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The NAERI/MSU Agricultural Sector Simulation: An Evaluation

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(The following is the first of six evaluation papers prepared during January-March 1974 on the agricultural sector analysis/modeling effort jointly undertaken by the Korean National Agricultural Economics Research Institute (NAERI, or AERI before it became "National" in 1973) and Michigan State University (MSU). The "overall evaluation" section of this paper begins on page 18 and is followed by a summary of the recommendations made in the main body of the report.)

Following-up preliminary but abortive simulation studies of Nigerian agriculture, Michigan State University has been cooperating since mid-1971 with the Korean government (NAERI and the Ministry of Agriculture and Fisheries) to produce a series of agricultural sector reports and the beginnings of a simulation model for the agricultural sector. In the first phase of this work (August 1971 - June 1972), the joint NAERI-MSU team prepared a preliminary agricultural sector analysis, a rudimentary simulation model plus model-aided examinations of four broad agricultural development strategies, and a final sector report and associated recommendations. This was supplemented by a report on investment priorities prepared during the project's second stage, July-September, 1972.

Five research <sup>sub-projects</sup> projects were continued during the third phase of the project from October 1972 to date. These dealt with (1) a foodgrain management sub-model, (2) an agricultural resource allocation sub-model involving recursive linear programming, (3) a livestock production sub-model, (4) an international trade sub-model, and (5) a population migration sub-model. In addition, several team members produced computer calculations for a fifth alternative agricultural development strategy, specifically aligned with Economic Planning Board guidelines for a longer term, 1972-1981, planning effort. This latter work required about three months and was finished in May 1973.

The MSU team through March 1974 will have invested about 14 man-years of short and long term research effort and about US\$1 millions of A.I.D. funds.<sup>1/</sup> The Korean "counterpart" contribution

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<sup>1/</sup> "Manpower and Budgets: USAID/MSU Contributions," February 1, 1974, covering Contract Number AID/osd-184 and Number AID/osd-2975.

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through January 1974 was about 18 professional man-years and an equal amount of computer programmer and research assistants' time. Korean monetary contributions, largely for wages and salaries, were a relatively modest 20 million won or roughly US\$50,000.

Physical outputs included published sector and investment reports, about nine published special reports, a variety of internal and mimeographed memoranda and papers, various portions of a simulation model, and associated computer software including a lengthy "User's Manual" for the first phase simulation model. All of the published reports appeared during 1972.

#### Evaluation methodology

AID's decision to launch an independent evaluation of the model was made in late 1973 in anticipation of MSU contract renewal discussions before March of 1974. The evaluation was to "measure the degree to which...specific objectives have been fulfilled in Korea, identify factors that have determined the degree of success of the approach, suggest steps that can be taken to extend and improve the model's performance, and indicate the necessary conditions for transferring this approach to sector analysis in other countries." Objectives of the MSU contracts were identified as having been to:

- 1) Adapt, extend and test the computer simulation model developed under project AID/osd-1557 for Nigeria to evaluate selected agricultural policies, programs, projects in Korea;
- 2) Establish linkages with national planning and research agencies in Korea; and

- 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 formulation.

The Evaluation Plan<sup>1/</sup> called for "six related but independent papers" on:

- 1) Capacity and utilization of the model in Korea
- 2) The systems model
- 3) Recursive linear programming production component
- 4) Population component
- 5) Grain management program component
- 6) Livestock component

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<sup>1/</sup>Lehman B. Fletcher, "Plan for Evaluation of the Korean Agricultural Sector Simulation Model," January 15, 1974, 5 pp.

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The first paper was further described as follows:

The most important single criterion for success in this sector analysis effort is the extent to which Korean personnel have been trained and have the opportunity to use, adapt, and further improve the model. This continuing analytical capacity is essential to make computer models viable and low-cost planning tools. It involves trained personnel, computer capability, and organizational arrangements that make it possible for the analytical results to be applied to the policy-making process. This phase of the evaluation will assess the extent to which this capacity has been developed and actual utilization of the model in the planning process has taken place in Korea. It will also determine the interrelationship between the formal model and the Korean agricultural sector analysis completed under project AID/csd-134 (Korean Agricultural Sector Study).

In spite of the last sentence above, it was generally agreed that the evaluation was to focus primarily upon the model-building effort as being the more innovative and controversial part of the NAERI-MSU project. I have of course taken some liberties with the evaluation guidelines quoted above. Although focusing primarily upon the human and institutional setting, I touch briefly on technical model-building matters. I also devote more attention to the post-model-building utilization phase than may have been originally intended. Interviews upon which the following observations are based were conducted during the week of January 28-February 2, 1974, in Seoul. I was assisted during some of the interviews by the sympathetic company of Lohland Fletcher from AID/Washington and by the helpful counsel of AID's rural development officer in Seoul, Francis Jones. The MSU staff members in Seoul, including project director Edward Rossmiller and local team leader Tom Carroll, could not have been more cooperative. I owe my chief thanks, however, to the 27 Korean professionals with whom I discussed the model-building and sector analysis effort and particularly to the 8 staff members of the National Agricultural Economics Research Institute with whom I had extended discussions. The names of those interviewed are contained in the Annex.

It should be obvious, finally, that observations based upon a limited number of interviews and limited acquaintance with Korea will contain errors of various degree and kind no matter how confidently the observations may appear to be expressed below. Criticisms and corrections of this report are therefore encouraged.

#### Adapting, extending and testing the computer model

This topic is to be the subject of the other five evaluation papers. It is clear, however, that it had been possible to modify elements of the Nigerian model and to use them, interspersed with hand calculations and "man-machine interaction," to provide an input into the phase one agricultural sector study. I did not look into the exact timing or man-power costs of this work nor the extent to which adaptation was carried out in East Lansing rather than Seoul. The opinion of the MSU team

members, with which I see no reason to quarrel, was that the Korean sector study was finished more quickly and at a lower cost than would have been possible without the prior work done on Nigeria. It is also true that subsequent to completion of the sector study, Korean team members were able to produce a fifth set of alternative computer runs within a three month period.

My impression, however, is that the number of model elements adapted from the Nigerian effort was relatively modest and that it was not a particularly easy job to fit them to Korean reality. Model results provide a backdrop and an air of quantitative respectability to the sector study, but it is not clear to what extent the sector study's conclusions and recommendations were dependent upon the computer runs. The feeling among the Koreans was that it took much of the initial, 9-month phase-one period to educate the Americans about Korean agriculture. (Having a model framework in mind during this educational process, however, probably reduced the time requirements.) The sector study itself is quite well done - one of the best I have seen - but the Korean view was that there was little in it (or in the preceding series of "special reports") that was new to the Koreans. This of course does not detract from the value of the study, and a number of the study's recommendations have already been implemented.

Some notion of time requirements for model use can be gained by examining the "fifth alternative" runs made in March-May 1972. By this time the preliminary adaptations of the model had been completed, some improvements in software had produced more readable print-outs, and the primary problem was to tie in model results to Economic Planning Board (EPB) targets for population growth and 1981 per capita income. The interaction with the planning process will be discussed further below. Here it may be noted, however, that the utilization process took "20-25 computer runs." These produced "four or five final results," all but one of which was rejected as not agreeing closely enough with various constraints or prejudices of assorted administrators in the Ministry of Agriculture and Fisheries.

The point to be made here is that even under the best circumstances model-using requires much time and effort. Models, after all, are only tools, and a certain amount of trial and error experimentation will always be necessary before intuitively useful results can be obtained. The corollary of this is that the employment of a large mathematical or simulation model may not speed up the planning or decision-making process. Nor will it generally reduce the need for economists and other professionals. If anything, such models are labor-increasing. The benefit in the models lies not in reducing the time needed for decisions but in improving the quality of the judgements and the plans which are made.

Two further points, the first on data problems and the second on model validation: Korea has probably one of the best collections of economic and related data of any developing country. Four sets of input-output tables exist for the 1960-1970 decade, the most recent having nearly 400 sectors. There are nearly 20 years of detailed national accounts, and quarterly data are available going back to 1960. Yet the data demands of a major model-building effort are almost insatiable, and I ran into considerable criticism of the model's data base on two grounds. The first had to do with sheer magnitudes. As one participant put it, "One thousand kinds of data were used by the NAERI/KASS (Korean Agricultural Sector Simulation) team, and ninety percent of them did not have long enough time series to give reliable parameter estimates." At the micro level there is a paucity of data needed by a detailed model and too little existing analytical work on data that are available.

The second data problem has to do with persistent biases in existing series. These arise from the natural desire within a government bureaucracy to have reported reality agree as closely as possible with previously announced targets and plans. Data are collected in many cases through the same channels which are charged with administering action programs. Reported figures may be subject to further negotiation and adjustment before publication. Such difficulties appeared to be well-recognized, and in the case of rice production estimates the KASS

team was able to use an alternative set of data for modifying the official figures. There is the suspicion however, particularly on the part of those outside of the government, that biases are more widespread than was perhaps appreciated by the MEU participants and that a predictable sequence has existed and will continue to exist of optimistic forecasts being followed by appropriately biased data estimates. It should be noted that one step has already been taken (as a result of KASS recommendations) to reduce this problem in the future by removing agricultural data enumerators from the control of local governments and placing them under the Economics Statistics Division in the Ministry of Agriculture and Fisheries.

Data difficulties make doubly important the job of checking the validity of the model. A certain amount of "sensitivity testing" was done by the KASS team, and model output was subject to numerous checks of common sense and expert opinion. One Korean observer, however, criticised the modeling work for not having attempted to make backwards "projections" into the past, beyond those years used for preparing the bulk of the model's parameters.

The basic philosophically difficulty is that the "art" of the scientific method is to simplify reality, eliminating extraneous factors or those with only a minor impact upon the outcome, and focusing upon a relatively small grouping of cause and effect interrelationships. This is more difficult to do in the real world than in the laboratory because extraneous factors are always appearing from nowhere to affect the results. The tendency is, therefore, to make models more and more complicated in order to encompass as many peripheral relationships as possible. When it comes to testing such a model, however, it is hard to say which of what may be many dubious data elements needs improvement or modification. "Fine tuning" adjustments made at this point to improve the model's correspondence to past experience may or may not be adequate when the model is applied to future or hypothetical situations.

Linkages with national planning and research agencies

Effective linkages depend upon adequate knowledge of what is being supplied and how it is to be used, a satisfactory quid pro quo between the parties, and a degree of trust, tolerance, and mutual accommodation. These conditions are as necessary in non-pecuniary transactions as they are when money changes hands, although personal relationships may be more important in the former case. Personal relationships, in turn, may be heavily linked to the position, status, and perhaps age of the individuals involved.

In the case of the NAERI/MSU model-building and sector analysis efforts, the natural linkages are with:

- other divisions within the National Agricultural Economics Research Institute
- operating bureaus and divisions within the Ministry of Agriculture and Fisheries (MAF)
- data-supplying units within MAF and elsewhere, in and out of government
- planning and higher level decision making units within MAF
- sectoral and higher planning levels within the Economic Planning Board
- other government ministries, especially those having to do with forestry, regional development, local government, and infrastructure
- the Blue House (executive offices of the President)
- providers of computer services and training, especially the National Computer Center (NCC) and the Korea Institute of Science and Technology (KIST)
- quasi-governmental research or training groups such as the Korea Development Institute (KDI) and the Korea Advanced Institute of Science (KAIS)

- quasi-governmental operating groups, especially the Agricultural Development Corporation (ADC), the Agriculture and Fisheries Development Corporation (AFDC), and the National Agricultural Cooperative Federation (NACF)
- university sources of research and training such as among others, the College of Agriculture, Seoul National University, Suwon (COA/SNU)
- donor and foreign technical assistance agencies, chiefly USAID, other bilateral donors, UNDP, and FAO

There was not enough time for interviews at all related institutions. I did not get to Suwon (COA/SNU and ORD - Office of Rural Development). Neither did I visit any of the quasi-governmental operating agencies, ADC, AFDC, and NACF. Most of the other groups on the above list were represented, however. Details are given in the Annex.

On the matter of information flows, there appears to be inadequate knowledge even among other NAERI divisions. Most interviewees other than KASS team members had only a vague idea of what the simulation model was all about. The general impression was that the model was quite complicated, mathematical, and difficult to understand. One or two prospective customers were quite enthusiastic about the potential usefulness of the model, but it was not clear how much of their enthusiasm was based upon sound knowledge. To date there has been little first hand experience with the model on the part of outsiders. The results produced by the KASS team have been useful though not particularly striking and seem to have been largely employed by the five-man central planning staff within MAT.

Both suppliers and consumers are aware of the problem of inadequate knowledge. NAERI sponsored a lecture course on systems analysis in November 1971. The Institute also ran a 10-day workshop in July-August 1973 which reached about 60 economic analysts and higher-level decision makers and was apparently quite well received. The most common suggestion encountered for improving information on model use and potential benefits was to exchange staff members with the KASS project

or perhaps to assign short term staff members to work with the KASS team. This has and is being done where KASS needs specialized assistance in modeling a particular area, but it might be more difficult to organize and provide supervision for if outsiders were to join the KASS project for short periods as general purpose "research assistants" or apprentice programmers. Nevertheless it is probably the most practical way for informing outside agencies at the staff level of model capabilities and operation.

On the matter of appropriate quid pro quo, there has been quite a lot of cooperation in data gathering, etc. This seems to rely rather heavily on informal friendship channels, chiefly deriving from attendance at Seoul National University's College of Agriculture. Similarity of ages and graduating classes thus becomes a factor. Among the younger professionals in particular, there is probably a certain glamour attached to giant, computerized models and a consequent willingness to contribute to and be associated with the KASS effort.

Among the higher level users there is more of an attitude of, "How can the model - or NAERI for that matter - help me with my job?" The KASS reports have helped ORD get a sizeable research loan from AID and have helped MAF's Economic Statistics Division gain control over its field enumerators. Both contributions of KASS have been warmly welcomed. Direct use of the model results have so far aroused mixed reviews. To some it gives a promise of considerable potential, and it provided "one more tool" to the bureau chiefs and planners who worked on the 1972-1981 projections in early 1973. There has apparently been some criticism of the KASS effort within MAF for not producing enough visible results to date and proving the model's worth in some dramatic fashion. This seemed to be a rather vague complaint among unidentified "ranking officials" and may partly reflect the fact that the KASS team has so far produced little analytical work based on the modeling effort and few reports of any kind for general circulation since the latter part of 1972.

Although not mentioned by any of the model users, I suspect that greater attention to computer output format would make the results

more directly usable and recognizable. The EPB, for example, is interested in "agricultural, forestry and fisheries GNP" while the KASS model (Alternative 5) produces estimates of "agricultural value-added." What is the relation between these two concepts? EPB deals with "farm population" while KASS reports "rural population." In the Livestock Bureau of MAF, the director is accustomed to thinking in terms of millions of eggs. Egg output from the KASS model, on the other hand, is reported in millions of metric tons. These are minor problems of comparability and measurement and should be easily remedied. Until they are, and until the model is programmed to produce additional details which an administrator may require to help him with his job, the usefulness of the model results will not have reached <sup>its</sup> their logical potential.

Finally, although the NAERI staff seem anxious to provide services for potential users, their psychic and economic rewards for these services seem so far quite modest. Their status as an institution is not high, and among the competitors for new graduates from agricultural colleges they offer the lowest salaries within the research or educational community. The MSU team is believed to have "plenty of money," but NAERI is under-funded and experiencing periodic pressure from AID or MSU to produce additional counterpart funds. Some NAERI personnel outside of the KASS division feel that NAERI resource allocation is being distorted in favor of sector studies to the detriment of the other divisions (agricultural development, rural economics, agricultural production economics, and agricultural marketing). Other NAERI divisions have furnished data for the sector studies division but they have not yet learned how to benefit from the modeling and sector analysis effort.

Most importantly, in the view of a number of observers, KASS has a shortage of front-rank, senior professionals who can serve as sales promoters and consultants to other agencies on model use. This is a job that must be done by Koreans and often at a rather high level. There were sharp differences of opinion between KASS and EPB staff during the

1972-1981 planning exercise over whether 50-percent off-farm earnings for farmers in 1981 would be consistent with other proclaimed EPB guidelines. There were at least some junior staff members at EPB who were reportedly sympathetic with the KASS view, and agreement upon a 65:35 split between farm and non-farm income (for farm families) appeared likely. This lower-level agreement was apparently reversed at higher levels within EPB and the final, published figures showed the original 50:50 split.

A direct intervention with EPB by the respected head of NAERI, Dr. Kim, Dong Hi, might have changed the outcome, but there is a limit to how thin the NAERI director can spread himself on such relatively minor issues. Yet it is through personal briefings, high level campaigns to sell the product, and a willingness to debate technicalities with competing model-builders that the simulation model's usefulness can be demonstrated and improved. As one outside economic analyst put it, "Selling is now the big problem. Dr. Kim, Dong Hi, is enthusiastic about his staff's research results, but he cannot be both an administrator and a salesman. A high-level 'bridge' is needed between KASS and other agencies, and this is a need which can only be filled by Koreans."

Such a bridging operation appears to be particularly necessary if the KASS model is to make an impact on the EPB guidelines for the Fourth Five Year Plan (FFYP). These guidelines should be coming out in early 1975, and before this time the EPB staff must have worked out a consistent macro-economic framework for the years 1977-1981. If KASS model results are to be taken seriously at this preliminary but critical stage, EPB policy makers must learn more about the KASS model and must be able to judge where its results may be superior to other projections. At a minimum this suggests several months of hard questioning and debate among the Korean technicians most intimately connected with the various competing consistency models. (These appear to be the KASS model, a multi-sector projection model that has been under development at KDI<sup>1/</sup>

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<sup>1/</sup> See for example, Model Work Committee, KDI, "A 52-Sector Interindustry Projection Model for Korea, 1973-1981," Korea Development Institute, September 1973, 69 pp.; and Song, Heeyhon, "An Econometric Forecasting Model of the Korean Economy," Korea Development Institute, October 1973, 81 pp.

and the more traditional linear, econometric and input-output extrapolations which have been the mainstay of past EPB planning forecasts.)

In terms of specific linkages, those between KASS and other divisions within NAERI appear to be quite weak at present. There does not seem to be a great deal of staff interaction on professional matters. Regular research seminars (in Korean) and perhaps staff exchanges with the KASS division might assist the internal communications (and training) problem.

Communication within the Ministry of Agriculture and Fisheries appears adequate for this stage of model development but could be improved by greater personnel contacts and a more frequent flow of information, analytical papers, etc. There may be a specific problem, too, in how to deal with higher level pressures for "quick results."

There had been little or no previous contact with the Korea Advanced Institute for Science until just recently, but there appears to be a good opportunity for cooperation in areas of systems science. Relationships with the Korea Development Institute appear cordial, but most traffic has consisted of technical advice from KDI Fellows to NAERI staff members, and a viable quid pro quo does not yet appear to have been developed.

Difficulty in arranging any form of quid pro quo appears to have handicapped the KASS linkage to the National Computer Center. NCC, with a 131 K memory UNIVAC 1106 computer, is supposed to provide services without charge to all parts of the government. The capacity of the machine is being severely tested, and no formal system apparently exists for setting job priorities, for rationing scarce computer time, or for avoiding needless waste of "free" machine time. The UNIVAC memory will be doubled next year, but demands are expected to continually expand, and the director of the Center appears to have no plans to rationalize the work-scheduling process in the near future.

The KASS group has been unwilling to employ the informal methods which are sometimes used to speed up turn-around time and as

a consequence is lucky to get one set of results back every one or two days. (Average turn-around is closer to two days since waits of up to five days are occasionally encountered.) Development work on the livestock and grain management sub-models are reportedly six months behind schedule, at least in part because of the computer bottleneck. NAERI therefore is planning to increase their use of the CDC CYBER computer at the Korea Institute of Science and Technology. This installation uses machine-scheduling (rather than operator scheduling) of jobs, permits a choice of three priorities, and offers a good set of software plus possibilities for "interactive mode" user terminals at a low marginal cost. This latter arrangement would be ideal for model-development and debugging work. NAERI plans to install such a terminal by February 10 and to squeeze out of their regular budget the additional funds needed to pay for at least a part of the new service. (MSU may use some of its AID budget for purchasing the necessary hardware.)

Linkage with the universities has been helped through papers presented to the Korean Agricultural Economics Association (but not yet to the competing but smaller Korean Agricultural Policy Association whose members were largely graduated from universities other than COA/SNU). Director Kim, Dong Hi, has been teaching at COA/SNU for some time; Dr. Kim, Ho Tak, assistant professor from COA/SNU, is currently undertaking post-doctoral studies at MSU and will work part time for KASS upon his return. Mr. Lee, Jeung Han, on leave from the Agricultural University at Chinju, is also at MSU undertaking PhD studies in an area of potential usefulness to the KASS model.

As yet, however, there appear to be no university courses in Korea which are directly related to the agricultural simulation model or which would give local graduates an appreciation of the model's potential. There also appears to be a dearth of public research funds for universities, and most of the respectable research in the country seems to be limited nowadays to research institutes such as NAERI, KDI, ORD, etc. A longer run, public service-type investment for KASS, therefore, might be to offer regular courses (or lecture series) on sector modeling at a local university or universities and perhaps to

contract out a limited amount of research to university staff members if that should be feasible.

Staff training and development of model-building and testing capability

This is an area to which considerable thought and effort has obviously been devoted by NAERI leadership and by the MSU team. Seven of those staff members who worked with MSU team members during early stages of model development are currently studying at MSU. Their programs range from regular masters and PhD studies (largely in agricultural economics) to a special "Multi-National Study Program in Agricultural Economics Analysis and Systems Simulation." Other Koreans are completing coursework elsewhere (Minnesota, Missouri, Hawaii) and are slated to return for work with the KASS division or elsewhere within NAERI. A good deal of on-the-job training is occurring under MSU team members' supervision. Three NAERI staff members have been given varying amounts of computer programmer training by the KIST Computer Operations Department.

Developing staff competence has at least three different aspects: finding, training, and keeping talented people. I could not gain much of a feel for how good the staff selection process had been for the KASS division. Junior staff members appeared generally competent, but a large proportion of the more competent members are presumably among those now overseas. The chief source of new professional staff members appears to be the College of Agriculture at Seoul National University although two or three had been trained elsewhere. The NAERI Director hopes to augment the KASS staff by finding part-time expertise in technical agriculture, sociology, and public administration, but these posts may not be filled before 1975.

There appears to be a considerable felt need for further formal training, especially among the more junior staff members or those who have not yet been overseas. The three computer programmer trainees (none yet qualifies as a programmer in my opinion) seem particularly unsure of themselves - although part of their insecurity stems from temporary appointments, low salaries, and uncertainties over the desirability of programming as a career. (On-the-job training for the computer programmers

has been handicapped by the discouragingly slow computer turn-around time discussed above. The installation on an interactive mode computer terminal at NAERI should improve the situation greatly. Future on-the-job training for other staff members will largely depend upon the quality of the KASS leadership and upon staff members being able to work on a variety of jobs at increasing levels of responsibility.

One aspect of training which so far has been relatively neglected has to do with interaction with professionals outside of the KASS organization. These include higher-ranking policy makers and model-users, technicians on the staffs of operating bureaus within MAF and elsewhere, members of the academic community, and other Korean researchers working on agricultural sector and related problems. To be sure there have been numerous staff contacts with outsiders during the model-building and sector-analytical work so far, but more can be done in the future through regular programs such as:

- regular seminars on research topics to which outsiders are invited both as observers and participants
- provision of system simulation training for professionals from other divisions of NAERI and other government departments
- encouragement of KASS staff to present papers on a regular basis at the quarterly meetings of the Korea Agricultural Economics Association and the Korea Agricultural Policy Association
- expanded use of ad hoc meetings at other government bureaus to describe KASS results and discuss analytical problems
- encouragement of Korean PhD candidates studying overseas to return to Korea under KASS sponsorship to work on PhD research topics

These programs also involve the "linkage" aspects of KASS work discussed above, and the educational benefits for the KASS staff are an important benefit of such linkages.

Attracting and retaining well-trained, competent staff members is closely related to the kinds of economic and professional benefits provided and to the quality of professional activity within the KASS division and NAERI itself. There is also a more basic question of the extent to which KASS may wish to retain its staff. A relatively high rate of turnover may help spread systems simulation competence elsewhere in the government and may provide a route to more rapid advancement for the KASS staff members remaining with the organization.

The problem of adequate salaries and perquisites was a topic that was very much on the mind of the KASS staff. Junior researchers apparently make the equivalent of less than US\$100 monthly, senior researchers slightly more, and division chiefs US\$125-150. A certain amount of after-hours moonlighting to make ends meet seems to be a necessity for many staff members. NAERI is at a salary disadvantage with respect both to Korean universities (especially the private ones) and the semi-independent research institutes such as KDI and KIST. There may also be greater inflexibility with regard to promotions, especially at higher levels. The NAERI Director hopes to recruit a few key professionals on a "contract" basis that would permit salaries competitive to those offered by KDI (\$400 monthly for a new PhD and \$500 for a PhD with three or more years experience). This may solve one problem but may dramatize inadequacies at lower levels.

The best longer-run solution to staff salaries may be to emphasize the indirect economic benefits of a KASS appointment, namely strong training programs (including improved possibilities for overseas study) and a rapid promotion policy made possible through active efforts to place senior staff members in other parts of government. (This latter possibility is undoubtedly tied up with civil service rules, regulations, and rigidities; it may be considerably more difficult to put into practice than I have supposed.)

### Overall evaluation

There appears to be a good possibility that the NAERI/MSU agricultural simulation effort will lead to a significant step forward in Korean planning capability. At a minimum it should provide operating bureau chiefs with a tool for more easily examining the logical and multi-faceted implications of alternative policies. It should provide them with more accurate and consistent estimates for use in the internal bargaining processes in which policies and programs are forged. There are already bureau chiefs within the Ministry of Agriculture and Fisheries who understand these possibilities. They are impatient for the model (and especially the sub-models directly related to their own problems) to be perfected and tested and for their own staff to acquire model-using capabilities. Their enthusiasm, if the analytical tool comes up to their expectations, should eventually prove contagious as other policy makers and policy influencers find themselves at a competitive disadvantage.

There is also a more remote possibility that the sector modeling effort will lead to important discoveries of new policy alternatives. This will require extensive experimentation, analytical efforts, and model refinement by the NAERI staff. The results will sometimes be politically unpopular with regard to entrenched interests, and understanding and acceptance at higher decision-making levels therefore, becomes important. Close cooperation with the Economic Planning Board and the Korea Development Institute will probably improve the chances of higher-level acceptability.

Both of the above possibilities hinge upon the technical accuracy and utility of the model itself and upon the imagination and creativity of those who are charged with the care and feeding of the model. Other evaluators will be able to form more accurate judgements than I on the current state of model development and upon the longer run prospects. There are many questions in my own mind, however, about the quality of basic data, the accuracy of parameters and of model specification, and about the ambiguities created by endless model runs, each producing slightly different and sometimes contradictory outcomes.

Until we learn to have considerable confidence in the model itself, I would not attempt to apply a similar multi-million dollar effort to other developing countries (MSU contracts to date in Korea total close to US\$ 1 million and follow-up work may cost twice that amount) and would hesitate to fan the flames of enthusiasm prematurely within the government of Korea. This reluctance partly reflects the cost of such a model (US\$ 72,000 per expatriate man-year for the MSU contracts in contrast to far lower costs - but much longer time requirements - for a largely indigenous effort), partly the fact that most other developing countries have even less reliable and extensive data, and partly that the Iowa State effort in Thailand under Professor Earl Heady should be evaluated and contrasted with the MSU experiment before major new ventures are planned.<sup>1/</sup>

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<sup>1/</sup> The "multi-level" modeling work in Mexico of the World Bank should also be included in such a comparative evaluation.

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Turning to the institutional setting within which model development work is occurring, I conclude that considerable effort will still be needed to develop a market for the product. There is currently little detailed knowledge or understanding of the KASS effort at working levels within the Korean government. There is little inclination as yet at higher policy levels to shift to a multisectoral, multi-level modeling approach such as that represented by the NAERI-MSU effort. A major and continuing sales promotion effort is needed, especially as the model developers begin to have increased confidence in the technical utility of their product. This suggests a continuing expenditure of model-development funds and a shift more and more over the next 3-5 years to working out and demonstrating model applications. It should be obvious that much of this future effort must be made by Korean rather than outside technicians, although foreign consultants will undoubtedly have contributions to make for a number of years. Since much of the future work will continue to represent a mutual learning experience of potential benefit to other countries, it would appear legitimate for outside donors

to finance foreign consultants and training for the project and to contribute to the more experimental of local development costs.

Summary of recommendations

Although the terms of reference for this model-evaluation report said nothing specifically about recommendations, there have been a number either explicitly or implicitly included in the above text. These may be summarized, albeit with considerable overlapping, under three headings:

A. Product development and testing

1. Development work on the model should continue for at least another two to three years with MSU participation.
2. A special effort should be made to fit model-testing in with work on Korea's Fourth Five Year Plan.
3. Model output should be made more useful and intelligible to users through greater attention to output format, summary items, and units of measurement.
4. Computer linkages in Korea appear to be quite inadequate and should be strengthened through installation of a remote terminal and through considerably more effort to develop or hire competent programmers.
5. The forum for testing model results, data reliability, and technical assumptions should be expanded through a greatly increased output of technical papers, seminars, reports, lectures, etc., both within and out of government.
6. A future evaluation effort should include contrasts with the Iowa State work in Thailand and the World Bank multi-sector modeling in Mexico.

B. Sales Promotion and public service

1. Increase the allocation of KASS staff time to policy analysis and to promoting the use of the KASS model in assisting other divisions and bureaus both within and outside of NAFRI.

2. Give more explicit attention to making the KASS models and sub-models understandable by non-technicians.
  3. Assist in forming a macro-economic model coordination team to reconcile differences among the KASS, KDI, and EPB macro-models in preparation for the Fourth Five Year Plan.
  4. Hire at least one first-rank Korean economist to assist the NAERI Director with the technical aspects of sales promotion. To improve the link with KDI, a joint appointment with that Institute might be considered.
  5. Promote interdivisional seminars within NAERI and greater research exchanges with other organizations.
  6. Expand training aimed at helping other organization utilize and expand upon the KASS results. This should probably include 3-12 month in-service training programs for outside personnel and perhaps staff exchanges between KASS and other units.
  7. Adapt a policy of assisting 1-2 KASS senior professionals each year in finding higher-paying jobs in client organizations.
- C. Staff development and training
1. Continue to emphasize formal and informal training for KASS staff and to encourage donor agencies to provide fellowships for overseas study up to the PhD level. (It may be advantageous, however, to require a 2-4 year return to Korea between an overseas masters and an overseas PhD degree, providing that the staff member is relatively young.)
  2. Assist local universities, as necessary, with teaching at both the undergraduate and graduate level the quantitative analytical skills of use to future research staff.

3. Work for increased flexibility within MAF to train overseas PhD's for operating as well as for research groups on the grounds that research users must have the competence to understand and adapt research results and that NAERI research, for example, can be improved through collaboration with research-oriented professionals in operating agencies.
4. Consider an explicit policy of "overstaffing" KASS to provide greater opportunities for staff training and for promoting competent staff members to outside groups.
5. Encourage the use of NAERI facilities by masters degree candidates and PhD candidates (including those returning to Korea from overseas) who may wish to do research on KASS-related problems.
6. Explore possibilities for a cooperative training/research relationship with the Korea Advanced Institute of Science on problems of systems simulation.

Jakarta

February 10, 1974

List of Interviews by Type of Institution

- A. KASS Korean staff members or those directly concerned with developing the KASS model
1. Dr. Kim, Dong Hi, Director, NAERI
  2. Mr. Kim, Sang Geo, Acting Division Chief, KASS, NAERI
  3. Mr. Lee, Bu Kwan, Programmer Section, NAERI
  4. Mr. Lee, Hyo Bok, Programmer Section, NAERI
  5. Miss Cho, Jeung Sook, Programmer Section, NAERI
  6. Miss Park, Kyong Sook, Research Assistant, KASS
  7. Mr. An, Chang Bok, Agricultural Economist, KASS  
(until recently with NAERI Marketing Division)
  8. Mr. Lee, Sang Won, Junior Researcher, KASS
- B. MSU team members in Korea (includes only those having extended discussions with evaluator)
1. Dr. Edward Rossmiller, Director, Agricultural Sector Analysis and Simulation Projects
  2. Dr. Tom Carroll, Acting Field Project Leader
- C. Other divisions within NAERI
1. Mr. Kim, Sung Ho, Head, Agricultural Development Division, NAERI
- D. Operating bureaus and divisions within MAF
1. Mr. Lee, Kyong, Administrator, Food Bureau, MAF  
accompanied by: Mr. Moon, Se Kuen, Chief, Planning Bureau, and  
Mr. Won, Kwang Sik, Staff Economist, Planning Division
  2. Mr. Kim, Yong Jin, Administrator, Livestock Bureau, MAF
  3. Mr. Kim, Kwang, Hee, International Cooperation Office, MAF
- E. Planning and higher-level decision makers within MAF
1. Mr. Chang, Duck Jin, Vice-Minister, MAF
  2. Mr. Suh, Han Hyeck, Special Assistant to the Vice-Minister and former NAERI/KASS coordinator for staff arrangements
  3. Mr. Son, Jong Ho, Agricultural Planning Officer, MAF
- F. Data-Supplying Units within MAF and elsewhere, governmental and private
1. Mr. Suh, Joong Il, Head, Economic Statistics Division, MAF  
accompanied by: Mr. Park, Hyeong Ho, Agricultural Economist  
Mr. Kwon, Juyng Hyan

G. Sectoral and higher planning levels within EPB

1. Mr. Choi, Chang Nak, Planning Coordinator, EPB

H. Other government ministries: none

I. Executive Offices of the President

1. Dr. Park, Jin Hwan, Special Advisor on agricultural affairs

J. Providers of computer services and training

1. Dr. Lee, Yong Teh, Manager, Computer Operations Department, KIST
2. Dr. Song, Kil Yang, Director, National Computer Center, Ministry of Science and Technology

K. Quasi-governmental research or training groups

1. Dr. Han, Sang Joon, President, Korea Institute of Science and Technology
2. Dr. Joseph D. Park, President, Korea Advanced Institute of Science
3. Dr. Kim, Mahn Je, President, Korea Development Institute
4. Dr. Moon, Pal Yong, Senior Fellow, KDI
5. Dr. Ban, Sung Hway, Senior Fellow, KDI
6. Mr. Ryu, Byong Suh, Research Fellow, KDI, and formerly with Planning Office, MAF

L. Quasi-governmental operating groups: none

M. Universities

1. Dr. Pak, Ki Hyugk, Dean School of Business Administration, Yonsei Univ. accompanied by: Dr. Kim, Jong Bin, College of Business and Economics, Yonsei University

N. Donor and technical assistant agencies

1. Mr. Michael H.B. Aider, Director, USAID/Korea
2. Mr. Francis Jones, Chief, Rural Development Division, USAID/Korea
3. Luncheon meeting with:

Richard M. Brown, Assistant Resident Representative, UNDP  
Geoff Chandler, UNDP Long-Range Forestry Development Plan  
Lawrence J. Clarke, Korea-United Kingdom Farm Machinery Training Project

Thomas H. Day, Team Leader, FAO Soil Survey and Fertility Team  
Helmut Havfo, UNDP Long-Range Forestry Development Plan  
H. Arthur Lamey, Project Manager, FAO Strengthening Plant Protection Research and Training Program