP program, including assistance in determining long-term goals, demonstration of policy analysis approaches, and in-house training of counterpart and collaborative economists. We found in the ADC expressions of interest in pursuing new methodologies for project feasibility studies and emerging interest in assessing rural development impacts in project areas, rather than solely pre-project economic feasibility aspects. If the Agricultural Development Department's Agri-Economics Section pursues this course of expanded analysis above current feasibility study efforts, it seems that additional staffing is required. The present staff numbers only 12 in total with 5 or 6 economists, 3 of whom have M.S. degrees. The units could also benefit from price analysis and farm management studies.

Accomplishments to Date

The following are representative comments focused on land and water relating to KASS/KAPP efforts and elicited from our interviews:

- The Planning Committee for the Increase of Food Production, formed in 1973 with representatives from various government agencies, utilized KASS demand projections for food grains in

designing the food self-sufficiency program as well as relevant policy directions for land and water development projects.

- KASS recommendation was also utilized to put more emphasis on increasing wheat productivity by the reclamation of slopeland.
- KAPP's poly-period L.P. model provided major guidelines for ADC to design long-term land and water development projects through the year of 2000. Utilizing the KAPP's model results, ADC was able to determine the internal priority ranking of irrigation, drainage, reclamation, and consolidation projects. ADC was also assisted by KAPP to submit budget proposals for various long-term projects under alternative investment programs.

Reports include the identification of the research procedure to be used to yield an ex post evaluation of 66 small and medium scale irrigation projects (Duvick, Richard D., et al., A Proposal for Economic Evaluation of 66 Small and Medium Scale Irrigation Projects in Korea, 1975). This could prove to be an important contribution in project analysis, for ex post evaluations are needed for projects in virtually all countries. A timely report using a poly-period programming model (Duvick, Richard D., et al., Estimating Future Capital and Labor Needs of ADC to Meet Korea's Demand for Rice, 1975) responded to the need for assessing development alternatives in a framework of capital expenditure minimization. Another study (Duvick, Richard D., Analysis of Long Term Impacts of Land and Water Self-Sufficiency of Food Grains, Korea, 1976 - 2000, 1975) linked poly-period

programming with selected KASM sub-sector models to assess impacts on grain self-sufficiency via land and water development alternatives under alternative levels of investment. The study, requested for the Fourth Five-Year Plan, clearly depicts outcomes of policy alternatives. Still another paper examined the possible policy of extensive slopeland development (Duvick, Richard D., Korea's Plan to Develop 300,000 Hectares of Slopeland, 1975). It suggests that rapid slopeland development might be ill-advised.

These reports were mentioned by several people interviewed during the review. They have obviously proven useful as inputs to relevant policy-makers and staff. In addition, less formal activities have been pursued, the sum of which leads us to strongly recommend the need for policy analytical capabilities in land and water resources after MSU leaves Korea at completion of the KASS/KAPP activity.

We have not here attempted to review the research output in more detail, being more concerned with utilization. However, we note imaginative use of KASS/KAPP data and quantitative approaches, observe that a U.S.-trained Korean -- J. H. Lee -- has two NAERI publications, and that a U.S. student -- M. Hanratty -- is involved in dissertation research examining alternative land use policies. Further economic and policy analysis should be encouraged.

Recommendations

The land and water development area is only one of many areas of application of KASM. The following three recommendations consider this area to illustrate more specifically possible uses of KASM in other areas.

Recommendation 6

We are particularly impressed with the usefulness of recent activity carried out under KAPP with respect to land and water development. The next year will reveal the permanency of that contribution to policy analysis. We feel that policy analysis capability in the area of land and water development, and surely other areas as well, is an important need to be developed after the KAPP phase-out.

Recommendation 7

While land and water development issues are not likely to require extensive use of the entire KASM development, policy analysis tools are likely to include submodel and other quantitative techniques, as needed. Our concern is that sub-model capability be carried forward into the future.

Recommendation 8

The need may exist for additional professional analytical staff in ADC to assess individual project feasibility and rural development studies if the planned increased scope of this activity becomes a reality.

IV. GRAIN POLICY

History and Status of the Grain Management Program Model (GMP)

Early Development. Korean grain policies were recognized as important in the initial design of the KASS program. Development of the forerunners of the present GMP model began in 1972 as an integrated part of the overall Korean Agricultural Sector Model (KASM). Soon afterward, differences in purpose, time dimensions, capability together with dangers of over-complexity indicated that a Grain Management Program Model (GMP) should be developed as a separate and independent system from KASM. At the time of the formal evaluation of the KASS models in January, 1973, some components of the GMP model were fairly well developed while others were not. The present model is improved over the version reviewed in 1973 and reflects most of the suggestions of the evaluation team.

Annual Grain Price Policy Analyses. The Annual Grain Price Policy Analyses Model (AGPPA) projects the consequences of a set of Government purchase and release prices by applying various change parameters to a set of initial conditions and then account, for the consequences of the resulting changes. The central component of the model is a system of demand equations that project the per capita demand for the three most important food grains -- rice, barley and wheat -- separately for the farm and non-farm populations given the set of Government purchase and release prices that are pre-specified. The model is structured to project one period ahead from a base period, which is generally a best estimate of the current situation; this period can be of

any length, such as one season or one year, but it must be the same length as the base period (Thodey, Abkin, Gibson and Ingvaldson, Model Documentation: Annual Grain Price Policy Analyses, 1975). The model uses three specified policy variables to solve for three solution variables. As used in Korea, proposed price levels are specified and the model is used to predict the corresponding demand quantities. This information for alternative proposed price levels is used as information to support annual divisions on the support price levels for rice and for barley.

The model has been revised somewhat by the KASS consultant each of the four times since 1974 it has been used. The current version is fully operational, and documented in the report cited above. The model is operated as a self contained unit. The same model is used as the "front-end" component of the complete Korean Grain Management System Model (GMP).

It should be relatively easy for Korean analysts and policy makers to develop the needed experience for the annual Grain Price Policy Analyses. It is anticipated that additional modifications may be needed in the model to support future Government decisions on price support and consumer price levels. With the decision to retain a MSU systems scientist in Korea through December of 1977, consulting support will be available to aid in these tasks.

Complete GMP Model. The complete simulation model of the Korean Grain Management Program Model (GMP) is a dynamic simulation model with five major components, (1) farm subsector, (2) Government subsector, (3) private market subsector, (4) urban household subsector, and (5) price

and transaction linkage mechanism. These components are fully interphased and are not designed to operate separately as independent models. The total GMP model is completely independent of the Korean Agricultural Sector Model (KASM) and the components (Gibson, Kim and Thodey, Simulation Model of the Korean Grain Management System: Demonstration Results, 1976). The model determines solutions by periods of less than two days (1/200 of a year) sequentially over the specified planning period. It is believed by the developers to be reliable for total planning periods of perhaps three years.

At this writing (March 1976), the GMP model is developed and operational in the sense that complete demonstration runs have been made and the results printed and plotted. The model was partially documented in KASS Issue Paper 13 and previous KASS publications. Complete documentation is scheduled to be completed at Michigan State University within the next few months.

To the knowledge of the review team, no dynamic simulation model of the type and complexity of the GMP model is being used to support grain policies in other countries. The GMP is a first, and because it is, it deserves careful and complete review by the Korean Government for possible direct applicability and utilization prior to any decision on whether and how it will be installed to support Korean grain policies. The kinds of grain policy and management questions it is designed to address (buying and selling prices of government grain, release quantities and patterns, imports, storage stock levels and deployment) are important issues in Korea. The potential benefits appear to be large, but the costs of developing staff and supporting activities to utilize the model may be substantial also.

Accomplishments to Date

Utilization of the Annual Grain Price Policy Analyzer. The present version of the annual grain price policy analyzer model and predecessor versions of this model have been used to predict the consequences of proposed specific given price policy decisions to assist government officials in finalizing these decisions. The first application was made for the last quarter of the 1974 rice year when rice stocks appeared insufficient to last until the 1975 rice year stocks became available. A task force consisting of planning officials from the Ministry of Agriculture and Forestry and the Economic Planning Board plus researchers from MAF and NAERI together with KASS/KAPP consultants worked together in formulating the specific questions for the model, obtaining the output of the model and interpreting the results. The findings were forwarded to policymakers who reportedly used them together with findings from independent analyses by the Korean Development Institute and from other research in formulating the price policy which was implemented at that time.

Under a similar task force organization analyses were made with the model to support (1) the rice purchase price decision for rice year 1975, (2) the barley purchase price decision in June 1975 and (3) the rice purchase price decision for rice year 1976. In each of these utilizations of the AGPPA model, the modifications in the model, the formulation of the input and the operation of the model to obtain the output were made by KASS/KAPP consultants.

Utilization of the Complete GMP Model. To date there has been no direct application of the complete GMP model to support grain management policy decisions in Korea. This fact reflects the present status of the model development. The GMP model has just now reached the final development and testing stage. The stage has not been reached so that the complete model could have been utilized.

Considerations Affecting Future Utilization to Support Grain Price Policies

Review by MAF. At the time of the KASS/KAPP review team interviews, the GMP model was under active review by the Ministry of Agriculture and Forestry to determine its potential for application to support grain policy decision making. Top Ministry officials have expressed interest in the model and its potential, and have stated their intention of participating personally in the review. The hope is to come to a decision regarding use of the model in time to reflect it in the final planning and budgeting for the Fourth Five-Year Plan. Such timing also will take advantage of any needed additional consultation with the KASS advisors before their forthcoming return to the United States.

Requirements and Potential Benefits of the GMP Model. Both the potential benefits and the probable costs to the Korean government of installing and utilizing the GMP model are relatively high. It is impossible to quantify the potential annual benefits precisely, but some indication is apparent from a test run made with the model for the period 1974 through 1976 (Gibson, Kim and Thodey, Simulation Model of the Korean Grain Management System: Demonstration Results, 1976). The trial solution

indicates average annual potential savings of some 80 billion won (about U.S. \$160 million). The computed savings arise from (1) reduced storage, handling and marketing costs, (2) reduced costs of imported food grains and (3) increased revenue through delayed sales of government grain at increased prices. It is probable that the full computed savings indicated by the trial run would never be realized, because factors other than cost savings must be considered in decisions regarding grain price policies and grain management. A fair guess is that actual achievable benefits might be something like 25 percent of those indicated by the trial solution. Even this would be 20 billion won (U.S. \$40 million) per year.

The probable costs to the Korean government associated with such benefits could be estimated with relative accuracy, once a specific time-phased plan were worked out. The major costs would be in the development of highly qualified staff people (and/or the opportunity cost of transferring them from other assignments) which would be required to make effective use of a model of this complexity. The related costs for computer services, supporting micro analysis and generation of input data, while substantial, will be less than the cost of developing the required critical mass of human skills.

Need for Time-Phased Priorities. A time-phased plan of implementation should be developed along with accompanying PERT charts to insure maximum benefits and to avoid an extended development period before significant utilization is achieved.

It seems probable that a first step would be to install and begin to utilize the annual Grain Price Policy Analyzer. A next step might be to install a limited version of the GMP model which would be capable

of addressing the higher priority grain policy and issues. Through time the model could be expended toward its full capability, with application to a broader range of policy issues step by step as the capability is developed.

Location of the Model. Unlike many of the other models in the KASS system, the GMP model is designed to address short and intermediate term issues. It may require input data which are classified within the action agency. Alternatives may be analyzed which, after the results are seen, may be discarded.

Because of the short turn around and the need for day to day use by those making policy decisions, the question arises as to where the model should be located and who should operate it. One possibility is that the model and its use to predict the consequences of alternative policy decisions and actions would be lodged within the appropriate action agency of MAF. Other possibilities include persons on detail from NAERI to the action agency or vice versa, or as yet another alternative to a permanent joint task force.

Analytical Staff Requirements. The requirements for qualified analytical staff people in order to make use of the GMP model will include

1. A senior agricultural economist with a number of years of experience in system analysis of grain problems. Such a person could be a part-time professional consultant employed by the MOF.
2. A full time grain management economist who is well trained (preferably a Ph.D.) in formal analysis with relatively complex models.

3. A well-qualified full-time systems scientist.
4. A competent and experienced computer programmer.
5. Qualified assistants for the above staff.

During the early stages of implementation, the required staff might be deployed on a part time or temporary basis. This is true particularly during the period when only the AGPPA model is being used. The full staff component can be developed as the capacity and utilization of the GMP model is increased through time.

Consulting Support. It seems clear that even with an effective staff development program, consultative support will be required, at least over the remaining period of KAPP specialists from Michigan State University in Korea. The system scientist now committed to the program will be essential. In addition, those directly responsible for development of the GMP model will need to be available on a short-term basis at the critical points in time when the model is being installed. Likewise, the consulting services of agricultural economists and others under the KAPP program will need to be made available to the Korean staff with the installation and utilization of the GMP model.

Grain Management Questions the Present GMP Model Does Not Address.

The grain policy and grain management decision makers in Korea should understand that the GMP model is not designed to answer all questions for which they may desire computerized analytical support. In particular, it is not designed to solve for minimum shipping patterns, warehouse utilization patterns by specific location and related questions. There

apparently is interest in such models within MAF. Once the time-phased priorities are established, models which will do these things efficiently could be added to the analytical capacity within the action agency. They could be operated parallel to the GMP model, utilizing much of the same input data. Additional support from the KASS team may be needed if decisions are made to add models beyond that of the existing GMP model.

The foregoing discussion brings out the complexities involved in developing the GMP model and attaining successful use for policy purposes. It is beyond the limits of effort of the review team to make recommendations on the specifics of how implementation should proceed. The current MAF review is a needed beginning of serious consideration of the issues. At the same time, it is apparent that further sustained effort will be required. The review team recommendation is that active steps be taken to bring about the needed continued effort.

Recommendation

Recommendation 9

A group should be established with representation from NAERI and action agencies to meet regularly (at least monthly) to direct further model development, trial use and planning for permanent lodging of the GMP, including consideration of possible organizational changes that may be called for. The group should not be disbanded until tasks are completed.

V. AGRICULTURAL STATISTICS AND OUTLOOK

While statistics and outlook are not a direct concern of KASS modelling, the data requirements and the various KASS analyses, particularly those of a shorter term nature, make the KASS/KAPP effort closely related to these areas. Inasmuch as there is a potential contribution of KASS/KAPP activities to statistics and outlook, the review team considered how to ensure a productive statistics and outlook environment within which these contributions can be made.

Background and Status of Agricultural Statistics Program

The Korean agricultural data system consists of the Bureau of Statistics, MAF; other bureaus and organizational units in MAF; and a number of other agencies, including NACF, Economic Planning Board, and Bank of Korea.

Much of the statistics collected by operating bureaus of MAF are of broad interest to other agencies and the nation in general. Often data collected by operating bureaus comes through administrative channels. At one time field statisticians of the Statistics Bureau came under operating bureaus of MAF.

Many significant improvements have been made in recent years in the data collection and processing system of the Bureau of Statistics. A complete new system of independent regional statistical offices were set up in 9 provinces and in each of 139 counties. These came under control of the Ministry of Agriculture and Fisheries and under the supervision of the Bureau of Statistics. New sample surveys have been

recently designed to improve data for crop area, yield and production; livestock numbers and production and some other basic agricultural statistics. The Bureau also has been recently reorganized (Figure 3).

Another development that may help to improve the government data collection system is the recent appointment of a new coordinator for overall government statistics. This statistical standards function is in the Bureau of Statistics, Economic Planning Board. Interviews with the new EPB Statistical Counsellor indicated he plans to move to a more effective coordination of Government data collection systems as well as improve standards for data collection accuracy and relevancy of government statistics.

Background and Status of Agricultural Outlook

Initial planning and discussion of an outlook program began in 1962 in the Ministry of Agriculture and Fisheries. The program never fully materialized in MAF. Instead, the outlook program was transferred to the National Agricultural Cooperative Federation (NACF). NACF apparently felt a outlook program would help in the administration of NACF and assist cooperative managers and coop members. The outlook program was transferred to NACF in 1965, and during 1965 and 1966 work was initiated on data collection and training of the outlook staff. The scope and methods of outlook work and statistical analysis work were given added impetus in 1967 and 1968 with the help of a U.S. consultant and with passage of the Fundamental Law for Agriculture, which obligated the Government to carry out an agricultural outlook program. Several staff

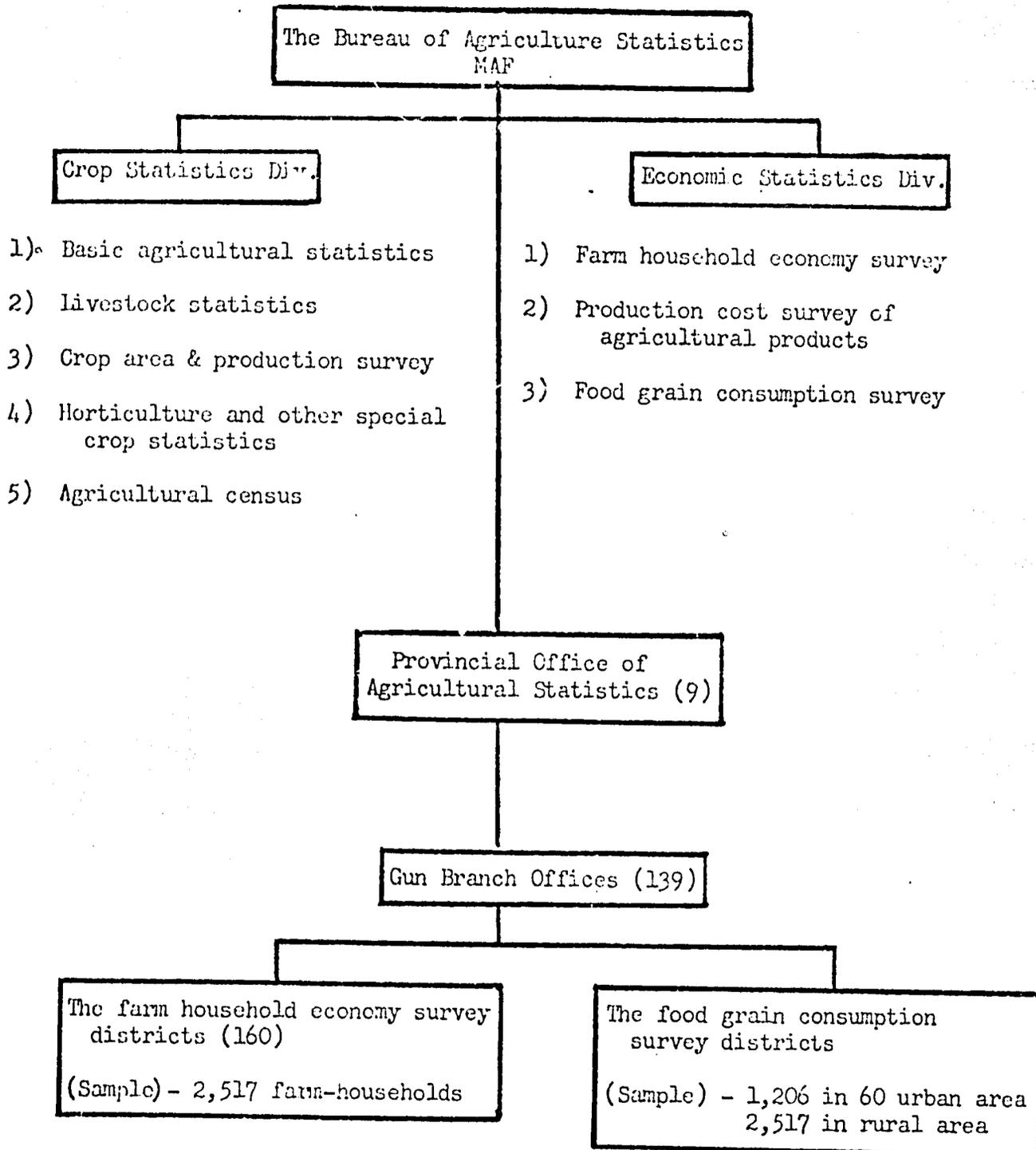


Figure 3. Organization Structure of the Statistics Bureau, MAF

members were sent to U.S. universities for training. The NACF outlook leadership has indicated its recognition of the broad scope for an outlook program -- economic analysis and information for decision making. Considerable progress has been made in developing a staff and an economic situation and outlook capability in the NACF.

Recommendations

The MAF statistics program has rather broad coverage, and apparently sampling techniques on a sound basis. The review team feels that in the program consideration is needed of organizational relationship to other bureaus and of internal operating procedures. After a brief review, the team suggests the following issues as deserving of the attention of the leadership of MAF.

Recommendation 10

Timely and regular release of basic statistics on agriculture. In order to monitor developments and influence decision making in agriculture, relevant statistics must be timely and regularly available, at least to the minister and leadership of MAF. The team feels this area warrants attention of MAF leadership to consider possible institutional changes as well as staff, available computer facilities or bureau operations to facilitate timely regular release of basic agricultural statistics.

Recommendation 11

Accuracy, data coverage and coordination. Accuracy is of course most important; a very high degree of accuracy becomes very costly. Even though sample design is excellent, it is important to carefully examine the training and performance of enumerators and the systems

field editing of surveys, and bureau methods of review and processing of data to assure greater accuracy.

Data coverage may be excessive in some areas while gaps in coverage may exist. This problem requires a close working relationship among the Statistics Bureau and the users as well as a frequent hard review of data coverage. For example, there is considerable detail on diseases of horses and dogs; yet data are quite inadequate on stocks and utilization data for major commodities and on coverage for fruits, vegetables and livestock.

Coordination among agencies on statistical standards and data coverage is needed to assure that data collected by different agencies can be related to and combined with other sources into overall data for the nation. The MAF rural economic household survey and the EPB urban household survey might be cited as examples where closer coordination would be worthwhile. Effective coordination and development of overall standards for statistics collection is needed for accuracy, data coverage and the timely release of information with cost efficiency.

The review team suggests the following observations as general guides to development of a combined Economic and Statistical Analysis Organization and Agricultural Outlook Service, regardless of the institutional setting for such a unit.

Recommendation 12

The primary function of a statistics and outlook unit is to provide the Minister and his top administrative staff with a steady flow of economic analysis, relevant statistics and other information for decision making:

(a) What is happening in the supply, use and price of major foods; in farming and income to farmers; in supply, use and prices of major farm inputs (fertilizer and chemicals, machinery and equipment,

credit, labor, etc.); and in foreign market developments affecting Korean agriculture.

(b) What are the major forces influencing changes in agriculture -- an explanation of major supply and demand forces as well as program operations affecting developments in agriculture.

(c) What is ahead in agriculture -- the outlook--, including expected developments based on available current statistics, economic and statistical analysis and forecasts of likely developments.

Recommendation 13

An economic analysis and information unit should relate to the MAF organization in such a way that the unit has ready access to available statistics, program developments and plans especially of the Statistics Bureau, Food Bureau, Grain Marketing Bureau, Long-run Planning activities, National Agricultural Cooperative Federation, Office of Rural Development, including the Rural Guidance Service, and the Agricultural Development Corporation.

The analytical unit should have direct linkages to the leadership of MAF that facilitate a steady flow of economic analysis and information for decision making. Basic statistics and economic analyses and must be objective and timely in order to be helpful in policy development, program evaluation and other MAF decision making.

Recommendation 14

An economic and statistical analysis unit must have a staff well trained in economic theory and statistical analysis. The staff needs ready access to modern computer facilities; they must have the capacity and depth to carry out current analytical work as well as conduct research necessary to develop and maintain analytical tools ranging from the most simple techniques to complex commodity and agricultural sector models; the analytical tools should be capable of

contributing to day-to-day program operation of MAF, annual market developments, special analyses, and longer-run analyses useful in planning and resource allocation; and the staff should have or quickly acquire a first-hand knowledge of agriculture and how agriculture interfaces with the general economy and world economic developments.

Recommendation 15

General procedures and methods of initiating an outlook capability could include a number of steps.

- (a) Initially the outlook analysis unit could bring together the analytical work in KASS-KASM and the Grains Management model, some of which can be adapted to appraisals of the shorter-run -- from 2 or 3 months up to 2 or 5 years. The demand analysis work, including elasticities (price, income, and cross commodity) for major commodities should be directly applicable to commodity outlook analysis and forecasts. The recursive linear programming model can provide insights, with carefully chosen restraints, into probable annual changes in production.
- (b) The Grains Management model might be adapted to provide insights into likely shorter-run variations in the important grain markets.
- (c) Work should be initiated to assemble the range of commodity data available on production (including area and yield); stocks; imports; on-farm use for food and feed; urban food and industrial uses; prices at farm, wholesale and retail levels; price supports as well as Government purchases, sales, stocks and other operations influencing the production, demand, and prices of major commodities. Related data need to be available on consumer income and its generation, on consumer market forces as well as relevant information on foreign markets and their impact on imports, exports, and prices of major farm products.
- (d) With basic data available, simple commodity analyses can be developed and designed for forecasting, primarily for the marketing year and perhaps for 1 to 2 years into the future.

(e) As staff experience and analytical capability builds up, the analytical tools can be improved and made more realistic. Eventually, related commodity sectors can be combined into forecasting tools for the agricultural sector and its relationship with the general economy and world markets.

Recommendation 16

The flow of economic analyses and information for decision making initially may often be primarily for internal use within the Government. However, it will generally increase overall economic efficiency if relevant statistics, economic interpretations and prospective developments are made available to farmers, other business men and consumers as a guide in production planning and use in adjustment to changing market conditions. As publication becomes feasible, the reporting of relevant statistics and analyses might be in a monthly bulletin or in a number of short reports for major groups of commodities or on special analyses or longer-run appraisals directed to special interests of farmers and farm groups as well as other business men and consumers.

Recommendation 17

In view of questions of accuracy, detail of forecasts, and the nature of sensitive price forecasts and projections, neither the economic analyst nor analysts from any other discipline can foresee the future with a precise accuracy. Economic analysis can provide the decision maker with relevant statistics and interpretations of current developments, which are usually the major bases for decision making. Economic analysis can give the decision maker insights about important inter-relationships and major underlying forces at work from which plausible alternatives for the future can be examined. To expect highly accurate quantitative forecasts of the future is to expect the superhuman. One may insist that the economic analyst be specific about important forecasts, but there is a band of uncertainty about any appraisal of the future. Precise

forecasts of prices or precise projections for some future date may be less helpful to the decision maker than a correct evaluation of the forces at work and perhaps qualitative evaluations of expected trends and developments.

A correct appraisal of the future (including price forecasts) based on current conditions and prospects may be made incorrect by action of the administrator or private decision makers designed to modify what might be considered undesirable developments. For example, a program administrator may release more or less grain to the market, modify support prices or subsidies, change the tax structure or take other actions to counter prospects of what he considers undesirable probable economic developments. Private decision makers also may change plans as a result of the forecast and thus help to create conditions that will make the forecast incorrect. At the same time, the forecast served the purpose for which it was made -- it provided appraisals to guide public and private decision making. Natural calamities -- poor growing conditions, floods, disease, and perhaps other "acts of God" -- may intercede in the course of events to make an economic analysis and forecast very wrong.

The review team feels that appreciation of the use and limitations of economic analyses, forecasts and longer-run projections will make for better decision making as well as for more effective use and reporting of statistical and economic analyses to support decision making in agriculture.

VI. INSTITUTIONALIZATION

Meaning of the Term

The term institutionalization expresses the key question in this review. It refers to the extent to which an analytical and planning capability has been created in MAF, and the expectation that this capability will continue, improve, expand and be utilized after the departure of the KASS/iAPP team. For an economic analysis capability to be effectively institutionalized, the following conditions appear to be essential:

- A. Organization - a formal organizational structure that places the economic and policy analysis unit in an effective working relationship with policy makers and with sub sector and commodity bureaus in MAF.
- B. Environment - recognition by policy makers of the role economic analysis can play in policy determination and credibility of the capacity of the unit to generate timely and relevant information.
- C. Staff - sufficient number of adequately trained personnel to do the necessary tasks of model development, application, interpretation, and transfer of information to policy makers.
- D. Support and Services - salaries and working conditions adequate to attract and retain qualified staff; access to computers, data and other supporting services.

A great part of the team's efforts was devoted to considering how to ensure that these conditions will be met. The findings and recommendations of the team on these matters are presented in this part of the report.

Organization and Environment

Organizational and environmental requirements are intertwined. A basic problem is posed by an organizational set-up that has tended to separate the analytical capability being developed at NAERI from the policy and decision makers in MAF that might have utilized it more fully. Another important set of linkages that appears to need strengthening is links by NAERI to basic data and other technical information available in the various bureaus of MAF.

To obtain improved linkages between the economic analysis capability (NAERI) and policy makers (MAF) and necessary technical information, a number of actions should be considered by MAF.

1. A program for orientation of senior MAF staff on the capabilities and limitations of the models and other analytical capability being developed with KASS/KAPP assistance. This would appear to be highly productive regardless of other actions that might be taken.
2. A more formalized set of linkages between NAERI and the various Bureaus and Offices of MAF that would assure access to technical and statistical information in MAF by NAERI and access to useful analyses by MAF policy makers.
3. A reorganization of MAF that would transfer NAERI to MAF as a Bureau for Economics Analysis and Planning. Such a reorganization might

include this new Bureau with the Statistics Bureau under an Assistant Vice Minister for Planning and Analysis or create a new Bureau of Economic Analysis and Planning within the existing structure of MAF.

The primary advantage of this arrangement is the improved linkages that would result. There would be a number of organizational complexities that would have to be addressed by MAF and other elements of the ROKG. In addition, the need to maintain the unit's longer-term research capability while at the same time responding to policy makers' short term requirements in a timely basis will require careful consideration by MAF.

It is considered essential by many in the Korean agricultural economics research community that the organizational integrity of an agricultural economics research institution be maintained. Having the necessary critical mass of scholars to do effective research located in one institution will also help to assure a technical and institutional environment conducive to research.

The challenge is to maintain an environment conducive to effective and useful research unit, wherever located, competitive with private industry and the universities so that trained and capable staff are retained in the unit over long enough periods for them to gain the necessary experience and for continuity in conducting effective and useful research.

The first recommendation to be made on organization and environment pertains to NAERI. NAERI is central in the institutionalization question, since the KASS work has been carried out there. The following considerations bearing on NAERI support the recommendation to be made.

BRIEF HISTORY OF NAERI

Although NAERI was established in its present form in 1973, the original body was founded in 1961 when MAF established it as the Farm Management Division and attached it to ORD in Suwon. It was expanded and renamed the Research Institute of Agricultural Economics, ORD in 1967. Then it transferred from ORD to MAF and moved to Seoul in 1970. It was further reorganized as NAERI by adding a new division, the Agricultural Sector Analysis Division which has had close collaboration with the MSU (KASS Team) under USAID.

There are now five divisions in NAERI: 1) Agricultural Development Division, 2) Rural Economic Division, 3) Agricultural Economic Division, 4) Agricultural Marketing Division, and 5) Agricultural Sector Analysis Division. The major change in the role of NAERI has been to shift the emphasis from micro-analysis to macro-analysis of the agricultural sector in order to provide more adequate information and analyses on current issues confronting the MAF policy making body.

IMPACT OF KOREAN AGRICULTURAL SECTOR SIMULATION STUDY

Since 1971 a joint venture with Michigan State University (MSU) and NAERI has carried out the KASS approach and agricultural policy analysis in Korea. The major ongoing projects are:

1. Grain management program model
2. Livestock development model
3. Recursive linear programming model for resource allocation at farm
4. Population and rural-urban migration model

5. Crop yield projection model
6. National economy model (input-output model)

The following suggestions may be helpful in securing use of these models. First, the timely supply of research results to the users or policy makers is important. One example of a problem in providing results is the grain manage model. This model was scheduled for completion near the end of 1974. However, it is still incomplete and certain portions need further revision and testing. Second, most of these tools are very sophisticated. Their level of complexity hampers the policy makers' understanding of the model itself and the results generated by the model. There needs to be a conscious effort to simplify the results of the models' output so that it can be easily understood by the final users or policy makers. Third, it is too early to evaluate the long term effects of the training program. Hopefully, the personnel trained through the project will be able to take over the responsibilities of modifying and developing the models.

IMPROVING NAERI'S ROLE

It is crucial to equip trained manpower for the successful institutionalization at NAERI after the KASS project terminates. NAERI seems to have two alternative ways to build up its professional teams. One is to recruit qualified personnel, and the other is to train existing staff members of NAERI. Already NAERI has dispatched nine trainees to MSU since 1974. The present status of its staff is as follows: 1 Ph.D., 6 M.A's, 4 one year trainees, and 34 research assistants. NAERI is expecting to have 3 Ph.D's in system science by 1977.

However, bottlenecks to obtaining or maintaining qualified professional personnel are threatened because of inflexibility of the salary scale and promotion system, which is not competitive with other institutions in Korea. The reorganization or promotion of NAERI is still in a preliminary stage. It should be pursued vigorously.

Recommendations

Recommendation 18

Steps should be taken by MAF to strengthen the working relationships between NAERI and the bureaus and offices of MAF, particularly to facilitate "back and forth" communications and interactions at both the working staff level and with policy makers.

Such steps could be formal - consistent with MAF operating procedures - or informal or both.

The next recommendation concerns KAPP. Inquiry into KAPP activities apart from their relationships to KASS is outside the scope of the team responsibilities as outlined in Section I. It is likewise not possible within the time allotted to the review to make highly specific recommendations with regard to administrative or organizational changes. One of the main findings of the team is that further pursuit of these matters is needed to ensure institutionalization and utilization of the KASS/KAPP analytical capacity as well as other analytical work in MAF.

Recommendation 19

KAPP has as part of its charge the responsibility to recommend and help implement analytical procedures and organizational and administrative changes to facilitate the use of analytical input and to assist in organization and techniques for improvement of the data and information acquisition system. The team recognizes both the importance of and the present constraints imposed by these issues in successful completion of the KASS and KAPP activities. Therefore, the team recommends that careful review and study of these issues be done by MAF, AID and MSU at an early date to establish the basis for identifying and relieving such constraints to the success of these projects.

Manpower and Support Services

The most important resource required to carry on KASS/KAPP activities is manpower. Sufficient numbers of professional persons are required, and they must have sufficient qualifications. While the prime requirement is for persons to carry out KASS/KAPP activities, prospects for future capability are brightened by the growing numbers of persons in Korea and in MAF with training in economics appreciative of the kinds of results KASS/KAPP activities can supply.

The contribution of foreign training to professional competence is difficult to measure for several reasons. Accurate figures on training completed are not readily available. Some idea can be obtained from records on AID supported training. The number of Korean students who had received support from AID graduate work in agricultural economics and related funds up to 1971 was 54. The number of additional

students supported through 1975 is 30. The comparable number supported by the Agricultural Development Council through 1971 was 17, with four additional through 1975. While these figures are incomplete, particularly in neglecting the Colombo Plan, they indicate that there has been a substantial increase in the number of professional persons in Korea with advanced foreign training in agricultural economics and related fields.

A significant portion of those returning to Korea have entered or returned to government or quasi government service. At least eleven persons returning to Korea after receiving M.S. or Ph.D. degrees with AID or the Colombo Plan since 1971 are now employed in MAF. For ORD the number is 19, and for NACF it is 8. For NAERI, the number is 5 at the M.S. level, with planned return of some persons completing the Ph.D. by 1977.

Regarding requirements within NAERI, discussions with the Director and with numerous other persons inside and outside MAF indicate that salary scales and status are a hindrance to attracting and holding the high caliber personnel necessary to sustain modelling and analysis after MSU participation terminates.

The specific job at hand is to maintain the staff required to manipulate and further develop the KASS models, carry out policy analysis and communicate the results. The present Korean personnel in NAERI who are concerned with KASS are shown in Table 4. The job consists largely in augmenting this complement.

Table 5 was prepared by Mr. Kim, Dong Min, Director of the KASS Division of NAERI. The first column of the table shows Korean personnel assigned at present to KASS by field and by level of formal training. The second column shows planned personnel which, if realized, would

Table 4. Research Personnel, KASS Division of NARI

Fields	Present	Planned
System Science	None	Sung Hoo Park (Ph. D) Sang Won Lee (M.S.)
Agricultural Economics	Dong Min Kim (M.S.) Sang Gee Kim (M.S.) Hong Do Hwang (B.S.) Chang Bok Ahn (B.S.) Byung Kyul Kim (B.S.) Yong Jin Kim (B.S.) Chong Bok Park (B.S.) Kyong Sook Park (B.S.) (Part time) Jeung Han Lee (Ph. D) Ho Tak Kim (Ph. D.)	Young Shik Kim (Ph. D.)
Technical Agriculture	Chong Bok Park (B.S.)	
Computer Programming	Bu Kwan Lee (B.S.) Yong Suk Kim (B.S.) Hyo Bck Lee	Bu Kwan Lee (M.S.)

Notes

- () is part time positions included in total.
- *both have participated the development analysis program in MSU.
- ** three of five have participated the development analysis program in MSU.
- Additional inputs will be necessary from the fields of Technical Agriculture, Sociology and Public Administration through cooperative arrangements with ORE, MAF, Universities, etc.

Table 5. Status of Research Man Power, KASS Division of NAERI

Fields		Present	Planned	Ideal
System Science	Ph. D.		1 (1)	3 (1)
	M.S.		1	2
	B.S.			
	Sub-total		2 (1)	5 (1)
Agricultural Economics	Ph. D.	2 (2)*	3 (2)	5 (2)
	M.S.	5**	5	2
	B.S.	3	3	
	sub-total	10 (2)*	11 (2)	7 (2)
Technical Agriculture	Ph. D.			2 (2)
	M.S.			
	B.S.	1	1	1
	Sub-total	1	1	3 (2)
Computer Programming	M.S.			
	B.S.	3	2	1
	sub-total	3	3	3
Sub-total	Ph. D.	2 (2)	4 (3)	10 (5)
	M.S.	5	7	6
	B.S.	7	6	2
Total		14 (2)	17 (3)	18 (5)

largely replace the losses of American personnel. The third column, labelled Ideal, shows the somewhat greater numbers estimated to be needed to fully carry on the activities. The total increase from 14 to 17 (planned) and to 18 (ideally) should be viewed recognizing that the average years of experiences and training in analytical tools will decrease if there is one for one replacement.

Recommendations

An urgent need is to ensure that the targets shown in the second and third columns of Table 5 are actually reached. Beyond this, there is a need to provide for at least partial replacement of American KAPP personnel with Korean personnel. This is particularly important because of KAPP's role in helping bridge the gap between analytical capability and use of results in policy and programs decisions. We are unaware of any definite plans to replace American KAPP personnel with Korean personnel.

Recommendation 20

A full scale review, with possible recommendations for improvement, should be made of the ability to maintain staff of sufficient ability to carry on modelling and analysis. The review should consider salary structures; hiring procedures; logistic support and other amenities affecting staff capability to perform modelling and analysis; and factors affecting professional esprit.

Budget and support priorities should be provided for replacement of both KASS and KAPP activities, giving particular attention to needs for personnel to help apply KASS results to policy and analysis problems of concern to high level officials.

Similar planning is needed for support in the form of data; computer services; research, clerical and secretarial assistance; and office space and equipment. The team did not consider plans for these types of support in detail. We assume plans for support are being made.

Recommendation 21

Detailed plans should be prepared for future support needs in addition to manpower. These support plans should be compared with tasks required to carry out the KASS/KAPP activities, in order to note and correct any gaps.

VII. TRANSFERABILITY TO OTHER COUNTRIES

Agricultural sector analysis is rapidly becoming more widely practiced in LDC's and assistance agencies. Although it is a general concept whose meaning varies among analysts and agencies, sector analysis deals basically with the problems of strategy selection and priorities among alternative policies, programs and projects. As such, it can assist decision makers in LDC's and aid programs in confronting crucial problems of resource allocation and program selection.

There are several reasons for the growing interest in sector analysis. One is that the increasing emphasis on multiple goals for agricultural development, involving equity as well as production, makes the problem of choice among alternative policies, programs and projects much more complex and difficult. Relations between goals must be understood as well as the consequence of alternative choices on the various goals. This leads to a growing concern for a coherent approach to sector development so that multiple goals can be jointly attained or, when goals are competitive, a priority goal can be reached with minimum sacrifice of lesser goals.

The increasing number of trained people both in policy making and technical positions in LDC's is also leading to growing interest in the use of modern tools and quantitative approaches to assist in decision making. The widespread availability of computers has opened up exciting opportunities for the utilization of modern tools and techniques for planning and policy analysis in many LDC's.

The review team considered the transfer of the computerized system simulation approach used in Korea to other countries. We approached this question with full recognition of the importance of the unique conditions in each country which requires that any analytical approach be adapted to local conditions. Yet we believe that the search for low-cost, quick pay-off approaches is important enough to consider transfer possibilities in general terms even if application elsewhere of an approach would require a prior evaluation of needs and opportunities in the particular country.

A policy analysis and planning capability is an investment requiring scarce manpower and budgetary resources. Once such a capability is developed in one country, the question arises as to whether or not the results obtained can be applied elsewhere. The team concludes that such inter-country transfer of results, conclusions and policy recommendations is not possible. There is no real alternative but to develop the analytical capability in each country. Transfer possibilities therefore are limited to conceptual approaches, software components, people and lessons of experience.

The team feels that opportunities for transfer of model components and software are possible but limited. Any transfer potential in these areas would almost certainly be tied to the transfer of people with a close familiarity with the model components and software being transferred. Even in those situations where people are transferred, country differences in institutional arrangements, agricultural enterprises and technologies, and available data may make it about as efficient to construct

new model components as to adapt existing model components to local conditions.

In thinking about the transfer of model components and software it is important to realize that their development involved many different choices (e.g. level of aggregation, economic behavior, feedback mechanisms) from among alternative choices. In the setting of another country, these choices may be quite different. If so, there would be little advantage in attempting to transfer model components vs. constructing them from scratch. Indeed, it may be just as efficient to begin anew. This leads us to conclude that the transfer of experienced personnel who can collaborate with workers in another country in developing new models and components is a more important possibility than the transfer of components and software.

Possibly the most promising transfer involves principles and lessons that can be derived from the Korean experience. Our review of KASS suggests that the following principles could be useful in guiding sector analysis projects elsewhere:

1. Start with small, relatively simple models directed to priority policy and investment problems.
2. Look for early utilization possibilities that will help to convince policy makers of the usefulness of analysis.
3. Develop models in close cooperation with subsector - commodity technicians to promote acceptability of the results.
4. Don't get model development too far out ahead of the capability and availability of local staff.

5. Emphasize training and transfer of responsibility from the beginning.

Some of these principles have guided the KASS effort from the beginning. Others represent conclusions based on our evaluation of the KASS experience using an advantage of hindsight. We believe that each of them can be usefully applied in the development of agricultural sector analysis capability in other countries. They are offered in the spirit of the goal of KASS -- the development of an effective capacity in other countries for agricultural planning and policy analysis.