Evaluation of the Grain Management Program Simulation Model

Being Developed for Korea by Michigan State University — Contract Aid/csd-2975

KSU

FOOD & FEED GRAIN INSTITUTE
KANSAS STATE UNIVERSITY

MANHATTAN, KANSAS 66506

EVALUATION OF THE GRAIN MANAGEMENT PROGRAM SIMULATION MODEL

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PREFACE

This report represents one of six related but independent evaluation papers focusing on identified phases of the Korean Agricultural Sector Simulation (KASS) Model being developed and tested by Michigan State University under Contract AID/csd-2975. The six phases, involving separate evaluation papers include:

- Capacity and Utilization of the Model in Korea
- The Systems Model
- Recursive Linear Programming Component
- Population Component
- Grain Management Program Component
- Livestock Component

As one of the six, this report is addressed specifically to the grain management component developed by Dr. Thomas J. Manetsch and Forrest J. Gibson of the MSU staff in close collaboration with Kim, Sang Gee and other Korean counterparts at the National Agricultural Economics Research Institute in Seoul. Other components of the KASS Model are addressed only to the extent that they are linked directly to the grain management program component.

The evaluation comes at the late stages of development of the grain management program component, but before testing, de-bugging and tuning of the various submodels in the component. This has the advantage of providing opportunity for the evaluation to affect the final product, but it means that assessment of applications in Korea must be based on judgment of probability rather than on demonstrated fact.

An attempt has been made to assess progress in development of the grain management program component not only in terms of the direct input given to it, but also in terms of the total setting under which the MSU assistance for the Korean Agricultural Sector Simulation Model has been provided. This setting includes the experience with the Nigerian simulation model developed under Contract AID/csd-1557, the parallel Korean Agricultural Sector Analysis under Contract AID/EAD-184 (and the pressures of time and budget imposed by that project to produce workable results from the first partially manual version of the overall KASS Model), and the related input to the total effort under MSU's 211-d grant project.

The evaluation reflects personal interactions with the MSU project staff at Lansing and Korea, as well as with key people in the various Korean agencies and organizations concerned. Both authors spent February 4 and 5 on the MSU campus, and Dr. Phillips spent February 14-28 in Korea. During the entire period in Korea, Mr. Gibson worked very closely with Dr. Phillips, and participated in most of the interviews with Korean officials. The complete itinerary for the contacts in Korea is given in the appendix of the report.

All MSU project staff members have been most cooperative and helpful. Without their help and the full support from USAID/Korea and from Dr. Kim, Dong Hi, Dr. Chyun, Soon Pyo, Mr. Lee, Sang Won and other NAERI staff members, the evaluation would not have been possible. In addition, a debt of gratitude is owed to the busy Korean officials listed in the appendix who willingly gave their time and help, frequently on very short notice.

EVALUATION OF THE GRAIN MANAGEMENT PROGRAM SIMULATION MODEL

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I. TERMS OF REFERENCE FOR THE EVALUATION

The Project Evaluation Plan developed by AID/Washington under the leadership of Dr. Lehman B. Fletcher contains the terms of reference for each of the identified phases of the Korean Agricultural Sector Simulation (KASS) Model being developed under Michigan State University Contract AID/csd-2975. The assignment to the Food and Feed Grain Institute at Kansas State University relates specifically to the Grain Management Program Component Model (GMP) of the KASS system.

The terms of reference for the evaluation include:

- Measurement of the degree to which the specific objectives of the project have been fulfilled.
- Identification of factors that have determined the degree of success of the project.
- Suggestion of steps that can be taken to extend and improve the project's performance.
- Indication of necessary conditions for transferring the approach to other countries.

The Evaluation Plan further states (page 2) that:

> By assessing actual experience with a computer simulation model in a developing country, the evaluation will help to establish the validity of this approach in designing, analyzing and implementing alternative policies, programs and projects for agricultural development. It will also help to identify further work needed to improve this approach to agricultural sector analysis.

The specific objectives of the KASS project against which achievements are to be measured include the following:

(1) Adopt, extend and test the computer simulation model developed under project AID/csd-1557 for Nigeria to evaluate selected agricultural policies, programs and projects in Korea;

(2) Establish linkages with national planning and research agencies in Korea;

(3) Train the human resources and develop the organizational capability in Korea to use, modify, and improve the computerized simulation model for actual agricultural planning and policy formation.

These specific objectives are designed to accomplish the basic objective of the Michigan State University project, namely, "To develop an operationally useful systems-science simulation model applied to agricultural sector planning."

Those directly concerned with the KASS Model and its applications in Korea are anxious that the evaluation identify specific additional efforts that will be needed to make the model fully productive. This is made clear in a letter to Dr. Fletcher from Francis C. Jones, Rural Development Officer, USAID/Korea, dated January 10, 1974. The letter states in part

> . . . both the Ministry of Agriculture and Fisheries and the USAID are delighted that this review and evaluation is to be carried out. We hope that the evaluation will put particular stress on what remains to be done in Korea during the next several years both in terms of model development and formal training of Koreans to insure that the model can and will be used in a continuous assessment of the agricultural sector. In other words, we would like this evaluation to be Korea specific as well as being an assessment of the usefulness of the model per se in agricultural sector analysis.
>
> . . . it is important that the evaluation team assess the model from the standpoint that it is component of a larger planning activity being carried out by the Ministry of Agriculture and Fisheries with the assistance of a separate team from MSU.

The total terms of reference are summarized clearly in the introductory letter from Dr. Kim, Dong Hi, Director of the National Agricultural

Economics Research Institute to the Korean officials visited by Dr. Phillips (see appendix). The letter states simply that "The overall evaluation is designed to assess the advantages and disadvantages of the systems simulation approach as an operational approach to agricultural sector analysis and to determine what additional work is needed to improve the approach."

II. GRAIN MANAGEMENT PROGRAM COMPONENT IN THE KASS MODEL

The grain management program component (GMP) in the Korean Agricultural Sector Simulation Model being developed under the Michigan State University contract is designed to be an instrument through which researchers and policy makers can evaluate the impacts of proposed alternative grain management policies and programs. Particular emphasis is placed on the time dimension of flows and stock levels in the marketing system from producer (and import point) to final consumer; time periods throughout the various submodels in the component are 1/40 of the grain marketing year. Less emphasis is placed upon the form and place utilities generated by the marketing system in response to consumers' demands. Place utility will be reflected through market position (farm, country point, consumer market point levels) and at least potentially through the three-area disaggregation contained in the overall KASS Model. Form utility will be reflected through market preferences for the different food grain products, and perhaps for the native varieties of rice compared to IRRI-667 rice.

The component depends upon the market price mechanism for information flows through the system. Simulated market prices under alternative policies are used to induce changes in purchase and sales patterns and influence stock levels from one 9.1-day period to the next. The simulated prices are used to register deviations from targeted goals and signal needed changes in the rates of acquisition or sale of Government-controlled grain and related inventory management and import decisions. Simulated market prices are the principal interface mechanism between the GMP component and other components of the KASS Model.

The GMP component deals specifically with the three major food grains, and the consumer products derived from them, in Korea. In order of importance these are rice, barley and wheat; corn, grain sorghum and other feed grains are not included. Until the livestock component is developed little purpose would be served in including feed grains in the GMP component, because Korean policy makers view food grain policies separately from those affecting feed grains.

Development Status of the Component at the Time of Evaluation

At the time of this evaluation, the GMP component models are in the final stages of conceptual development, but are not operative. The plan is that Forrest J. Gibson, who has been working on the component in Korea full time for the past 16 months, will return to East Lansing soon to do necessary debugging where he can get rapid computer turn around. This also will give him the opportunity for face-to-face interaction with other MSU staff members involved in the project. Before he goes he will have the opportunity for additional interaction in Korea with Dr. Lloyd D. Teigen who currently is developing the revised urban demand models needed for the GMP component.

At the present stage of development, parts of the total GMP component exist in varying degrees of perfection. Many exist in compiled computer programs, but have not been tested with real data. Others still are at the conceptual stage. None have been tuned to the point where realistic output can be expected. Obviously, no complete documentation has been prepared at this stage.

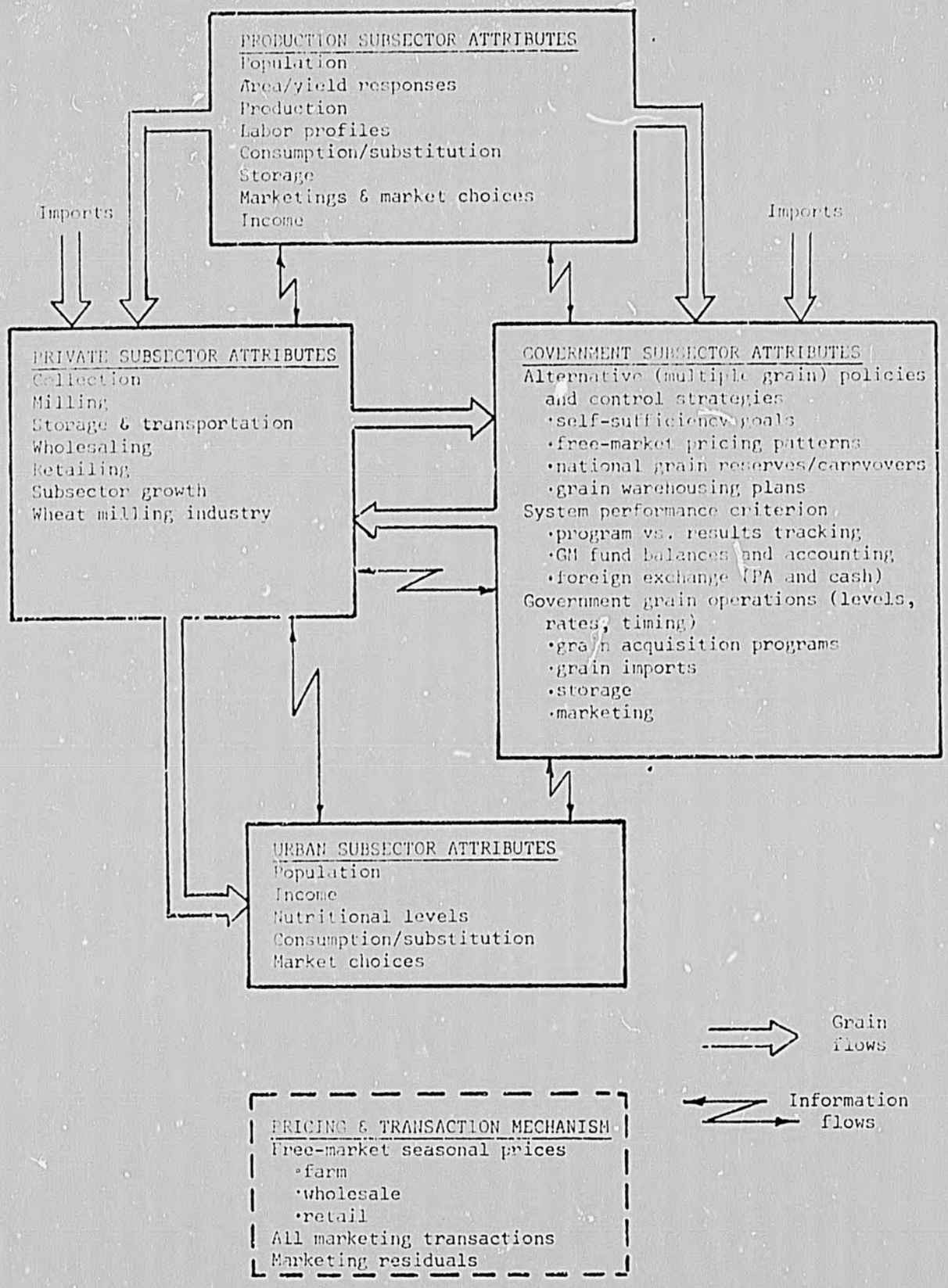
The reviewers have had full access to all working papers that have been prepared on the component and the emerging current version of the total KASS Model. More importantly, Dr. Phillips has had access to the very

preliminary drafts of pieces of what will become up-to-date working papers, both from Mr. Gibson and Dr. Teigen. This full cooperation has been most helpful to the reviewers. Nonetheless, it is hoped that the reader will be mindful of the difficulty of making a meaningful evaluation of simulation models still being developed and for which documentation is yet to be prepared. Partly for this reason, the reviewers have included a summary of the GMP component of the KASS Model in the approximate form that they anticipate it will emerge.

Integration of the Component with the Total Model

The accompanying general diagram of the GMP component was recently prepared by Forrest Gibson. Its Korean language counterpart was used by he and Dr. Phillips in discussing the potential application of the component with the Korean officials contacted (see appendix). It portrays the basic flows of grain from the farm production subsector and from imports through the Government grain marketing subsector and the private grain marketing subsector to the urban grain product consumption subsector. Information flows (essentially prices) among the subsectors are indicated by the solid arrows, all of which run both directions. The key variables in the pricing and transaction mechanism are indicated in the dotted box at the bottom of the chart.

Although the farm production subsector at the top of the chart and the urban consumption subsector at the lower portion of the chart are essential parts of the GMP component, the models for these subsectors operate within the main KASS Model. Both are currently being modified to meet the .025-year time unit and other specific requirements of the Government subsector and private subsector models in the GMP component. Thus, the GMP component may be viewed as "inside" and an integral part of the



GRAIN MANAGEMENT PROGRAM MODEL

overall KASS Model at both ends, production and consumption. Only the two marketing subsectors lie basically "outside" the master KASS Model. However, it must be remembered that the GMP component, per se, includes everything portrayed in the accompanying chart.

General Outline of the GMP Component Models

The system of models involved in the GMP component simulation model may be outlined as follows:

- Farm Production and Marketing Subsector Model
  - -- Production response and harvesting patterns
  - -- Farm demand (family consumption for food and alcoholic beverages, farm seed, and in the case of barley for on-farm poultry and livestock feeding)
  - -- Seasonal farm storage and marketing patterns
  - -- Excess demand and farm prices response
  - -- Accounting mechanism for the farm subsector
- Private Marketing Subsector Model
  - -- Marketing function mechanism (by key function)
    - Assembly
    - Milling
    - Shipping
    - Wholesaling and retailing
  - -- Private grain stocks mechanism (by position)
    - On-farm
    - At country points
    - At consumer market points
    - Consumer holdings

-- Marketing system capacity response mechanism

Millers (milling capacity, storage capacity)

Shippers (storage capacity, possibly transport capacity)

Wholesalers and retailers

-- Imported wheat milling and marketing mechanism (by function)

Importation

Milling

Baking

Noodle manufacture

Other

Product distribution

-- Financing and accounting for the private sector

- Government Grain Management Subsector Model

  -- Market price controller

  -- Stock level and import controller

  -- System capacity mechanism

  Government-owned storage controller

  Private industry contractors mechanism for milling and storage

  -- Financing and accounting controller for the national grain account

- Urban Demand Subsector Model

  -- Urban expenditure projections

  -- Import/(export) quotas (for given set of policies)

  -- Annual price determination mechanism

  -- Import/(export) quota adjustment

  -- Seasonal demand response mechanism

  -- Accounting for the urban sector

- Seasonal Price and Transaction Mechanism
  - -- Prices by level in the marketing system
  - -- Choices and transactions between Government and private channels

Capabilities and Incapabilities of the GMP Component

The kinds of alternative Government grain policies by season for rice, barley and/or wheat which the GMP component of the KASS Model is designed to address include:

- Levels of controlled market prices
- Buying and selling rates
- Levels of farm price supports
- Inventory management policies by market position
- Import policies
- Total Government-owned storage capacity
- Custom storage and other marketing functions performed for Government in private facilities
- Financing of warehouse construction
- Financing of imports
- Incentives and regulations to stimulate desired storage and marketing patterns by the private sector (by market position)

The kinds of alternatives which the GMP component as presently structured is not designed to address include:

- Storage of brown rice versus rough rice and versus polished rice by position
- Pre-sale mixing and mix rates of barley with rice
- Location of storage stocks (or storage capacity)
- Geographic differences in farm price supports and/or controlled market prices (except possibly by the three regions of the Republic)
- Inventory or shipping order management and accounting by individual warehouse
- Programs to increase marketing efficiency and reduce marketing costs
- Price differentials by quality (except possibly between domestic varieties and IRRI-667).

The capability to address questions of this kind could be added to the GMP component at a later date if desired.

III. SETTING FOR THE GMP COMPONENT IN KOREA

There are many dimensions within the Korean setting which affect the structuring and potential use of the grain management program component of KASS Model. Some of these are similar to those found in other countries; others are unique in degree if not in kind. Some are crucial to realistic simulation modelling; others represent details which no model can (nor should) attempt to reflect. One of the secrets to successful model building is to understand the reality being modelled well enough to know which factors in the total setting should be reflected in the model and which can be omitted.

The purpose here is to identify those factors in the total Korean setting which are believed to be key to judging the effectiveness and potential utilization of the GMP component models in the overall KASS system. Some understanding of these factors in the setting is crucial to a realistic evaluation of the simulation models. In a sense, they represent the specific setting within which the evaluation must be made.

Importance of Grain Policies in Economic Development

There is no doubt that the grain management program simulation model is addressed to important real policy issues in Korea. From the man on the street and in the fields to the president of the Republic, everyone is affected by and conscious of the impacts of public policies affecting market quantities and prices of rice, barley and wheat products.

Rice especially represents a major source of income to almost all of Korea's farmers, and a major household expenditure to almost all of Korea's urban families. The KY 1973 rice crop of 3,957,190 metric tons will provide nearly 50 percent of the average farmer's cash income and demand about 17.5 percent of the average consumer's disposable income, for example.

The Government of Korea has been engaged in active programs to carry out national food grain policies for many years. These programs encompass the complete food grain system from grain production to retail distribution of food grain products. They involve importation, storage, milling, transport, merchandising and other functions in the system. They affect not only market supplies and prices at a given time, but also the type and quality of product available (e.g., the mix of preferred local varieties and the less preferred IRRI-667 rice; the mix of rice and barley). Even though food grain imports are second only to petroleum imports in claim on Korea's valuable foreign exchange (approximately 11.2 percent of the value of total imports in 1972), Korean consumers rarely find in the market all of the quality rice and other food grain products in the form, time and place that they would like to buy at prevailing market prices.

The increasingly complex interrelationships among the alternative food grains and food grain products are making Government planners more and more aware of the value of a systems simulation model with the capability for testing the probable impacts of alternative sets of policy measures. The interrelationships in demand response and in supply response, both in domestic markets and in world markets, combine to make partial analysis and and commodity-by-commodity planning relatively ineffective. Consider one specific example. Rising world prices for wheat make the present controlled

domestic price of wheat flour relatively very low. If maintained, the situation promises to create a serious drain on the Government grain account and Korea's foreign exchange. The domestic wheat flour price probably needs to be raised, but by how much? When and how? There will be impacts on rice demand, but how much, and will it be primarily in the urban areas or in the rural areas? What about the impacts on barley demand? Through the effects on wheat millfeeds and the indirect effect through barley, there will be impacts on animal feeds, and eventually on animal products. If the KASS Grain Management Model were able to generate answers to these kinds of questions today, Government planners in Korea would insist that it be used to do so.

Because of the dominant role of rice and other food grains to both producers and consumers in Korea, any efforts which help result in more effective grain management policies and programs should have relatively high pay-off in progress toward achieving development goals. While th re may be some difference in the magnitude of such pay-off, this statement will hold regardless of the relative emphasis given to increased domestic food grain production in Korea's national development plans. Thus, it appears that by helping to generate information in a complex setting to support more effective planning in a segment of the Korean economy with potentially high pay-off, the grain management program component of the KASS Model deserves relatively high priority.

Interrelationships Among the Food Grains

It is clear that the grain management program simulation model must reflect the structural interrelationships among the alternative food grains in Korea. While rice is dominant in the Korean diet, barley also is important, and rice-barley mixes are common. Wheat products, includ-

ing both noodles and bakery products, are significant and apparently still increasing in relative importance, even though Korea has to import some 89 percent of the needed wheat. Rice and barley frequently move through the same marketing channels from farm to final consumption point, and are stored in the same warehouses. Except for limited quantities of domestic wheat which move through Government channels, wheat, wheat flour and final wheat products involve marketing channels which are distinct from those for rice and barley.

The interrelationships between the three major food grains and other food grains are of less concern. Some 20 different varieties of pulses are produced in Korea, and move through private "grain trade" channels into direct human consumption. For the most part the pulses do not substitute for the food grain products in Korean diets, however. Likewise, they usually do not compete with rice and barley for land use, but instead are grown on the upland soils. The limited production of corn and grain sorghum is used primarily for livestock and poultry feed rather than for human food.

Interrelationships between the major food grains and the feed grains are of some concern. Substantial quantities of rice bran and most of the barley bran and wheat millfeed move into livestock and poultry feeds. Rice bran also moves into the edible oil extraction industry, and the resulting rice bran cake and meal into feeds. Barley, wheat and glutinous rice are used for the production of alcoholic beverages, the by-products of which are used for feed. Most of these kinds of interrelationships can be reflected through appropriate conversion coefficients applied to the raw food grains. Barley grain is of greater concern, since it is used for livestock and poultry feed as well as for human consumption. That moving through

the commercial feed industry is known, but the much larger portion which is fed directly on the farm is difficult to identify quantitatively. These factors will be more troublesome later in the development of the livestock component and interfacing it with the GMP component in the KASS Model.

Emerging Competence in Econometric Methods

The potential use of the GMP component and other components of the KASS Model in Korea is dependent upon competence to adjust the models and the coefficients used in them to reflect current conditions and policy questions to be addressed. There must be some depth of competence in econometrics and systems science, not only at the National Agricultural Economics Research Institute, but also in other agencies of the Ministry of Agriculture and Fisheries, in the Economic Planning Board, in public and private research institutes, at the universities, and other agencies conducting planning research in Korea. Even with the felt need by policy decision makers for the kind of information the grain management planning simulation model will be able to generate, the model cannot be used unless there is competence to use it.

Competence for using the GMP model requires a limited number of people who fully understand the model and its inter-workings. It requires a larger number who understand econometrics, systems science and related disciplines who can request specific runs from the model, suggest improvements in subsectors of the model, provide research information for up-dating the model and feeding coefficients into it, etc. It requires a larger number still who are competent in quantitative research and how to design research studies that will provide information so that the model can be made more and more precise through time.

Organized training for staff members of NAERI is underway, supported by the Government of Korea-USAID ongoing training program. A number of staff members are now at Michigan State University, and more are scheduled to go in the months ahead. Even though there is a constant conflict between the need for more formal training of the NAERI staff and the need to get them back on the job, this kind of training is essential, and will make increasing impact as more and more trained people are rotated back to regular positions in NAERI.

Beyond this, effective use of the GMP component and other components of the KASS Model requires that those in Korea who are already trained and in training be drawn upon. Fortunately, there are an increasing number of such people now in key positions in Korea. Many of these people with full competence in quantitative methods also have substantial depth of understanding and experience in areas directly related to the kinds of issues addressed in the GMP model. Dr. Moon, Pal Yong and other senior researchers at the Korean Development Institute are excellent examples. Working relationships between the NAERI staff and qualified people in the key positions in other agencies are being established, and need to be strengthened.

Administrative Organization for Grain Policies and Programs

For the most part the establishment of public plans and policies relative to the food grains and the carrying out of programs to implement the policies involve separate line functions and administrative organization in Korea. The broader national grain policies are reflected in the national 5-year plans, the analysis for which is centered in the Economic Planning Board with direct support from the Ministry of Agriculture and Fisheries as well as research institutes outside MAF such as the Korean Development

Institute. The development of the national 5-year plans involves substantial participation by the President's Office and the National Assembly. Comparable procedures and organization are involved in the development of major food grain policies from year to year and even month to month within the current 5-year plan.

The more detailed polices and programs for government grain management are the responsibility of the Food Management Bureau of the Ministry of Agriculture and Fisheries, of course with review by top MAF officials as well as by EPB and the President's Office. The Food Management Bureau is not responsible for the operation of the government grain programs.

The parallel bureau in MAF, the Grain Management Bureau, is solely concerned with the operation of the public grain programs, both for domestic grain and imported grain. Some of the operations are carried out directly through government-owned facilities. However, the bulk of the assembly, handling, milling, blending, storage, transport and distribution of government grain is done by private operators and the National Agricultural Cooperative Federation (NACF) on a custom basis for the Grain Management Bureau.

Government Grain Marketing Channels

The Government grain marketing channels for rice and barley are somewhat different for domestically-produced grain and imported grain. In the case of domestically-produced rice and barley, the threshed whole grain is purchased directly from farmers at the announced support price at designated buying stations throughout the production areas. The Government buys only during designated seasons -- normally November through February for rice and June through September for barley. The locations of most of the

buying stations coincide with those of the NACF warehouses (or those of other designated custom receivers for the Government), and NACF actually performs the receiving function, except for grading and financial settlement with the farmer. The whole grain remains in these warehouses until the Grain Management Bureau orders shipment to one of the 600 private rice mills designated for contract milling of Government rice (or barley). These mills are members of the Korean Grain Association which does the negotiating and accounting with the Government for them. The whole grain may be stored at the mill for a period, but the rice and barley normally are not stored long after milling. The mills usually are given specific blending orders for the mix of IRRI-667 and native varieties of rice, and perhaps also the mix of this rice blend with barley for the final consumption blend. Orders then are given for shipment to distribution warehouses, and from these warehouses to approved retail outlets. Shipments for the Government are arranged by private agents, the dominant one being the Korean Express Company; KEC also is a major public warehouse operator for milled rice owned by the Government. The consumer prices of Government rice and barley, as well as the charges for handling, storage, milling, blending, retailing and other marketing services, are fixed as a given point in time, but subject to change from time to time.

Imported rice and barley also are handled largely by private operators on a custom basis for the Grain Management Bureau. Port services and port-to-mill transport are contracted through Korean Express Company. Polishing of imported brown rice and milling of imported barley are done under contract by firms which handle no domestic grain. The warehousing and distribution channels for the Government imported rice and barley in the form for consumption are comparable to those for domestic grain.

Normally the imported rice is not blended with IRRI-667 or other domestic varieties, but may be blended with barley for distribution through the Government-controlled channels.

Until recently, the retail outlets authorized to distribute Government-owned rice and barley were located only in the larger cities representing major deficit areas. The interior points were served exclusively by the private industry. However, the increasing percentage of the total off-farm marketings moving through Government channels has made it necessary to establish authorized distribution outlets for the Government grain at interior points.

Private Grain Marketing Channels

The key segments in the private marketing channels for domestic rice, barley and wheat are the millers, the shippers, the commissioners (wholesalers) and the retailers. Separate assemblers and other specialized traders are evident in some areas.

There are some 21,000 private millers located throughout the country. The average capacity and function varies by production area. All perform a custom milling function for producers, and receive payment for this service in kind (typically 4 percent of the milled rice, for example). To support this service, many offer free storage of the paddy rice for the farmers who sometime later will have the rice processed at that mill. Some offer pick-up, transport and assembly service from the farmers' house to the mill; for this service they raise the total milling fee, say to 5 percent of the milled rice. In the more commercial production areas to the south, the millers perform a "shippers" function also; that is they buy the whole grains from farmers, store it, mill it and merchandise the milled

product to wholesale "commissioners" in the consuming markets. This is especially common among the millers in the Honam area.

With the increasing importance of the Government purchases, the private milling industry is faced with excess milling and storage capacity and relatively low return on investment. Through the Private Millers Association, the industry is making various attempts to improve these conditions. For example, in order to modernize milling equipment to process the IRRI-667 rice efficiently, the Private Millers Association has requested a low-cost Korean Government loan on behalf of its members of 30 billion won. The Association points out that a public benefit of the some 3-percent gain in milling yield would result from the investment in improved milling equipment.

Grain shippers buy the milled grain (rice and barley), transport it to the wholesale markets in the consuming areas and sell it to the wholesale commissioners in these markets. In areas where the private millers do not perform this function, the shippers buy directly from farmers, in part through independent assemblers or agents, but often directly. Some operate assembly warehouse facilities for the milled grain, but this capacity is used primarily for relatively short term storage, rather than for holding from the harvest period through the marketing year until the next harvest.

The "commissioners" at the wholesale markets in the consuming areas buy daily the milled rice and barley consigned to the markets by the shippers. They maintain some storage space which usually fills after harvest and is nearly empty prior to the next harvest. However, the storage stocks are used primarily to adjust for short run supply changes rather than those caused by the seasonal harvest patterns. Some of the commissioners also do some cleaning as well as re-bagging into uniform weights, but their primary function is to supply the retail outlets in the consumer markets.

The many small private retailers in the consumer markets buy the milled rice and barley in the rice-straw bags, usually only a few bags at a time, and sell these grains from bulk display piles by the kilogram (or gram) to consumers. They maintain only a few day's supply in inventory. However, during the peak marketing season following harvest, they carry larger stocks, and are able to supply consumers who want to stock several month's consumption with individual lots as large as four or five straw bags at a time.

It is clear that the farm producers are the largest holders of seasonal food grain stocks which move through private marketing channels. Final consumers may be the second most important holders of such stocks. Within the marketing channels, the largest holders are the shippers, especially if they are also millers, as in the Honam area. The wholesale commissioners and retailers build up their stocks seasonally, but have limited capacity for holding large storage stocks.

IV. EVALUATION OF THE FARM SUBSECTOR MODEL

As outlined in the previous section, the farm subsector model for the GMP component is included in the overall KASS Model. As documented in project publications, including the appendix to the Korean Agricultural Sector Analysis report and the KASS Users Manual, existing tested versions of the farm subsection model have the capacity to generate seasonal production patterns for each of the food grains by time increments of 1/40 year. However, the on-farm demand and off-farm marketings in those versions operate on an annual basis, and must be modified for the GMP component. In the July 1973 status report on the Grain Management Program component, it is pointed out that the simultaneous equation system developed by Dr. Moon, Pal Yong of the Korean Development Institute could be modified for incorporation to give the KASS Model capability to generate seasonal demand and marketings in the production subsector. This since has been pursued to the point of developing dynamic price and excess demand equations to replace Dr. Moon's static market equilibrium identities, transformation of the coefficients in Dr. Moon's system to fit the KASS units of measure, and incorporation of Dr. Moon's equations into the Fortran statements for the GMP component. It appears that there may be problems with this approach, however, and it may be desirable or even necessary to develop a new approach, following the pattern being developed for the urban demand subsector (see Section V). If so, the on-farm demand and off-farm marketings models for the production subsector will be re-

vised substantially. The considerations involved are discussed under the corresponding subsections below.

Production Response and Harvesting Patterns

This part of the farm production subsector model is essentially operative now for rice and barley. The original KASS Model is capable of generating annual production response and seasonal harvesting patterns, and will be more powerful when key variables such as yields can be generated within the system. The seasonal harvesting pattern routine can be adjusted to approximate closely actual harvest rates. The harvest patterns are determined largely by climatic factors, and are relatively stable from year to year. Published data on the harvesting patterns for rice and barley are available, and can be used to make the model reflect this dimension of reality accurately.

Yet to be reflected accurately in the model are the production response and harvest patterns for wheat and for IRRI-667 rice. Although relatively small quantities of domestic wheat reach urban consumers, and most of the domestic wheat and wheat products move through private marketing channels without Government control, domestic wheat is a significant product in the rural economy of Korea. If it is to be realistic, the GMP component must be able to reflect this fact. Although Korean wheat production data are less reliable than those for rice and barley, it appears that sufficient information is available for reflecting domestic wheat in the model and tuning the coefficients to conditions in Korea.

The IRRI-667 rice has unique characteristics which emphasize the need for treating it as a separate crop from the indigenous varieties. IRRI-667 is harvested earlier and over a shorter time span. Because of its tendency to shatter before threshing, it is handled differently from the field to the

farm home, and from the farm through local assembly channels to the mill. It has distinct milling characteristics and milling yields. It is a different product to the consumer, and sells at a discount below milled rice of other varieties. The production function for IRRI-667 is different from that of other rice grown in Korea. It shows substantially greater response to fertilizer and other technical inputs, and under favorable growing conditions produces much higher yields. However, it is more subject to the risks of weather, and under adverse conditions such as those for the crop harvested in the Fall of 1972 may produce lower net income for the farmer than the better indigenous varieties. All of these things emphasize the need to model IRRI-667 as a separate food crop.

The limited imformation about IRRI-667 creates some problem for treating it as a separate crop, and will require keen judgment plus some luck in tuning the models. It has been produced in quantity for only two years. The growing conditions in the two years represent more nearly the two extremes rather than the normal. Cultural practices as well as milling and marketing have yet to be perfected. Practically no hard data exist for measuring cross price elasticities of demand between IRRI-667 and other rice, much less between IRRI-667 and barley and between IRRI-667 and wheat products. The challenge to the model builders is great, but it is believed that it can be met within a reasonable period of time.

Those who are familiar with the statistics for food crops in Korea find it necessary to make some kind of adjustment in order to reconcile supply and disappearance balances. The KASS approach is to use production "deflators." Dr. Moon's approach is to force production to equal disappearance through his market clearing identity equations. Some attribute the problem to an upward bias in the production statistics, and this may

explain part of the difference. However, if disappearances other than for human food can be reflected accurately, the need for the production "deflators" may disappear. Other types of disappearance which are important in the farm sector include seed, home brewing, and (especially in the case of barley) feeding of the grain to poultry and livestock. Statistics on such disappearances are almost non-existent in Korea, but it is believed that seed, brewing and feeding uses can be budgeted for more accurate results than achieved by an aggregrate production "deflator." Seeding and brewing use have definite seasonal patterns which should be fairly easy to reflect. A more interesting phenomenon may exist if producers are uncertain of the area to be seeded the forthcoming year, and hold excess stocks until seed requirements are known. This could be an important factor in barley marketings, since the seeding rates for barley are relatively high.

Farm Demand for Rice, Barley and Wheat

Dr. Moon's equation estimates the average on-farm per capita consumption of rice for a particular month in the rice year for the Republic as a whole as a function of the following variables:

(1) The monthly average wholesale price of polished rice (deflated by the index of non-grain wholesale prices).

(2) Weighting factors on the rice price for the October-January (harvest) period and the February-May period.

(3) The monthly average wholesale price of polished barley (deflated by the index of non-grain wholesale prices).

(4) The monthly average wholesale price of wheat flour (deflated by the index of non-grain wholesale prices).

(5) The farm per capita stock of rice at the end of the previous month.

(6) The per capita value of off-farm sales of rice for the month.

(7) The per capita value of off-farm sales of barley for the month.

(8) The farm per capita income originating from other than rice and barley sales (deflated by the index of prices paid by farmers).

(9) A dummy variable for the harvest period (1 if October-January, otherwise 0).

(10) A dummy variable for the February-May period (1 if within the period, otherwise 0).

The estimating equation for average on-farm per capita consumption of barley for the month is comparable, with appropriate adjustments in the dummy variables to reflect barley harvesting patterns. Comparison of the estimates for historical years with reported figures give quite good results for both rice and barley. Recently, Dr. Moon has developed and published in Korean a comparable estimating equation for on-farm consumption of wheat products.

Problems may arise in the use of Dr. Moon's equations for farm demand in the KASS Model from several sources. They were not developed for prediction purposes, so that his coefficients may require quite a bit of tuning in the simulation model. If so, there are many "knobs" to be tuned. His equations are part of a simultaneous system which also includes equations for estimating urban demand. Problems may arise in using his equations for farm demand and another method for urban demand. The coefficients in the system apply for the country as a whole rather than by regions. The equation for wheat is preliminary, and none exists for IRRI-667 rice. The equations do not distinguish farm demands for non-food uses from those for family food consumption. They do not reflect seasonal changes in the relationship between wholesale prices and the corresponding prices received by

farmers. They do not distinguish between farmer-owned stocks stored at home compared to those stored at the mill. The coefficients tie back to Dr. Moon's market clearing equations which force "net" production to equal total consumption. The dummy period variables indirectly reflect differences in farm demand for holidays and festivals, but only by 4-month period, not 1/40 year period.

It is hard to tell how many of these limitations will turn out to be serious, and how many can be ignored. Only running of the total GMP component with Moon's system of equations and testing the results can tell. The alternative under consideration is to generate period-by-period farm demand following the methods under development by Dr. Teigen for generation of the corresponding urban demand, discussed in Section V. This alternative would give more consistency to the models, and should provide more flexibility for regionalization, for reflecting non-food farm demand, and perhaps for reflecting seasonal differences in price differentials between the farm and wholesale levels.

Seasonal Farm Storage and Marketing Patterns

In his simultaneous system, Dr. Moon's equation estimates the average monthly per capita off-farm sales of rice for Korea as a function of the following:

(1) The monthly average wholesale price of polished rice (deflated by the index of non-grain wholesale prices).

(2) Weighting factors on the rice price for the October-January (harvest) period and the February-May period.

(3) Farm per capita liabilities as of the end of the previous month (deflated by the index of prices paid by farmers).

(4) Farm per capita expenditures for clothing, education, etc. (deflated by the index of prices paid by farmers).

(5) The farm per capita stock of rice at the end of the previous month.

(6) The per capita value of off-farm sales of rice for the previous month.

(7) The per capita value of off-farm sales of barley for the previous month.

(8) The farm per capita income originating from other than rice and barley sales for the period (deflated by the index of prices paid by farmers).

(9) A dummy variable for the harvest period (1 if October-January, otherwise 0).

(10) A dummy variable for the February-May period (1 if within the period, otherwise 0).

The estimating equation for off-farm sales of barley is comparable. Dr. Moon's recent work may not include a comparable equation for wheat sales, since domestic wheat represents only 11 percent of total consumption of wheat products in Korea, and much of this is consumed on the farm.

The parallel between the farm sales equations and the farm demand equations is Dr. Moon's system is clear. The limitations and possible problem areas pointed out in the above subsection are directly applicable here as well. In fact, even if it proves desirable to use Dr. Moon's on-farm demand equations, it may be better to use a different method for predicting seasonal off-farm sales.

If variables comparable to numbers 3 and 4 in Dr. Moon's sales equations are reflected, the system developed by Mr. Gibson for predicting sea-

sonal levels of privately-owned grain stocks should be directly applicable to the farm subsector (see Section VII). Since farmers control a large portion of the privately-owned stocks stored at milling and shipping points as well as on farms, they represent dominant free-market storers in the system. The private seasonal stock level submodel seems to be an accurate and relevant simulation of farmers seasonal storage behavior.

Excess Demand and Farm Storage Response

Regardless of the final method for handling farm demand and farm marketings, the excess demand and farm storage response mechanism now under development will be needed to interface the farm subsector with other subsectors of the GMP component model, and insure consistency with the annual average prices and quantities in the overall KASS Model. The mechanism is straight-forward, and should give rise to no major problems in debugging and tuning. The planned integral equations should insure reasonable consistency between the annual prices and quantities generated in the KASS Model and the series of corresponding seasonal quantities and prices in the GMP component. Market clearing mechanisms between the farm subsector and other subsectors of the GMP component should be no problem, whether the final product is based upon Dr. Moon's simultaneous equations or upon Dr. Teigen's equilibrium price models.

V. EVALUATION OF THE URBAN DEMAND SUBSECTOR MODEL

The urban demand subsector model of the GMP component will be located within the overall KASS Model. The urban demand component of the earlier KASS Model is being revised to produce the necessary information for the GMP component. The exact form will depend upon whether the revision is based on Dr. Moon's simultaneous equations or Dr. Teigen's equilibrium price model.

Dr. Moon's system estimates the average per capita urban demand for rice in the country for a given month with an equation parallel to that for estimating the corresponding rural demand. The independent variables are:

(1) The monthly average wholesale price of polished rice (deflated by the non-grain wholesale price index).

(2) Weighting factors on the rice price for the October-January and February-May periods.

(3) The monthly average wholesale price of polished barley (deflated by the non-grain wholesale price index).

(4) The monthly average wholesale price of wheat flour (deflated by the non-grain wholesale price index).

(5) The relationship between the monthly average wholesale price of rice and average urban monthly per capita disposable income.

(6) Average urban monthly per capita disposable income (deflated by the index of urban consumer prices).

(7) A dummy variable for the October-January period (1 if within the period, otherwise 0).

(8) A dummy variable for the February-May period (1 if within the period, otherwise 0).

Dr. Moon's urban demand estimating equation for barley is comparable, except that the dummy variable periods are tied to barley harvesting patterns. Recently he has developed a preliminary urban demand equation for wheat also. The problems that may be encountered in applying Dr. Moon's equations in the KASS Model are discussed in Section IV. In any case, if Dr. Moon's model is used it will have to be properly interfaced with the many changes which have been made and are being made in the urban demand component of the KASS Model as described in the appendix to the agricultural Sector Analysis Report and the User's Manual.

If the period-by-period information on urban demand for rice, barley and wheat products needed for the GMP component instead is derived from Dr. Teigen's equilibrium price model, the approach will be quite different. Some problems will be avoided, but others may be encountered. Much work is yet to be done before everything in Dr. Teigen's equilibrium model falls neatly into place and can be documented accurately.

Regardless of the final approach used in the KASS Model, key models in the urban demand component which will be needed for the GMP component include those for (1) projected urban expenditures, (2) annual price and quantity determination for rice, barley and wheat products, and (3) seasonal demand responses. Each of these is discussed in a separate subjection.

Projected Urban Expenditures

The projected annual urban expenditures for rice, barley and wheat products under policy alternatives will be generated in the revised KASS Model. Refinements are being made in the population projection component, and presumably rural-urban migration will be addressed more explicitly. Through at least somewhat more effective interfacing with other sectors of the economy, more accurate projections of urban per capita incomes should be produced. Hopefully, too, more accurate and more complete price and income elasticities and cross elasticities for the major food grain products can be developed. All of these efforts should improve the accuracy of simulated annual urban expenditures for the individual products of concern in the GMP component.

Annual Price and Quantity Determination

As pointed out in KASS Issue Paper 5, a number of improvements have been made in the price determining mechanism of the KASS Model, and others are being developed. The changes are motivated in part by desire to have the model be able to address policy questions relative to tariff rates or quotas of either imports or exports of individual agricultural commodities. Certainly they should improve the accuracy of the mechanism to simulate urban demand and prices for rice barley and wheat products.

From the standpoint of the GMP component, a more refined breakdown of the major food grain products used by consumers in the KASS Model would be desirable. Examples with relatively high priority include IRRI-667 rice separate from other rice, separation of wheat products into at least bakery products, noodles, and "all other", and separation of brewing and fermenting demand from the direct demand for food. This kind of breakdown may have to remain on the list of "yet-to-do" for some time to come.

Seasonal Demand Response

The GMP component requires a mechanism to generate urban demand response to price change by 1/40-year period, and insure consistency with the annual quantities and average prices generated in the KASS Model. If Dr. Moon's equations are not used, an alternate mechanism will be needed. Forrest Gibson has given specific thought to this question, and has developed a series of integral equations to insure the necessary consistency. When the consistency condition is met, seasonal demands can be constructed in functional form as basis for simulating seasonal demand response to price changes. The Fortran statements to accomplish this have yet to be written, debugged, tested and tuned, however.

The present method of calculating consumer prices by adding a seasonally-constant marketing margin to the corresponding wholesale prices imposes some limitations. If the GMP component is developed by level in the marketing system, then separate seasonal prices may need to be developed by level also. It may be possible to do so even though the simulated annual prices in the KASS Model are "backed" to the consumer level and to the farm level from the wholesale prices.

VI. EVALUATION OF THE GOVERNMENT GRAIN MANAGEMENT SUBSECTOR MODEL

The Government grain management subsector model is the central focus in the GMP component in that it addresses directly the consequences and costs of alternative national grain policies and programs. The model is the most nearly developed and ready for testing of the subsector models. It is rather directly tied to government grain operations in Korea. It appears to be an accurate simulation addressed to many of the kinds of serious policy questions currently faced by the Government.

There are three automatic control mechanisms in the model. They are the market price controller, the stock level and import controller, and the marketing system capacity controller. All three operate in units of 1/40-year and reflect time lags in the marketing process wherever they are incurred in the Government grain operations. As pointed out in Section II, their capabilities are to address policy questions, not marketing and warehouse management questions as such.

In addition, the model contains a financing and accounting mechanism which simulates flows of income and expense and changes in level in the Government grain account. This too is of immediate concern in Korea; the drain on the Government grain account represents one of the major public expenditures in the Republic.

Market Price Control

This controller is designed to compare at 1/40-year intervals the targeted prices of rice, barley and wheat with existing market prices, and if serious

deviations are found, to generate corrective action through purchases, sales, import orders, etc. By showing the magnitudes of the adjustments required, it also will enable policy makers to assess the impacts and judge the workability of alternative price policies.

Most of the routines in the price controller mechanism are straightforward and should pose no problems in debugging and tuning. The exception is the formal price control routine itself, which controls on the "error" between the targeted and actual prices, the rate of change (derivative) of the error and the accumulation (integral) of the error over time. Furthermore, the weights given to each of these functions of the "error" include cross relationships with other grains as well as the direct effect for the grain in question. This latter feature is highly desirable, because if the parameters are properly specified, the routine will prescribe compensating buying or selling activity in the cross-commodity to cancel the effects of remedial action in the commodity under study. Empirical measurement and tuning of the coefficients needed for three functions and at least three commodities (rice, barley and wheat) will offer some problem, and may require some time and many experimental runs with the complete GMP component before the process is completed. The more commodities added (e.g., IRRI-667 rice, bakery products, noodles) the more difficult the job will be.

This is meant to be no criticism of the design of the price controller. It is merely to point out that all concerned must be aware of the time, effort and cost still remaining to make the controller fully operative for answers to the kinds of questions for which policy makers in Korea would like to have the answers now.

Stock Level and Import Control

The controller for stock levels and imports of Government grain works on the same design as the price controller, but it is much simpler because there are no cross-commodity coupling effects. The added delay mechanism for timing of import orders is based on the standard "DELDT" subroutine used throughout the KASS Model, and should require relatively little tuning effort.

One can raise the question of the need for targeted stock levels if the levels of controlled prices (and therefore the difference between controlled prices and simulated market prices) are targeted. The two are directly connected through the demand functions, so that the "desired" stock level for input to the stock level and import control routine can be generated internally as an endogenous variable. If stock levels are targeted separately, this linkage with the price controller would measure inconsistencies between the price targets and the stock level targets. This was discussed with Mr. Gibson, and it is believed that he will be able to revise the routine accordingly.

Another question relates to the desirability of designing for Government stock levels by position in the marketing system, and building in additional delay subroutines where needed (as say stocks located at country points for sales to impact consumer market prices in urban centers). The shorter the time interval in the model, the more important it is to simulate market position and delays in the model. At 1/40-year perhaps country point (farm, assembler, miller and shipper points) and consumer market point (wholesale and retail point) positions will be adequate. If this were done, separate average storage losses should be incorporated by market position as well.

Marketing System Capacity Control

The Government in Korea provides for the storage of controlled grains both in Government-owned warehouses and by purchasing warehousing services from approved warehousemen in the private industry. Related marketing services (Milling, dockside services, shipping, etc.) are obtained on a contract "custom service" basis from approved operators in the private industry. In the case of milling, contractors deal exclusively with Government-owned grain, and a separate group of private millers deal with free market grain.

The simulation model as documented in the July 1973 Status Report will be modified to reflect the way Government grain is handled in Korea. The capacity control mechanism as documented is fine for the Government-owned storage capacity. It prescribes the activities required to meet given plans for Government-owned capacity, the activities including the rates and timing for starting Government-owned warehouse construction. If such capacity is desired at country points (none exists at the present time) provisions could be made for identifying the Government-owned capacity by position.

Relatively little delay is involved in obtaining the use of approved private storage, milling and other marketing service capacity once the capacity exists in the industry. From the Government side, perhaps a simple delay subroutine is desirable to reflect time required to commit the service, although such delay may never exceed 1/40-year, and be unnecessary. The construction of capacity by the private industry to serve the Government probably can be handled best in the marketing system capacity response mechanism for the private grain marketing industry, rather than in the Government Model. Doing so also will avoid complications in the financing and accounting routine for the Government grain operation.

Financing and Accounting

The financing and accounting routine for the Government grain operation parallels the policy control mechanisms for storage stocks and imports and for Government warehouse construction. Revenues are computed from sales of Government stocks and the established selling prices. Costs of sales are computed from acquisitions (domestic plus import) at the appropriate buying prices, with adjustments for cash flows on imports acquired on delayed settlement basis. Operating fixed and variable operating costs are accumulated and net revenues calculated. Warehouse construction costs and cash flows are calculated, and everything is accumulated in the Government grain balance account.

Few changes are needed in the routine as documented in the July 1973 Status Report. The various costs for marketing services obtained from the private industry will be refined to reflect the actual services obtained and the standard service fees paid by the Government. Most of these are fee schedules rather than flat rates, reflecting the class of warehouse, position in the marketing system, etc. The standard skrinkage rates allowed by the Government will be incorporated in the loss factors. Separations will be made for whole grain storage and milled grain storage so that the volumes and fees for each will be compatable, and so that volumes and costs can be reduced to a common denominator, say milled rice equivalent. When these "real world" factors have been incorporated, the accounting and financing submodel for the Government grain operations should produce accurate results.

VII. EVALUATION OF THE PRIVATE MARKET SUBSECTOR MODEL

The private market subsector model of the GMP component in the KASS Model is intended to simulate the time, place and form utility pipeline between marketed farm production of the three grains and the final urban purchases of the products from these grains. The model is linked to the Government grain marketing subsector model so that when Government is active in grain operations a portion of the marketings are diverted from the private channels at Government purchasing prices, moved through the Government channels and later released into the private market channels (at the retail level) at announced Government sales prices. When the Government is not active, the entire off-farm marketings flow into and through the private channels.

The model is being modified considerably from the form described in the July 1973 Status Report to more nearly reflect the reality of the private grain marketing system in Korea. As outlined in Section II, the model includes separate routines for simulating (1) marketing functions in the private subsectors, (2) levels of privately-owned grain stocks, (3) stocks and rates of flow in the marketing system, (4) marketing system capacity responses and (5) handling, storage and milling of imported wheat. The subsector is modelled to be responsive to price changes as they relate to costs and profit opportunities. If the prices are properly controlled by the Government grain marketing program, the model will reflect the motivation of the private sector to take over much of the task of storage, milling and marketing now moving through the Government subsector. Likewise, if the prices are improperly controlled, the model will reflect the adverse effects and disinvestment in the

private marketing subsector. The model also will do the accounting for the private subsector probably including the investment in facilities for providing milling, storage and other services for the Government subsector on a custom for-hire basis.

Marketing Functions in the Private Subsector

This routine in the model is designed to simulate the private subsector market channels, the flows of grain and grain products through these channels and the grain inventories in the channels needed to support normal operation of the subsector. The basic mechanisms of the routine are described in the July 1973 Status Report; however, they are being expanded to reflect more accurately the operation of the private marketing subsector in Korea. They will reflect the typical operating patterns for each of the key marketing functions, including assembly, milling, shipping and wholesaling and retailing.

Because there are substantial differences in the organization and operation of the private marketing subsector among the three regions included in the KASS Model, separate simulations by region would be highly desirable. In most of the northern region serving Seoul and Incheon, the millers operate strictly on a custom basis for farmers, and do not take title to the grain (see Section II). Shippers buy the milled grain from farmers and maintain relatively low inventories. In the central region the millers do take title to the grain and hold substantial inventories of the whole grain to support their milling and merchandising (shipping) operations. In the southern region, both types of organization prevail in the private marketing industry. If the model is operated by region, a mechanism will be needed to reflect at least the dominant one-way flows between regions (particularly to the northern region from

the central region) as well as the vertical flows from assembler to retailer within regions.

Care must be exercised to be sure that all flows, levels, capacities, unit costs, prices, etc. in the simulation are converted to a common denominator such as milled grain equivalent. Farmers and millers store the whole grain primarily. Shippers, wholesalers and retailers deal with the milled grain. The inter-regional and other long distance shipments move in the milled grain form.

Levels of Privately-Owned Grain Stocks

This routine is designed to simulate a rational profit-motivated grain inventory management pattern during feasible storage periods (when the positive change in price during storage exceeds average total variable costs of storage). Greater profits can be realized on privately-owned stocks which are held for longer times during these feasible periods. Therefore the objective of the storer operating under this rationale is to accumulate inventories as early as possible during the feasible periods and manage them in such a way that the inventory level at the end of the feasible storage period is at the minimum for continuing his business activities (milling, merchandising, etc.).

If storage capacity is less than the inventory level that would be accumulated following this logic, then the grain holdings, storage earnings and net income forgone are calculated by period and accumulated for the year. The forgone net income is compared to the incremental investment cost for new facilities to determine feasible conditions for expansion of private grain storage capacity. From this information, long-run growth characteristics of private storage capacity are simulated on the basis of exponential growth rates as a function of forgone net storage

income (with exponential smoothing of year-to-year variations).

The logic of the model is sound and the design is imaginative. There is no reason to believe that it will not simulate accurately the storage behavior of privately-owned grain stocks over and above those held to support the normal marketing functions such as milling and merchandising operations, and within the limits needed for sales to maintain financial cash flows for the operator. Both limits can be built into the model.

In order to be realistic, the subroutine should be able to deal separately with stocks held on farms, at country points, at consumer market points and by consumers. The same logic will work at all levels, so that the same routine can be used. Unfortunately, Korea does not maintain time-series statistics on grain stocks by position. Base information for the model must be developed from the unpublished records of the millers and handlers associations, NACF, Korean Express Company, etc., and perhaps in part by survey. At least until the needed statistics by position can be developed, it may be necessary to build a series of self-balancing checks into the model to insure orderly simulation of stock levels by position and the flows through the system from one level to the next.

Practically all of the whole and polished grain moving through the private sector is handled in bags. Therefore, the size of individual bins is not a factor in limiting the number and amount of different grains and different qualities held in inventory to fill the capacity at a given time; this factor can be ignored in the simulation. If total capacity becomes a limiting factor in actual application of the model, it may be desirable to build in a mechanism to establish a priority of claim among the grains for this capacity.

Marketing System Capacity Response

The marketing system capacity response mechanism in the private subsector model has yet to be developed at this writing. Presumably it will follow the logic of the capacity response mechanism for holding privately-owned grain stocks, discussed above. It will need to operate separately for the different marketing functions or levels in the private marketing subsector. For the rice and barley millers, it will need to reflect responses in both milling capacity and storage capacity. Storage capacity responses may be adequate for the shipping, wholesaling and retailing functions. However, transport capacity response could be important for the shipping function.

As pointed out in Section VI, the private capacity response mechanism seems to be the appropriate location within the total GMP component to reflect also the capacity response of privately-owned facilities used to support the Government grain marketing component. This includes the NACF (and any other) storage capacities which are performing the assembly function for the Government purchases. It includes the milling capacity and storage capacity of the private rice mills and barley mills licensed to deal exclusively with the Government-owned grain. It includes the appropriate portion of the capacity of the Korean Express Company and other privately-owned public warehouse companies used for wholesale storage of the Government grain. It includes the storage capacity of the retailers licensed to handle the Government grain. It includes the privately-owned milling and storage capacities used exclusively for the polishing and handling of imported rice and the milling and handling of imported barley (all of which are under Government control in Korea).

Milling and Handling of Imported Wheat

As outlined in Section II, the importation of wheat together with the port handling, milling, storage and product distribution to the bakers, noodle manufacturers, feed manufacturers and other outlets is handled by Korean private industry under close Government control. A separate routine has been developed to simulate this operation, and is ready for debugging and tuning. Subroutines are used to reflect the various functions performed by the Korean Flour Millers Industrial Association and its members from the placing of import orders to the distribution of wheat flour and millfeed. The Association maintains good records, so that the subroutines could be designed and the needed coefficients selected to reflect actual operations accurately. The entire simulation was discussed in detail with KOFMIA officials during Dr. Phillips' visit, and is believed to be an accurate reflection of the real world of imported wheat milling in Korea.

The model needs to be expanded to simulate the movement of wheat flour into the bakery and noodle industries, and into other outlets, and the movement of the products of these industries into final consumption. Practically nothing has been published on the channels, margins, capacities, flows and inventory patterns for these industries in Korea, nor on the price, cross-price and income elasticities of demand for the individual products. It may be possible to obtain some information from the bakery and noodle manufacturers association, but it is probable that these dimensions cannot be reflected accurately in the model until detailed research studies can be made of the industries involved.

As with the other routines in the private marketing subsector model, the imported wheat milling routine contains subroutines for accounting and

and financing for the industry. These are straight-forward and should cause no problems in final debugging.

VIII. EVALUATION OF THE SEASONAL PRICING AND TRANSACTION MECHANISM

The purposes of this routine in the total GMP component are to establish the needed price linkages among the subsector models and to provide a rationale for transactions within the component. The market prices of the food grains internalized within the component (and the total KASS Model) cause responses in the behavioral patterns of each subsector of the GMP component, and the behavorial patterns of the subsectors cause responses in market prices. The transaction subroutine provides an internal logic for governing transactions among the subsectors within the component.

The basic concept of the seasonal pricing and transaction mechanisms is outlined on pages 48-57 of the July 1973 Status Report. However, the mechanism is being modified and expanded from the version described to reflect the complexities arising from disaggregation by position in the market and the inclusion of wheat and wheat products in the model. Yet to be determined is a workable alternative to the use of wholesale prices throughout the mechanism and the "backing into" the retail, farm and intermediate prices with standard marketing margins.

Seasonal Pricing

The pricing dynamics in the seasonal pricing routine are simulated by generating prices as a function of excess demand by 1/40-year time interval, following the parallel logic of the annual price equations in the overall KASS Model. The excess demands are computed as total demand minus total net marketings by subsector. These variables are added across

subsectors of the GMP component in the price equation. The net marketings by subsector are computed in the transaction subroutine. It is probable that with modification, net marketings by position within the private marketing sector can be computed in similar fashion and then included in the pricing mechanism.

Problems may be encountered in tuning the pricing mechanism, especially when it is expanded to include more of the food grain products and different positions in the marketing system. Interdependencies among the products and among the positions will make the pricing mechanism considerably more complex. It is hoped that the tuning problems will not become insurmountable, and that it will not be necessary to develop an alternative concept for the pricing mechanism.

The transaction mechanism is based on the realistic assumption that once a certain amount of grain is marketed it will remain on the market until purchased (e.g., that marketing is not a reversible process). When the volume marketed exceeds the volume demanded for a time period, the residuals accumulate on the market and are added to marketings of subsequent periods to obtain the total "net" marketings for each subsector (and perhaps for each position within the private marketing subsector). After the excess demands within each segment are determined, a logic is provided to permit secondary transactions between segments within the time period if excess marketing in one can be used to satisify part or all of the excess demand in other segments. Excess urban demand (and therefore upward pressure on price) exists for the time period only if it still remains after the feasible secondary transactions are considered.

Choices and Transaction Mechanisms

Provision is made in the transaction mechanism for reflecting factors other than price in farmers' decisions to sell to the Government or to the private sector, and for factors other than price which may enter into consumers' choices between Government-controlled grain products and free market grain products. With respect to the farmer's choice of sales outlets, factors which should be included to reflect current conditions include: (1) the particular 1/40-year periods when the Government purchasing program is operative (see Section II), (2) the reluctance of farmers to sell to the Government at equal prices, because of the red tape involved, the feeling that Government grading penalizes farmers (grading is done for Government purchases, but not for free market purchases) and (3) that qualities which do not meet Government standards will not be purchased at any price. In the case of consumers decisions as to choices of outlets for purchases, current factors which should be included are: (1) the discounting for the forced blends of IRRI-667 and domestic rices and the forced blends of rice and barley at the Government outlets and (2) the limited number of licensed retailers handling Government grain; therefore, the greater average distance and inconvenience to get to a Government outlet facing most consumers.

Examples of additional factors that might be considered in simulating the impacts of alternative policies later on when the GMP component is operative, include: (1) Government restrictions on farmer sales to private channels and/or consumer purchases from private outlets, (2) conditions with which the producer must comply in order to sell through Government channels, (3) hidden "taxes" involved in sales to and/or purchases from Government channels versus private channels, (4) issuance of food

stamps or other devices for poor persons or other classes of consumers which are good only at Government outlets, and (5) consumer rationing programs which are applied differently to purchases from Government outlets and purchases from private outlets. These are only examples. There are many possible Government controls other than price that could be simulated and the probable imports measured through this feature of the program.

The feature is not located in the total GMP component in a way to effectively reflect the impact of non-price Government programs to modify producers' total sales through all outlets nor consumers' total purchases from all outlets. If such options are needed, they should be reflected in the producer subsector model and the urban consumer subsector model, respectively.

IX. SUMMARY OF SUGGESTED REFINEMENTS IN THE GMP COMPONENT

The suggested refinements in the grain management program simulation component summarized in the present section are viewed by the authors as relatively high-priority items. It is hoped that most of them can be incorporated into a fully-operative version of the component by December of 1974. They are not intended to increase the basic capabilities of the component, but rather to make it more effective for addressing the kind of policy issues for which it is designed. The evaluators' suggestions for adding to the scope of capabilities of the GMP component are included in Section XI of the report.

Most of the suggestions summarized here are included in the above sections dealing with the specific subsector models in the GMP component. Most if not all were discussed with Forrest Gibson in Korea; many may have been incorporated into the models making up the component by the time this report is available. In a sense the more nearly redundant this section of the report, the more successful will have been the in-process evaluation of the MSU project effort in developing the component.

The recommended changes in the GMP component simulation models include those for effective disaggregation and those to facilitate tuning the component to conditions in Korea.

Recommended Disaggregation

Three kinds of disaggregation are recommended within the GMP component models. They are: (1) disaggregation of the food grains into key products, (2) disaggregation of the Government and the private marketing

subsectors by major position (or function) in the marketing system and (3) disaggregation by the three regions included in the KASS Model.

A. Product disaggregation

It is recommended that the three food grains be disaggregated into clearly distinguished consumer products of these grains:

-- That rice be separated into (1) IRRI-667 rice, and (2) all other rice.

-- That wheat or wheat flour be separated into (1) bread and other bakery products, (2) noodles and (3) other products.

Although there are differences between naked barley and ordinary barley, and, on the consumer product side, between polished barley and pressed barley, these differences are believed to be less significant, and barley disaggregation in the models is not recommended at this time.

The reviewers recognize that rice is not separated in the overall KASS Model, and that separation of IRRI-667 will have to be made in all four subsector models of the GMP component (see the diagram in Section II). Nonetheless, it is believed that the unique characteristics of IRRI-667 in the production subsector, in the milling and marketing subsectors, and in the urban demand subsector make the distinction essential if the GMP component is to serve its intended purposes effectively.

The recommended breakdown for wheat involves only the separation into the key products of wheat, and consequently, only the private marketing subsector model and the urban demand subsector model of the GMP component. Noodles and bakery products have quite different demand functions, including different cross price elasticites with rice and barley. These products plus an "all other" category need to be separated and converted back to the wheat flour or wheat equivalent if the component is to be able to address the key issues facing food grain policy makers in Korea.

B. Disaggregation by market position

The reviewers believe that the private marketing subsector model and the Government marketing subsector models in the GMP component must deal separately with flows, levels, prices, unit costs, capacities, etc. by the key positions in the marketing system if the component is to be a useful planning tool to policy makers. The key positions which need to be distinguished are farm level, country point (milling and shipping) level, consumer point (wholesale and retail level) and consumer household level. The coefficients appropriate for most of the variables used in the models are significantly different from one of these levels to another in the marketing system.

C. Disaggregation by region

Disaggregation by the three general regions of the Republic included in the overall KASS Model is particularly useful because of the different rice-barley production patterns and the functions performed by the millers of these crops among the regions. It is believed that the same structural models within the GMP component are applicable in all regions--that only the coefficients appropriate to each region need be applied to regionalize the component. Regional disaggregation should insure more accurate simulation for the Republic as a whole as well as provide regional simulations matching those of other components of the KASS Model.

Recommendations to Facilitate Tuning of the Component

A number of fairly specific changes in the GMP component models are recommended to facilitate tuning of the component to fit conditions in Korea and improve the acceptability and usefulness of the simulator to the planners and policy makers who will be using it.

A. Non-food uses in the production sector

Rather than the catch all "production" deflater to adjust reported production to reported consumption (after reflecting imports) it is recommended that on-farm non-food uses of rice, barley and wheat be reflected in the demand routine for the production subsector. Examples of major non-food uses in Korea include seed, home brewing and on-farm feeding to poultry and livestock.

B. Off-farm sales

Rather than handle simulated period-by-period off-farm sales in the production subsector model, it is recommended that production, harvesting and farm demand be handled in this model and that the marketing patterns be generated from the seasonal stocks subroutine of the private marketing subsector model.

C. Urban demand

Regardless of the final procedure used to simulate seasonal urban demand, it is believed that a more effective linkage to the non-agricultural sectors is needed in the KASS Model if the GMP component is to be fully effective. This is even more true if seasonal purchasing (and storage) patterns by urban consumers are to be simulated in the private marketing subsector stock-levels subroutine and reflected in seasonal urban demand patterns--a procedure which the evaluators agree is essential for an accurate simulation of grain storage patterns in Korea.

D. Prices by market position

It is recommended that price and price responses be simulated by position (farm, country point, wholesale/retail, consumer) rather than be backed-off at average marketing margins from the simulated wholesale price. It is believed that the implicit assumptions of (1) demand co-

efficients at all positions tied to the wholesale prices rather than the relevant market prices and (2) seasonal constant marketing margins between all positions cover up much of what may be of direct interest in the simulation models.

E. Government stock targets

Given the market demand functions (which are used consistently throughout the GMP component as the driving mechanism), stock targets (inflows, levels, outflows) are given by price targets. Separate Government targets for prices and stocks are inconsistent by definition. Furthermore, the simulator will be more direct and powerful if stock targets are generated by the model and then compared to current stock levels in order to produce the signals for remedial policy action.

F. Storage capacity subroutine for Government "leased" facilities

Since the Korean Government does not lease privately-owned storage and other marketing and processing facilities, but rather hires the services of the private firms on a "job" basis, the capacity adjustment subroutine in the private subsector model is the appropriate one for the non-Government-owned facilities used for handling Government grain.

G. Careful conversion to common denominator

Grain is handled part way through the Government and private marketing systems as whole unmilled grain. Capacities, unit costs, unit margins, etc. up to the milling points are based on the whole grain. From the milling point forward the grain is handled as milled grain. The variables and coefficients will have to be converted carefully to a common denominator (probably polished rice, pressed barley and wheat flour equivalents) before the GMP component models can be tuned accurately. Policy alternatives which would affect milling rates--say low cost public

loans to private mills for rubber-roller hullers--would change the conversions in the simulation. For this reason the conversion factors to a common denominator may need to be read in as data rather than written into the Fortran equations.

H. Capacity response mechanism

The needed refinements in the capacity response mechanism of the private marketing subsector model include the addition of milling capacity along with storage capacity responses. Transport or shipping capacity responses may be needed also.

Policy-makers in Korea also are much concerned with the quality of existing milling, storage and handling facilities. Perhaps the mechanism can be made to reflect responses in capacity at least by recognized classes in Korea such as Class I, Class II and Class III warehouses, type of rice milling equipment, etc.

1. Non-price factors in marketing choices

As designed, the price response and transaction mechanism of the GMP component has the capability to reflect factors other than price in farmers' choice of sales outlets and consumers choice of procurement sources between Government channels and private channels. It is recommended that this feature be activated to reflect the factors causing both farmers and consumers to discount the Government channels when prices are equal. Similar features would be desirable in the response mechanisms for the farm subsector and urban demand subsector models. This would give the GMP component the ability to reflect non-price factors in farmers' decisions of how much to sell and consumers decisions of how much to purchase, independent of the choice of channels.

J. Feed grains

Corn, grain sorghum and other feed grains are not included explicitly in the GMP component models at present. It is believed that it is not necessary for them to be included until the livestock component is developed and interfaced with the GMP component. In the meantime the important thing is for the GMP component to reflect the proper portion of rice, barley and wheat milling and brewing by-products which move into livestock feeds, and the amount of whole barley and other food grains which are fed directly on the farm.

X. NEEDS AND PLANS FOR EFFECTIVE UTILIZATION OF THE COMPONENT IN KOREA

Because the GMP component even in preliminary form is not expected to be operative until about July 1, appraisal of the utilization of the component in Korea has to be based on the anticipated needs and plans. The potential users of the component are the planners concerned with national policies for the production, importation, marketing and utilization of food grains in Korea. The agencies directly responsible include the Ministry of Agriculture and Forestry, the Economic Planning Board and the planning staff of the President's Office. These people are aware that the simulation models are being developed and approximately when they can expect them to be operative, but have had no chance to develop familarity with the component and what it can do. This will come with seeing the models tried and judging the results.

The direct avenues to the key people who are responsible for national food grain policies are the top people in the planning sections of the Ministry Bureaus involved, including the Food Management Bureau of MAF and the planning divisions of EPB which are directly concerned with food policy. Some of these people have more familarity with the GMP component and are anxious for it to become operative.

Within these official planning groups in MAF and EPB are technically trained planners who can be expected to be the direct liaison with the National Agricultural Economics Research Institute for application of the GMP component models. Comparable potential liaison people have been designated or will need to be developed in other agencies, including

research and planning organizations such as the Korean Development Institute, the universities, Korean Express Company and other warehousing organizations, and the associations of grain millers and handlers serving both the Government channels and private channels. These people need to be fairly familiar with the GMP component and how to use it to simulate the consequences of alternative management policies for food grains in Korea.

Finally, the staff of Dr. Kim, Dong Hi in the National Agricultural Economics Research Institute must become thoroughly familiar with the simulation models and how they operate. They need to be able to follow the user's manual which will be developed for the component in order to use it to set up and simulate the consequences of many possible combinations of alternative national grains policies. Eventually, the Korean staff needs to have competence to modify the models as needed to improve and expand the capacity of the component to address critical national grain policy issues.

The setting in Korea for the potential utilization of the GMP component as seen by the authors has been summarized in Section IV. This setting is drawn upon to indicate the steps needed to achieve effective utilization of the component.

Developing Staff Competence at NAERI

Sufficient staff competence for using the GMP component simulation models effectively does not exist in NAERI at the present time. The training program for key staff personnel is underway at Michigan State University, but the number of trained senior people who have been rotated back has not yet been sufficient to make a major impact. A number of staff training seminars have been conducted by contractor personnel at

NAERI, but a series of specific seminars on the subsector models of the GMP component will be needed when the component has been developed, debugged and tuned for use. The push to date has been to finish the conceptualization and development of the component, and there has been little time nor opportunity to involve Korean counterparts heavily in this process. A concentrated effort will be required to get them involved and trained once the preliminary version of the GMP component of the KASS Model is operative.

Liaison With Technical Planning Groups

It is none too soon to start building and strengthening liaison relationships at the technical level with the key planning groups in Korea. Project staff members are aware of this need, and some accomplishments have been made in this direction. A liaison officer for the Food Management Bureau of MAF has been named officially, but not much liaison has been accomplished. The occasion of the evaluators' visit to Korea was used help move toward strengthing this relationship. In other agencies, including the Grain Management Bureau of MAF, the occasion of the visit was used to request that an officer for liaison with NAERI be named. Some of the visits to agencies and organizations outside MAF were used to open doors for moving toward the building liaison at the technical level with these organizations and agencies.

Perhaps it is unrealistic to expect that effective liaison can be built at the technical level until the GMP component is operative. Technical planners are interested in the conceptualization of the simulation and in its potential applications, but they are busy people with many other responsibilities. It is only when the component is ready as a work-

ing tool to help them discharge some of their assigned responsibilities that they are likely to give priority to building effective liaison with those directly involved with the component. Even then, however, conscious effort by Dr. Kim and his staff must be directed to building the liaison, for it will not come automatically.

Liaison with Planning Directors

Effort also must be directed toward strengthing relationships with planning directors in MAF and EPB and with others in direct position to convince policy makers of the value of the GMP component as a simulation tool for the kinds of questions to which it can be addressed effectively. Most of these people are viewing the component with a mildly-interested wait-and-see attitude.

Through the years Dr. Kim, Dong Hi has developed and maintained an effective working relationship with people at this level. His leadership will be even more important in the months ahead, but it will not be enough. His subordinates, particularly those directly involved with the simulation models, will need to cultivate the respect of and contacts with those who serve as the link between the technical people (who will understand the simulation models) and the policy makers who are the potential final users of the GMP component.

Role of the Food Grain Policy Makers

Those responsible for food grain policies in Korea are anxious to have improved analytical planning tools. Unlike those in some countries who are inclined to say "don't confuse me with the facts, I have important decisions to make," the top officials in Korea expect planning staffs to conduct sound analysis using the best analytical tools available. Of

course, they will not accept the results simulated by the GMP component on faith, but once its power has been demonstrated and tried by actual policies based on the simulated outcome, they will push for greater use of the component. The danger may be in their wanting to push too fast for the necessary staff competence to be developed at all levels needed for effective use of the grain management program component of the KASS Model in Korea. This is the more likely to be true because of the serious and complex grain policy issues now faced by Korea (see Section III).

XI. POSSIBLE LATER ADDITIONS TO THE GMP COMPONENT

The suggestions described in Section IX are intended to improve performance of the GMP component for addressing the kinds of questions for which it is presently designed. Those presented here represent possible avenues for expanding the scope of the component and the kinds of questions which could be addressed.

A list of examples of the kinds of policy questions for which the component is not now designed to address has been presented at the end of Section I. After the component as now designed is operative and has been fully tested, additions could be made so that it would be able to address these kinds of questions. The types of additions which are believed to have potential priority for use in Korea are indicated in the subsections below.

Optimizing Routines

If optimizing routines appropriate to the dynamics of the GMP component were added, the component could be made to address questions related to lowering total average costs, reducing total storage losses, improving geographic distribution patterns, etc. which the present version must take as given. In short, it could address questions of efficiency within the marketing system. Specific examples include the following:

1. What would be the aggregrate net benefits, positive or negative, of policies to stimulate only rice hulling at country shipping points and polishing at urban consumption centers? With and without conversion of the handling system for whole grain and brown rice from bags to bulk?

2. What would be the net benefits of sets of policies to hasten the adoption of Class I storage structures for grain?
3. What would be the impacts on the total marketing system of implementing specific marketing investment projects which are economically feasible viewed by themselves?

Input-Output Routines

If input-output routines were developed to: (1) tie agriculture to other sectors of the economy, (2) disaggregrate the agriculture sector into key subsectors, and (3) disaggregrate the marketing system into functional components, the KASS Model and the GMP component models would be more powerful. This would give the GMP models the capability of tracing the impacts of actions in one segment (say rice milling) through the entire system. It would enable them to simulate the incidence of the impacts generated by alternative sets of grain policies to achieve specific goals. It would permit the KASS Model to predict and trace the time path of development associated with alternative development strategies and policies.

Marketing System-Transportation Network Routine

If the geographic dimension were added to the GMP component, it would have the power to address marketing and storage management questions--the kinds of questions of direct concern to the Grain Management Bureau of MAF, for example. It would deal with questions of location and sizing of storage and other marketing facilities, the movements into and out of stocks and stock levels by location, shipment patterns, and so on. In short, it would add the space dimension to the time dimension now in the GMP component. With this dimension, additional policy

issues could be addressed also, including such questions as the impacts of geographic differences in price supports and/or price controls, and the impacts of road, railroad, port and other specific improvements in the transportation network.

Further Disaggregation

There are a number of kinds of further disaggregation within the present structure of the GMP component which also should be viewed as promising directions for future development. Additional grains and grain products, additional functional positions in the marketing system, and additional geographic areas are examples.

XII. POTENTIAL APPLICATIONS IN OTHER COUNTRIES

Since the application of the GMP component of the KASS Model as a tool for planning effective food grain policies in Korea will not be known for perhaps another six months, the judgment of the potentials for similar models in other countries gets one pretty well up into the area of blue sky. The judgment must be based on the degree of generality of the logic in the models, the requirements for reliable coefficients, the requirements for technical competence in using simulation models, the willingness of policy makers to make use of such tools, etc. which may or may not fit conditions in other countries.

Structure of the Component Models

The GMP component is addressed to the kinds of food grain policy questions which represent real and nearly overwhelming issues in many developing countries in the world. The basic structuring of the models and the subroutines used are not unique to Korea, and could be adopted for other countries in which relative prices are motivators without great difficulty. From these points of view, the component has the potential for general application. If it were not used as a component of a bigger simulation model, then the farm production subsector and the urban demand subsector models in the GMP component would have to be self-contained, with proper interfacing to other subsectors of agriculture and other sectors of the economy.

Input Requirements

The requirements for coefficients as input to the GMP component are not large in total number, but they are exacting if the component is to be tuned to the conditions in the country it represents. The more complete the component is made, the greater the problem of meeting the input requirements. Perhaps the needed input would be easier to develop for some countries than is the case in Korea. In other countries, it is probable that a substantial amount of research would have to be done in order to develop realistic coefficients needed for application of the models.

Trained Personnel

As pointed out in Section III, the requirements for trained personnel at all levels is an important dimension of the utilization which can be made of simulation models such as the GMP component in a country. The investment in the model development is such that this approach is hard to justify if used only once, say to develop a five-year development plan, and then abandoned. The tool should be utilized for more effective planning of food policies on a year-to-year and month-to-month basis. This means that the availability of trained personnel, and the training requirements to develop them, must be considered on a country-by-country basis.

Attitudes of Policy Makers

There are a number of dimensions to the attitudes of policy makers which affect the probable usefulness of simulation models such as the GMP component in a given country. Without the proper attitude and administrative support at the National level, a country is not likely to make

effective use of simulation models specifically addressed to the consequences of alternative food grain management policies and programs.

Recommended Next Steps

In order to reduce the uncertainties concerning potential application of the simulation model approach to agricultural planning and food grain policies, the evaluators recommend that priority be given to the complete development and application of the GMP component of the KASS Model in Korea. Until this is done, and the applications determined and the achievements measured, no one can be sure of the potential applications.

This recommendation of priority is also supported by the authors' interpretation of the needs and opportunities in Korea (see Section III). We believe it would be a serious mistake to do other than move full steam ahead on development, debugging, tuning and applying the models. We estimate that the GMP models could be fully operative in preliminary or semi-preliminary form by December of 1974; with project input at present levels, we estimate that it will take another year to develop the models and their utilization to the full potential expected by those responsible for food grain policies in Korea.

APPENDIX

Letter of Introduction

Korea Itinerary

KOREAN AGRICULTURAL SECTOR SIMULATION PROJECT

한국 농업쎅타 씨뮤레이숀사업

NATIONAL AGRICULTURAL ECONOMICS
RESEARCH INSTITUTE
REPUBLIC OF KOREA
대한민국, 국립농업경제연구소

DEPARTMENT OF AGRICULTURAL ECONOMICS
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18 February 1974

TO:

FROM: KASS Team: Dr. Kim, Dong Hi, Director, NAERI
Dr. Tom Carroll, Acting Field Project Leader
Dr. G. E. Rossmiller, Director, MSU
Agricultural Sector Analysis and
Simulation Project

SUBJECT: USAID/W evaluation of the Michigan State University Agricultural Sector Analysis and Simulation Project

During January and February, AID/W is evaluating the progress and accomplishments of the Agricultural Sector Analysis and Simulation Project at Michigan State University, a major part of which is the Korean Agricultural Sector Study (KASS). In total, five professional agricultural economists and systems scientists will come to Korea to evaluate different aspects of KASS. The overall evaluation is designed to assess the advantages and disadvantages of the system simulation approach as an operational approach to agricultural sector analysis and to determine what additional work is needed to improve the approach. It will clarify AID's objectives and opportunities for further applications of the approach in countries other than Korea. Equally as important, it will help AID determine the extent to which they will further support the work of the KASS team in Korea over the next two to three years.

During the last two weeks of February, Dr. Richard Phillips, Economist with the Food and Feed Grain Institute at Kansas State University, is visiting Korea to evaluate the grain management component of the KASS model. Dr. Phillips has been in Korea a number of times working with USAID, MAF, EPB, and MCC on development of analytical techniques for planning and project evaluation. He is drawing on experience with grain marketing and grain management programs in other countries of Southeast Asia and around the world in his review of the KASS grain management models and their potential applications for public and private grain operations in Korea.

We appreciate your taking time to meet Dr. Phillips and discuss these topics with him.

KOREA ITINERARY
for
Dr. Richard Phillips
KASS/GMP Component Evaluation

14 Feb. 74 (Thursday)

1240	Arrive Kimpo Airport (NW Flight #21) Greeted By Forrest Gibson
1330	Check in Residence Hall South Post - Rm. #212
1430 - 1500	Meeting with Francis Jones, USAID/KDB
1500 - 1700	General briefing and discussion of GMP with Forrest Gibson
1800	Dinner at Naija Hotel with John Craig

15 Feb. 74 (Friday)

0755	Leave Residence Hall for Chancery
0830 - 1230	Briefing and discussion on KASS/GMP component with Forrest Gibson
1230 - 1300	Lunch at Chancery
1300 - 1400	Continue briefing on KASS/GMP
1430 - 1540	Dr. Hoon, Pal Yong, KDI
1630 - 1700	Courtesy Call on M.H.B.Adler Attending: Phillips, Craig, Carroll, Jones
1730	Leave Chancery for Residence Hall

18 Feb. 74 (Monday)

0755	Leave Residence Hall for NAERI
0830 - 1015	Continue briefing and discussion KASS/GMP component Introduced to NAERI team members
1015 - 1130	Dr. Chyun, Soon Pyo, Chief KASS Division, NAERI
1200 - 1300	Lunch with Dr. Chyun and Mr. Gibson
1310 - 1400	Dr. Kim, Dong Hi, Director, NAERI
1400 - 1520	Formulate interview plans for week Mr. Lee, Sang Won to coordinate appointments
1520	Leave NAERI for South Post

19 Feb. 74 (Tuesday)

0810	Leave Residence Hall for Chancery
1030 - 1200	Interview at AFDC Mr. Lee, Sang Ho, Manager, Planning Dept. Mr. Koo, Chun Sur, Perishable Products Dept.
1215 - 1315	Lunch at Naija Hotel
1400 - 1600	Interview at NACF (accompanied by Dr. Kim, Young Bok, USAID/RDD) Mr. Choi, Byung Hwang, Manager, Research Dept. Mr. Suh, Won Ho, Senior Researcher, Marketing Research Section
1700	Leave Chancery for South Post

20 Feb. 74 (Wednesday)

0755	Leave Residence Hall for NAERI
1015 - 1230	Interviews at MAF (accompanied by Dr. Chyun, Soon Pyo and Mr. Lee, Sang Won, KASS/NAERI)
(1015 - 1130)	Mr. Son, Jong Ho Agriculture Planning Officer
(1130 - 1230)	Mr. Moon, Sae Keun, Chief Mr. Won, Kwang Sik Planning Division, Food Bureau
1230 - 1330	Lunch at Chancery
1400 - 1615	Interviews at MAF, Grain Management Bureau (accompanied by Dr. Chyun, Soon Pyo and Mr. Lee, Sang Won, KASS/NAERI) Mr. Suh, Won Chong, Administrator Mr. Shin, Hong Kyun, Chief Management Division Mr. Chin, Sook Hyon, Chief Storage Division

21 Feb. 74 (Thursday)

0755	Leave Residence Hall for NAERI
1100 - 1220	Interview at Korean Grain Association (accompanied by Mr. Lee, Sang Won) Mr. Lee, Sang, Cho, Managing Director Mr. Suh, Bong Sub, Chief, Management Section

21 Feb. 74 (Thursday)(cont.)

1230 - 1340	Lunch with Mr. Lee, Sang Cho and Mr. Suh, Bong Sub
1350 - 1615	Interview at NACF (accompanied by Mr. Lee, Sang Won)
	Mr. Kim, Seong Ki, Deputy Chief Grain Section Mr. Choi, Dong Myung
	Mr. Suh, Won Ho, Senior Researcher Marketing Research Section
1615	Return to Chancery
1710	Leave Chancery for Residence Hall

22 Feb. 74 (Friday)

0755	Leave Residence Hall for Chancery
0820 - 0900	Meeting with Robert Morrow, USAID/W
1100 - 1230	Interview at KOFMIA Mr. Kim, Nam Suk, Chief Planning Section
1240 - 1315	Lunch at Chancery
1330 - 1530	Interview at Korea Express Company (accompanied by Mr. Lee, Sang Won)
	Mr. Kwon. Tae Hong, Managing Director Mr. Han, Dong Hee, Deputy Manager International Trade Section Mr. Nam, Dae Teak, Deputy Manager Management for Government Section
1540 - 1630	Interview at Korea Feed Association (accompanied by Mr. Lee, Sang Won)
	Mr. You, Yun Su, Chairman Mr. Cho, Hong Lae, Chief Planning Section Mr. Kwon, Hong Kee, Deputy Chief Planning Section
1630	Return to Chancery
1710	Leave Chancery for Residence Hall

23 Feb. 74 (Saturday)

0755	Leave Residence Hall

23 Feb. 74. Saturday (cont.)

0830 - 0945	Interview at Chungang Grain Market (accompanied by Mr. Lee, Sang Won) Mr. Hwang, Il Ju, Vice-chairman Grain Commissioners Association
1130 - 1230	Lunch at Mr. Gibson's Home
1330 - 1530	Interviews with private millers in Suwon (accompanied by Dr. Chyun, Soon Pyo and Mr. Lee, Sang Won) Mr. Lee, Kee Yong, Chairman Suwon Branch of Private Grain Millers Association Mr. Kim, Kil Nam, Managing Director Suwon Branch of Private Grain Millers Association Mr. Kim, Dong Won, Private Miller Mr. Han, Chang Up, Private Miller
1600 - 1800	Interview at Daechang Rice Mill Co. in Young Deung Po (accompanied by Dr. Chyun, Soon Pyo and Mr. Lee, Sang Won) Mr. Huh, Yoon, President
1800	Return to Residence Hall

25 Feb. 74 (Monday)

0755	Leave Residence Hall for Chancery
0830 - 1200	Report Drafting
1200 - 1300	Lunch at Naija Hotel
1300 - 1700	Report Drafting
1730	Dinner with Mr. Suh, Won Ho, NACF

26 Feb. 74 (Tuesday)

0805	Leave Residence Hall for Chancery
1200 - 1300	Lunch at Chancery

26 Feb. 74 (Tuesday) cont.

1430 - 1700	Interview at Private Grain Millers Association (accompanied by Mr. Lee, Sang Won) Mr. Han, Gap Su, Vice Chairman Mr. Kim, Kyung Ho, Chief Planning Section
1730	Return to South Post
1830	Dinner at Tom Carroll's home with Jorgen Randers and KASS/NAERI staff

27 Feb. 74 (Wednesday)

0755	Leave Residence Hall for Chancery (Interviews at EPB and MOC rescheduled at their request)
1115 - 1230	Seminar on General KASS Model at NAERI (Critique and discussion with Jorgen Randers)
1230 - 1330	Lunch
1345 - 1730	Seminar on KASS/GMP Component Model (Critique and discussion with Jorgen Randers)
1740	Leave NAERI for South Post

28 Feb. 74 (Thursday)

0755	Leave Residence Hall for Chancery Meeting with Fran Jones
1000	Interview at EPB* Mr. Lee, Yun Soo, Director Planning Bureau Mr. Choi, Chang Nak Planning Coordinator
1200	Interview at MOC** Mr. Chung, Jai Suk, Vice Minister Mr. Chung, Jae Duck, Planning Coordinator Mr. Moon, Yon Lee, Director, Planning Bureau Lunch and Checkout
1315	Depart South Post for Kimpo Airport
1430	ETD NW Flight #12

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* Had to be cancelled at the last minute at request of EPB because of urgent meetings. Mr. Choi just promoted to Assistant Minister of EPB, and Planning Coordinator position currently vacant. Cancellation not considered to have any other implications; Dr. Phillips is personally acquainted with Mr. Choi through past association.

** Had to be cancelled at the last minute at request of MOC because of urgent conflicting meetings. Cancellation not considered to have any other implications; Dr. Phillips is personally acquainted with Vice Minister Chung through past association.