AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch #24

1. SUBJECT CLASSIFICATION

A. PRIMARY
Agriculture — AE70-0000-G662

B. SECONDARY
Distribution and marketing--Indonesia

2. TITLE AND SUBTITLE
Review of economic and engineering study: rice storage,handling,and marketing in Indonesia

3. AUTHOR(S)
Phillips,Richard; Pfost,H.B.; Chung,Do-sup; Pedersen,J.R.

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1973	38p.	ARC ID633.18.P562

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Kan.State

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*
(In Food grain drying storage,handling,and transportation rpt.no.35)

9. ABSTRACT

10. CONTROL NUMBER	11. PRICE OF DOCUMENT
PN-RAB-434	
12. DESCRIPTORS	**13. PROJECT NUMBER**
Evaluation Indonesia Rice Storage	**14. CONTRACT NUMBER** CSD-1588 GTS **15. TYPE OF DOCUMENT**

AID 590-1 (4-74)

REVIEW OF ECONOMIC AND ENGINEERING STUDY
RICE STORAGE, HANDLING AND MARKETING
THE REPUBLIC OF INDONESIA

WEITZ-HETTELSATER ENGINEERS

Prepared By
Richard Phillips, Harry B. Pfost,
DoSup Chung & John R. Pedersen
Food and Feed Grain Institute
Kansas State University

Prepared for the
AGENCY FOR INTERNATIONAL DEVELOPMENT
AID/csd-1588
Technical Assistance in
Food Grain Drying, Storage, Handling and Transportation
at the
FOOD AND FEED GRAIN INSTITUTE
KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS 66506

Dr. William J. Hoover, Director
Dr. Leonard W. Schruben, Associate Director
Dr. Richard Phillips, Agricultural Economist
Dr. Harry B. Pfost, Agricultural Engineer
Dr. Do Sup Chung, Agricultural Engineer
John R. Pedersen, Entomologist

TABLE OF CONTENTS

--continued--

LIST OF TABLES

REVIEW OF AN ECONOMIC AND ENGINEERING STUDY
RICE STORAGE, HANDLING AND MARKETING THE REPUBLIC OF INDONESIA
Prepared By Weitz-Hettelsater Engineers

INTRODUCTION

The Food and Feed Grain Institute at Kansas State University, under contract AID/csd-1588, Technical Assistance in Food Grain Drying, Storage, Handling and Transportation was requested by USAID/Washington and USAID/Djakarta to review the final copy of:

ECONOMIC AND ENGINEERING STUDY
RICE STORAGE, HANDLING AND MARKETING
THE REPUBLIC OF INDONESIA
Weitz-Hettelsater Engineers

The "Advance Draft" of the report was reviewed in detail by Dr. Richard Phillips (Economist), Drs. Harry B. Pfost and Do Sup Chung (Agricultural Engineers) and John R. Pedersen (Grain Science/Entomologist) in February 1972. The review was published as Food Grain Drying, Storage, Handling and Transportation, Report No. 29, "Review of an Advance Draft - Rice Storage, Handling and Marketing Study for the Republic of Indonesia (Economic and Engineering Aspects).

Reviewers of the final copy of the Weitz-Hettelsater report are all members of the Kansas State University staff working on the Food and Feed Grain Institute contract AID/csd-1588, Technical Assistance in Food Grain Drying, Storage, Handling and Transportation.

Comments on the Weitz-Hettelsater Study are grouped into three major categories:

GENERAL REACTION
METHODOLOGY
COMMENT ON MAJOR RECOMMENDATIONS

GENERAL REACTION

In reviewing the final report the reviewers found that the general reaction was essentially the same as that reported for the first seven chapters of the "Advance Draft Report." The general reaction presented in the review of the "Advance Draft Report" is reproduced here for convenience.

It appears that a concerted effort has been made to understand existing conditions surrounding rice production, marketing and utilization in Indonesia. The first seven chapters of the report are devoted to study of the existing conditions and problems, and the over-all setting is developed quite well.

- The producer problems associated with shifting to the new high-yielding varieties are discussed frankly (Chap. 2).
- The realistic expectations and problems with respect to Indonesia's goals for becoming a rice exporter are developed clearly (Chap. 2).
- The need to consider the production and marketing of corn and other grains as well as the use of by-products for livestock feeding is pointed out at several key points in the study, even though apparently the marketing of grains other than rice and rice by-products were considered beyond the scope of the study.
- Realistic and frank evaluation is made of the BIMAS Program and other existing rice production improvement programs (Chap.4).
- The rice price and production support programs of BULOG are evaluated realistically and the impacts of the program on producers, millers and handlers and consumers are discussed adequately (Chaps. 5 and 7).
- The existing rice marketing facilities beyond the village level including mills, storage facilities, highway and transport facilities are thoroughly reviewed (Chaps. 6 and 7).
- The supporting services including market news and outlook programs, grain standards and grading, marketing credit and marketing extension programs are presented and discussed in proper prespective in relation to needs (Chap. 7).

The reviewers commend the study team members in their efforts to put Indonesia's over-all rice marketing problems into proper perspective,

and for their frank appraisal of the needs and requirements for solving these problems.

Review of Existing Reports

A concerted effort appears to have been made to review, in detail, existing reports prepared on Indonesia and other countries with similar grain problems. Considerable emphasis has been placed on reports and papers dealing with the economic aspects of rice marketing, consumption, production and price policy in Indonesia prepared by Dr. Leon A. Mears, a member of the Faculty of Economics, University of Indonesia.

Data were obtained from various government agencies of the Republic of Indonesia including the Central Bureau of Statistics (production, supply, demand), Directorate General of Water Resources Development (production), Directorate of Agricultural Economics (prices), BULOG (prices, storage capacity), Directorate of Agriculture (rice processing) and others.

Special reports on various aspects of the rice storage and marketing situation in Indonesia were used to supplement government statistics. They included an FAO Special Report "Freedom from Hunger Campaign -- Fertilizer Programme" (production), an Agricultural Executives, Inc. report, "Study and Evaluation of Rice Production Programs in Indonesia, 1961-1970" (BIMAS production program), a BULOG report "The Government Policy in the Effort of Attaining Stabilization of the Price of Rice" (prices), an Asian Development Bank report "The Production and Availability of Foodstuffs in Indonesia: Price and Income Elasticity of the Demand for Rice," the Gadjah Mada University marketing study "The Marketing Margin for Rice" and several others.

Transportation data were supplied by the Kampax/Berger Interim Report (roads and land transportation), the Transportation Coordination Advisory Services (marine transport) and the German Railway Advisory Group (rail transport).

Estimates of losses occuring at various points within the marketing system were provided by BULOG for Indonesia and by the Asian Productivity Organization "Report of the Experts on Food Grain Marketing" for its member countries. Indonesian losses were at the low side of the range reported by the APO. Kansas State University staff members reviewed the methods and questionnaire proposed for use by the APO and felt several opportunities for bias existed.

- General Approach

The general approach to the problem reported by the contractor in the first seven chapters of the Study is good. The facilities which have been recommended by the contractor generally recognize the problems and situations existing in Indonesia. The facilities are not simply copies of facilities found in the U.S. and other developed countries. Construction materials and techniques should be adaptable to the local conditions.

- Storage and Marketing at the Farm and Local Level

This report is primarily concerned with the storage and marketing of rice during movement over relatively long distances. In most developing countries, grain is consumed largely on the farm where it is produced or in nearby villages. Data in this report indicates that Indonesia is typical. This report recommends the erection of about 600,000 tons of commercial storage but also assumes that 600,000 tons of additional on-farm storage and 400,000 tons of additional go-down (village) storage will be required. However, the first one or two steps in marketing and storage are relatively neglected. Problems of farm drying and storage should receive some attention. Transport from farm to the first assembly point for rice moving eventually over long distances is frequently very expensive; this requires the erection and maintenance of many closely spaced primary marketing points. Location, cost, and problems of providing these first primary markets has recieved little attention.

REVIEW OF METHODOLOGY

The methods of analysis employed in the study include (1) development of projections of domestic demand for rice, (2) development of projections of rice production and supply, (3) use of linear programming transportation model to determine least-cost storage and movement patterns, (4) estimation of economic profitability of recommended facilities, and (5) estimation of associated benefits and costs of the recommended program to the Indonesian economy. These major steps are standard for this type of study and all five are essential for an effective analysis. However, it is the belief of the reviewers that certain of the procedures used are open to question and may have led to misleading findings.

The authors of the Weitz-Hettlesater Study acknowledged that application of suggestions on methodology made by the "Advance Draft" reviewers would modify assumptions made; however, the formulation of models, inputs, and outputs were not modified from those used in the "Advance Draft" for the final report. The reviewers believe comments made on the "Advance Draft" remain valid for the demand projections, supply projections and transportation model formulations and they are reproduced here for convenience. Comments on economic profitability of facilities and associated benefits and costs of the recommended program to the Indonesia economy vary significantly from those in the previous review.

- Demand Projections

  The demand projections are based on accepted methodology of economic analysis for reflecting projected population effects, income effects and price effects in the future consumption patterns for rice. The reviewers find no objection to the basic projection models used. The objection raised relates to the application of the

models to projected aggregate total population rather than to the projected rural and urban population separately. It is probable that projected rice demand for the country as a whole under the alternative procedure would be comparable to that obtained in the study. However, it is believed that the geographic distribution of the projected demand among the islands and provinces might be quite different.

The report cites evidence that both present consumption patterns and the income elasticity of demand for rice are quite different among rural and urban populations in Indonesia. Rice is the major food staple among rural people and there seems to be little evidence that rural eating habits will change in the foreseeable future. The urban diet is more diversified, with evidence to indicate some shifting to bread and other rice substitutes. The Indonesian studies cited show the income elasticity of demand for rice to be about twice as high among rural people as among urban people (about 0.8 for rural people compared to 0.4 for urban people). In view of these differences, it is probable that the aggregation of the two populations in the demand projections overstates the projected demand of urban populations and understates the projected demand for rice by rural populations.

The relative importance of rural and urban populations is strikingly different from one area of the country to another in Indonesia. Furthermore, there are differences in the rate of urbanization, so the relative mix of rural and urban people from one province to another will change considerably by 1980. These things will affect the geographic distribution of rice demand within the country. Without making separate projections for the rural and urban populations, one cannot be sure of the magnitude of error caused by using only the combined population in the projections. However, it is probable that the projected demand in Java and other relatively urbanized areas has been overstated, while that in the dominantly rural provinces has been understated.

- Supply Projections

Two methods are employed in the report to derive projected supplies of rice by province. Both methods reflect the existing production base, the potential for increased water control, and the potential for new technology by province. However, Method I bases the potential yield increases through technology in all provinces in experimental results in Central Java, whereas Method II bases the potential through technology on qualitative scores of production conditions in each province. The qualitative scores reflect ten separate factors with respect to adoption of higher yielding varieties, fertilizers, agro-chemicals and cultivation methods. Even though there may be some question regarding certain of the qualitative scores, there can be no doubt that Method II is far more precise than Method I because it does reflect the vastly different rice farming conditions in the different provinces. This surely must have been the reason

that the more complex and costly Method II was developed in the study. The reviewers are much puzzled and concerned that, in spite of the development of the Method II projections, without further explanation the report states on page 264 (Chap. VIII), "The Method I medium production projections for both 1975 and 1980 are used in the development of the optimum shipment and storage patterns presented in Chapter IX." The Method II projections are not used at all.

The production projections obtained by the two methods are not greatly different for the country as a whole. There are substantial differences in the results by province, however. If one assumes that the Method II projections are accurate, the error in the Method I projections used in the study for 1980 are as shown in Table 1. These differences would drastically change the requirements for and solution of the transportation model used in the study (see Tables 9.2 and 9.3). Java as a whole would be surplus rather than deficit. The "other provinces" would be deficit rather than surplus areas. Surpluses in Atjeh would be much smaller than indicated. Movements from North Sumatra to South Sumatra would be substantially greater than indicated. The implications for the optimum size and location of marketing, storage, and processing facilities would be affected accordingly.

- Transportation Model Formulations

Two formulations of the transportation model are used in the study. The first is a simplified annual model designed to minimize transport costs when seasonal production patterns and storage are ignored. The second is a bi-monthly model designed to minimize transport plus storage costs under certain restrictive assumptions. Little need be said about the first formulation because there is no intention in the study that it be used as basis for representation of reality and formulation of recommendations. In contrast, it is intended that the second formulation represent reality in Indonesia and the solution is used as the basis for recommending needed facilities. The reviewers believe that the second model is not formulated adequately for this purpose.

Aside from the questions raised regarding the projected input data to the model because consumption is not projected separately for rural and urban population and becuase the projected production based on Method II is not used, the second model as formulated is believed to be inadequate in four respects. They are (1) the storage costs used do not include inventory carrying costs, (2) the solution of the simplified annual model is taken as restriction to the bi-monthly model, (3) the model considers two-month rather than monthly periods, and (4) no sub-models are used to determine optimum patterns within regions. Each of these shortcomings in the formulation as seen by the reviewers is discussed in turn.

TABLE 1. ERROR IN METHOD I PROJECTIONS FOR 1980 AS COMPARED TO METHOD II PROJECTIONS.

Province	Overstatement (Tons of Stalk Paddy)	Understatement (Tons of Stalk Paddy)
West Java and Djakarta		338,000
Central Java and Jogjakarta		338,000
East Java		508,000
JAVA AND MADURA		1,184,000
Atjeh	77,000	
North Sumatra		126,000
West Sumatra	9,000	
South Sumatra	105,000	
Lampung	67,000	
Benghula	18,000	
Riau and Djambi	13,000	
South Kalimantan		4,000
Other Kalimantan	none	
South SE Sulawesi	19,000	
Other Sulawesi	none	
Bali and Lombok	15,000	
Other Provinces	357,000	
OUTSIDE JAVA AND MADURA	550,000	
INDONESIA		634,000

- Storage Costs. It is intended that the solution of the transportation model show the least-cost pattern of storage and shipments of rice in Indonesia. Thus, the model is intended to test possible trade-offs between additional shipments and additional storage in finding the least-cost solution. In fact, however, it does not do this because the inventory carrying costs were omitted from storage costs, and as a result, the transport costs loom very high relative to the partial costs used for storage costs. Consequently, no real trade-offs were possible in the formulation used.

  The storage costs used in the model are Rp. 180 per ton for a two-month period plus an in-and-out charge of Rp. 258 regardless of the length of the storage period. Thus, the total storage charge would be Rp. 438 for two months, Rp. 618 for four months, Rp. 798 for six months, and so on. In contrast, the province-to-province transport costs are roughly ten-fold these amounts.

  Elsewhere in the report inventory carrying costs for rice are quoted at ranges from 2.5 per cent per month for some of the Government operations to 5 per cent per month for some of the private operators. Using an average value for rough rice of Rp. 20,000 per ton, the inventory carrying cost for a two-month period would be Rp. 1,000 at 2.5 per cent per month and Rp. 2,000 at 5 percent per month. At an intermediate cost of 3.75 per cent per month, the proper total storage charge in the model would be Rp. 1,938 for two months, Rp. 3,618 for four months, and Rp. 5,298 for six months. These storage costs would provide interesting trade-offs with transport costs in the model and the optimum computer solution might be quite different indeed. At least the optimum solution would move in the direction of more shipments and less storage -- a situation closer to present reality in Indonesia.

- Restrictions of the Simplified Annual Model. In order to reduce the required computer time, the optimum solution to the second model is based on restrictive assumptions from the solution of the simplified annual model. No province which is rice deficit on an annual basis is allowed to ship out rice in surplus seasons; no province which is rice surplus on an annual basis is allowed to ship in rice in deficit seasons. In Indoneaia where harvest seasons vary a good deal from one island to another, this assumes away much of the purpose for using a computer model to determine the minimum cost distribution system. It is very probable that the true optimum solution would indicate exactly the kinds of shipments prohibited under the model formulation used in the study. If an efficient computer algorithm is used, the core capacity and computational time required for the complete solution should not be unreasonable

- Two-Month Rather Than Monthly Periods. The two-month periods were used in the formulation to reduce the required computer capacity by cutting the size of the problem for solution in half. This is true even though monthly periods are used elsewhere in the study, including the subsequent hand analysis for selecting the recommended size and location of facilities. The result is that the model as formulated does not have the power to form a least-cost solution which is directly applicable to support the recommended facilities. It seems a pity that the two-month periods had to be used because with an efficient algorithm a 12-period, 16-region transportation problem is well within the core capacity a great many computer installations.

- Lack of Optimum Patterns Within Regions. The final concern of the reviewers in the transportation model formulation used is that it does not have the power to deal with intra-regional marketing and distribtuion of rice. The movements from farm to village market, from village market to assembly point, and from assembly point to terminal point appear to be central to Indonesia's rice marketing problems. Yet, the transportation model as formulated offers no help in this regard. Recommendations are presented for facilities of specific type and size at specific locations within provinces and priorities are given for the recommended facilities. The model as formulated offers no help on optimum location for these facilities and no supporting analysis is given for the locations selected.

  Normally when a transportation model is used to solve for optimum distribution patterns, the optimum intra-regional patterns are determined by sub-models, using the solution of the regional model as given. The sub-models optimize within regions in the same manner as the over-all model optimizes among them. Perhaps limitations of data and budget for the study precluded the formulation of sub-area models. Still, in areas such as Java, North Sumatra, and South Sulawesi, where a number of facilities are recommended by specific location, it would appear that the sub-area optimum analysis is prerequisite to the kinds of recommendations made in the study. The importance of farm and first assembly of grains is discussed more fully in the section on Comment on Major Recommendations of this review under - New Facilities.

- Economic Analysis of Rice Storage and Processing Facilities

The reviewers find the economic analysis of alternative rice storage and processing facilities in the final Weitz-Hettelsater report to be adequate, and believe that the findings are accurate. The report states

that the projected costs and revenues, and therefore, the rates of return and benefit/cost ratios for the alternative facilities are "general magnitude" figures. The authors intend that they be used as guidelines only, and state that, "The GOI can minimize its lending risks and the possibility of losses to borrowers by requiring adequate feasibility studies by the borrowers and developing its own expertise to judge the reasonableness of these studies," (page 477). The authors further conclude, "There is no single facility that is best, or most profitable, for all operating levels and market conditions . . . Any program which provides investment capital for only one or two types of facilities is unlikely to meet the needs of many private investors," (page 420).

The economic analysis of alternative rice conditioning, storage and milling facilities includes the following:

(1) Factors affecting utilization of facilities.

(2) Profitability analysis based on average rates of return on total investment.

(3) Benefit/cost ratios based on grain saved and discounted net profits.

(4) Employment effects of new facilities.

(5) Encouraging private investment in new facilities.

The analysis of factors affecting the present relatively low utilization of existing milling facilities (32 to 40 per cent), together with the analysis of alternative government policies to increase the utilization, appears to be sound. However, the conclusion that ". . . there is no reason to be particularly concerned about the present over-all level of utilization of milling capacity," (page 402), and the recommendation that Indonesia add more than 400 metric tons per

hour of additional milling capacity by 1975-1977 (Table 12.1) are open to question. It appears to the reviewers that much of the need may be for replacement of obsolete and worn milling equipment rather than for added milling capacity.

The profitability analysis of alternative facilities is based on the ratio of net profit (after depreciation and assumed annual interest charges of 12 per cent on facilities and 24 per cent on working capital) to the estimated capital cost of the facilities (without considering investment in working capital). The computed net profit used in the ratio assumes full operation, with no adjustment for time of construction nor transition to full operation. While this analysis is less powerful than internal rate of return and other measures based on discounted cash flows, it is adequate for the type of comparison of alternative facilities made in the report. As the authors indicate, the probable minimum acceptable rate of return to Indonesia investors is 12 to 15 per cent.

The rates of return for the various types of feasible facilities as mentioned in the study are summarized in column (3) Table 2. They vary from 15 per cent for the K 1 and K 2 bulk terminals operated at two full shift to 38 per cent for the G-1B self-contained mill with 1920 metric tons of flat storage.

The benefit cost ratios based on grain saved as calculated in the report are summarized in column (4) of Table 2. They are based on calculated yields with the feasible facilities compared to estimated yields under present farm storage and processing. The estimated savings are 4 per cent of the gabah stored, 5 per cent of the grain dried mechanically, 1 per cent of the grain dried on sun pads, 2 per cent of the volume processed by huller mills, 6 per cent of the volume processed by self-contained mills and 9 per cent of the volume processed by multi-stage mills. The benefit cost

ratios shown in Table 2 are based on the discounted present value of these savings over the useful life of the facilities discounted at the annual rate of 24 per cent. The ratios exceed 1.0 for prototypes C-1, G-B, G-1B, H-1, H-3, and H-3C. They are less than 1.0 for all the bulk terminal prototypes.

The benfit/cost ratios based upon "total economic benefits" summarized in column (5) of Table 2 represent an entirely different indicator of feasibility. They are calcualted by discounting the annual net profits before depreciation, interest and income taxes over the useful life of the facility to the equivalent present value at the annual discount rate of 24 per cent. This is a relatively powerful measure of the earning power of total investment in the facilities. The weaknesses of the measure as calculated in the report are that (1) no adjustments are made for the time lags for construction and transition to full operation, and (2) working capital is not included in the total investment figures used to compute the ratios. Consequently, the results are over stated, and the over statement is most serious for the larger facilities, particularly the bulk terminal prototypes. It is probable that the true benefit/cost ratios of direct economic benefit for these facilities may be only slightly more than 1.0 at the 24 per cent annual discount rate (see column (5) of Table 2).

The analysis of the employment effects of the feasible facilities contained in the report is based upon comparison of the alternatives with rice milling by hand pounding. Although the analysis does not purport to reflect indirect employment effects and the total social impact of modernizing rice marketing facilities, it does reflect the direct employment effects in proper prospective. The results are summarized in

TABLE 2. SUMMARY OF ECONOMIC MEASURES FOR FEASIBLE FACILITIES IN INDONESIA

Facility	(1) Radius (km)	(2) Shifts Operated	(3) Rate of Return	(4) B/C @ 24% Grain Saved	(5) B/C @ 24% Economic Benefit	(6) Discounted Cash Flow Equity Ratio	(7) Minimum Alternative Wage (Rp 1000)
(1) Huller Type Mills							
C (no storage)	5	0.5	28%	0.41	2.00	na	32
C-1 (600 T. flat)	10	1.0	23%	1.28	2.26	3.06	19
(2) Self-Contained Mills							
G-1 (920 T. flat)	15	1.0	20%	0.89	2.14	4.34	(7)
G-B (1150 T. flat) (606 T. vertical)	25	1.0	27%	1.17	2.06	5.59	na
G-B3 (Multi-stagemill) (1150 T. flat) (606 T. vertical)	25	1.0	30%	0.95	1.80	6.38	(59)
G-1B (1920 T. flat)	25	1.0	38%	1.19	2.60	7.70	na
(3) Bulk Satellites							
H (3200 T. vertical)	50	2.0	19%	0.80	1.73	4.36	(42)
H1 (4500 T. vertical)	80	2.0	34%	1.04	2.41	6.84	(66)
H3 (4500 T. flat)	80	2.0	24%	1.17	2.07	na	na
H3C (4500 T. flat)	80	2.0	36%	1.08	2.50	7.20	(70)
(4) Bulk Terminals							
K2 (10,000 T. flat)	150	2.0	15%	0.65	1.50	3.16	(14)
K1 (15,000 T. vertical)	225	2.0	15%	0.74	1.45	na	na
K3 (15,000 T. flat)	225	2.0	27%	0.85	1.56	3.43	(43)

the computed minimum annual wage in alternative employment for the rice pounders which is required to make the facilities feasible. For example, the calculated minimum annual alternative wage required to make the prototype C huller mill feasible is Rp. 32,000 per year (column 7, Table 2). The analysis indicates that most of the recommended facilities can be justified even though the alternative earnings of the replaced rice pounders are negative. For example, the prototype G-B3 facility can be justified even if the alternative earnings are Rp-59,000 per year (e.g. if there is no alternative employment, and the annual cost to society of maintaining each displaced rice pounder is Rp 59,000).

The analysis of alternative policies and programs to encourage private investment in modern rice marketing facilities is basically sound and the conclusions are justified. The analysis leads to the conclusion that the most direct and efficient way to stimulate socially desirable private investment in marketing facilities is the manipulation of terms of Government loans in favor of private borrowers. Such terms include (1) the interest rate, (2) the time period of the loan and (3) the percentage of total investment cost that the borrower must provide to obtain the loan. Examples have been developed to show the impacts of these factors on the potential profitability of equity capital provided by the private investor.

The ratios shown in column (6) of Table 2 summarize the impacts of providing construction loans (1) at 12 per cent interest, (2) grace periods equal to the time required to complete construction and bring the facility into operation, (3) a total loan equal to 80 per cent of the cost of the facility and (4) total loan periods equal to the estimated

useful life of the facility. The ratios shown have been computed by the reviewers from figures given in Tables 11.18 to 11.21 of the report. They represent the ratio of the present value of the discounted incoming cash flow to the investor over the life of the facility to the present value of the equity investment made by the investor. The equity investments and incoming cash flows are discounted to the equivalent present values at 24 per cent per year, the assumed opportunity cost of capital.

The discounted cash flow equity ratios illustrate that the feasible facilities can be made attractive to private investors in Indonesia by favorable terms on long-term loans. All of the ratios are substantially greater than 1.0. They range up to 7.2 for the H-3C bulk satellite and 7.7 for the G-1B self-contained mill with 1920 metric tons of flat storage. They appear to be adequate to stimulate private investment into all of the prototype facilities except the bulk terminals.

- Summary Evaluation of Economic Analysis and Findings

The reviewers believe that the analysis and findings with respect to the kinds of rice marketing facilities for Indonesia and the general numbers of facilities that will be needed are dependable. It is believed that they can be used by Indonesia as basis for planning programs for development of a modern rice marketing system.

The Kansas State University Food and Feed Grain Institute does not have the same level of confidence in the analysis and findings with respect to the size, number, type and location of recommended facilities by province. As has been pointed out, this analysis has not been modified from that contained in the preliminary report. We would

strongly recommend that the long-range rice supply and demand projections be redone and up-dated along the lines of our suggestions, and that the transportation model be reformulated and rerun before establishing a master plan for the specific facilities to be developed in each province.

COMMENT ON MAJOR RECOMMENDATIONS

For this report, the reviewers have followed the same sequence used in their review of the "Advance Draft" of the Weitz-Hettelsater study. Comments on Facilities follow the sequence in which rice flows from producer to consumer and are summarized under • Facilities. Comments on recommendations for Government policies and marketing institutions are divided into two areas:

- Supporting Services
- Government Price and Marketing Policy

• Facilities

It should be re-emphasized that in a study such as reviewed here, it is important to keep in mind that the ultimate goal should be to provide a nutritionally adequate diet for the population. The recommendations for facilities and equipment should reflect this goal.

- Farm and First Assembly

Storage Facilities. Storage and marketing of grain starts with the harvest of grain in the field. This problem is recognized in this report. This is an area which will require considerable future investigation considering the dependence of the total system on the farm storage and drying efforts.

The final report still reflects heavy dependence on on-farm storage and drying facilities (see Table 9.11, page 309). Since such a heavy dependence is placed on on-farm facilities, the reviewers feel that more emphasis should have been given to expanding farm drying and storage.

The question regarding the losses incurred by sun drying under various local conditions in Indonesia is not covered and the lack of detailed weather data makes it difficult to estimate this factor. Since added emphasis has been placed on sun drying at new facilities, it would have been desirable if more climatic data, particularly daily relative humidity were available.

The cost of providing storage at the farm or local level is not well treated. The revised recommendations for more and smaller facilities close to farm producer makes adequate farm storage less critical to the function of the over-all marketing system. However, on-farm storage for consumption requires investigation to develop efficient on-farm storage and handling systems.

In the future, large storages may be required at ocean ports. However, the size of the ships which will probably be used for water transport of rice and the amount of rice which they will probably load at one time will be relatively small. It would appear doubtful that it would ever be necessary to have more than a few thousand tons import/export storage in a single port facility at one time.

It is assumed that 400,000 tons of go-down storage capacity will be provided for balancing the total storage capacity needed in 1975. The location, sizing, and cost of go-down storage facilities should be recommended.

In reviewing the final report, significant changes are noted in recommendations for types of storage, drying and processing facilities. Greater emphasis has been placed on warehouse storage of bagged grain as opposed to vertical bulk storage.

Sun drying facilities have been provided at each type of storage and processing facility. Recommendacions include an increased number of smaller scale storage and processing units more widely distributed throughout Indonesia. The reviewers definitely feel this change from the "Advance Draft" report is in the best interest of Indonesian grain storage, processing and marketing system. Rate of return analyses showed the advantage of using smaller scale rice mills with warehouse storage over the 10,000-15,000 MT capacity terminals.

In addition, the use of more and smaller warehouses provides an opportunity for shorter transportation distances from farm to storage in a situation where conditions of transportation are poor.

The problems and costs of transport from farm to first receiving point are generally large in developing countries. Over-all transport and storage costs may be more economical in many areas if a greater number of smaller collection points are built. This storage can also serve to store rice for smaller villages and towns in the immediate area. A relatively large percentage of storage capacity near the point of production assures that the grain inventories will not be out of position.

Bulk versus Bag Handling. In developed countries where mechanical harvesting is practical and where labor costs are high, the economy of bulk handling and storage of grain is well accepted. However, in many areas of the world bag handling is still the best method. Some of the advantages of bag handling are:

(1) Many farmers must store and transport grain in small lots. Bags are very convenient for this purpose.

(2) Grain-tight wagons and truck bodies simply do not exist in large areas.

(3) Grain which is of high-moisture content is probably safer in bags where some air circulation can take place through the pile.

(4) Very frequently the retailer or village market merchanderizer will prefer grain in sacks.

(5) Since grain reaches the commerical channel in sacks and leaves the channel in sacks, the economics of emptying, storing in bulk, and resacking for final sale may not compensate for the possible savings and convenience of bulk storage at only one or two points in the marketing channel.

This report has recognized the importance of bag handling and storage in the over-all grain storage, handling and marketing program in Indonesia.

Drying and Quality Maintenance. The problems of drying and maintaining grain moisture levels for safe storage has not been treated extensively. Climatic data in enough detail to estimate the difficulty of sun drying is lacking. Also, after grain is dried, it will tend to reabsorb moisture to a dangerous level if temperatures and relative humidities are too high.

This report implies or assumes that the farmer can safely dry and store rice in all areas with his present methods; however, this may not be true. The recommendations, in this report, for more and smaller storage, drying and processing facilities is desirable since this places rice drying facilities closer to the point of production.

Perhaps sack dryers should be considered at these facilities in order to provide a better means for maintaining grain quality. If climatic conditions, especially during harvest, for new varieties are taken into account, sack dryers could be advantageous over sun drying.

In prototypes E, F, G, G-B, G-B1, G-B2 and G-B3, the report recommends in-bin drying. We feel a "diesel engine" batch dryer could be recommended for the smaller C-1, G, and G-1 installations. Operation and management of batch-type dryers is less critical than that of bin dryers in maintaining rice quality.

Aeration facilities are provided for all bulk storage without data to show what can or cannot be used advantageously or even safely. Large flat bulk storage facilities recommended for prototypes K-2 and K-3 would be a poor type of storage if aeration cannot be safely used. Large flat bulk storage relies heavily on aeration for keeping grain in good condition.

Operation and Management. The large facilities represent a high degree of technology which will require a high level of personnel competence, availability of supplies and repair parts, and mechanical competence. This has not been shown to exist. In fact, the references to the poor state of repair and use of existing grain storage, grain dryers, and rice mills indicates that this may be one of the greatest problems to be over come in improving the marketing system.

Areas deserving of further consideration before embarking on a project of this magnitude include:

(1) Where can the managerial and supervisory personnel be recruited and what will be their background? Where and at what cost can they be trained in problems of grain storage? Training programs are discussed further in this review in Supporting Services.

(2) The larger facilities will require the services of millwrights, electricians, and other general mechanics. If these trades are not available, how can they be trained?

(3) What repair parts depots will be required to provide the needs of the grain elevators, rice mills, and even trucks?

Without proper consideration of supplying the organization and funding to solve problems of this type, the success of the over-all project will be jeopardized.

- Discussion on an Import Facility for Brown Rice

The necessity for import facilities to handle brown rice is not ascertained at this time; however, the authors have explored the possibility of such a facility and have outlined a scheme for it.

Some items of major concern that the reviewers have regarding such a facility are listed below:

(1) Flat bulk storage is discussed for this type facility which, as pointed out, would serve a dual purpose in that bagged grain could be stored here when not used for brown rice. We have expressed our concern over the use of aeration and flat bulk storage in relation to quality maintenance in a climate such as that in Indonesia. It should also be pointed out that the equilibrium moisture content of brown rice is 14.8 to 14.9% when stored at 80% relative humidity and 20-22 ^{o}C as opposed to 13.8 to 13.9% when stored under the same conditions as rough (paddy) rice.

(2) In general, storage of brown rice is more difficult from the standpoint of preventing deterioration due to insects and/or molds. The hulls of rough rice provide a considerable amount of protection against the invasion of rice by insects and molds.

(3) Although not documented here, it is felt that the quality of the brown rice handled in bulk could also be a factor in determining the quality of the milled rice. Mechanical abrasion of thebrown rice in hulling and handling can result in exposure of the oils in the bran to the atmosphere with resultant oxidative rancidity attendant to off odors and flavors in the product. Deterioration of brown rice as a result of fat oxidation is dependent on methods of processing, handling and length of storage.

- Regional and Terminal Storage

New Facilities. General recommendation for facilities are simple, practical, and adapted to local construction capabilities.

(1) The 613,000 M.T. new storage capacity with milling and drying recommended by the end of 1977 is not in line with solutions presented by models used in the analysis -- Assumption that the balance of storage shown as needed by the models will be provided for by local community storage facilities is not supported by adequate data. As pointed out in the report, seasonal constant support price tends to discourage private development of storage facilities by not allowing a profit incentive for commercial storage, especially at the extremely high inventory financing costs.

(2) Major new facilities recommended. The report does not provide a supporting analysis of specific sizing and location of storage and/or processing facilities. In the absence of this analysis, our reaction to the specific recommendations is based on judgement and the economic analysis of profitability. Authors of the report have, however, indicated that the particular prototypes selected would be based on feasibility studies for the specific locations finally selected. The reviewers want to commend the authors on limiting the number of large size prototypes in favor of of more of the smaller prototypes.

(a) Thirty-one "H" and Modified "H" (H-1, H-2 and H-3C) Type Bulk Satellites (3,200 and 4,500 M.T. Capacity). The basic approach of using a satellite system is good, but in the absence of comparative cost analyses to support bulk handling, the question can be raised as to whether this is the proper time to shift to bulk facilities. The capacity of elements of these 3,200 - 4,500 ton satellites may be minimal. The truck scale would not be optional if a receiving rate of 16 tons per hour is anticipated. Two-truck dumps should be provided if most grain arrives in bags. Two dumps should be provided with separate cleaners, elevators, and working bins before and after the cleaners to keep various grades and varieties separate.

We question the advisability of the flat bulk storage capacity shown for types H-2 and H-3C. As previously mentioned flat bulk storage relies heavily on aeration for maintaining grain quality and it has not been established that aeration is feasible under all areas where these facilities have been recommended. Here benefit/cost ratio is only slightly higher than that of the H-1 prototype with vertical bulk storage and the authors indicate that choice of flat versus vertical bulk storage should be based on factors other than cost/ benefits ratio. It is also estimated in the report that an operating radius of 50-80 Kms is required for these units.

(b) One Hundred Eighty (180) Modified "G" Type (G-1, G-B, G-1B and G-B3) Small Facilities.

The reviewers agree completely with the concept of using a large number of smaller size units dispersed throughout Indonesia to store, dry and process rice. Even though the average variable cost for in-bin drying is lower than that of sun drying, it might be advantageous to consider the "diesel engine" batch drier for G-B and G-B3 prototype installations. In-bin drying, in general, requires greater operating skill in maintaining rice quality. The reviewers also feel that mechanical drying should be included in the G-1B prototype and that a bag-type drier at G-1 installations could be justified in addition to sun drying presently recommended. The reported required trade radius of 15-25 Km appears to be a reasonable range for Indonesia. What provision for weighing grain in and out of this type of facility is proposed? We would expect that platform type scales would be used since grain would be received in bags.

(c) 150 Flat Warehouses for Bagged Storage. Construction costs of the warehouses are much more economical than the bulk terminals and satellites and utilization is more flexible. The reviewers agree completely with the increased number of warehouses for bagged storage of grain throughout Indonesia. The use of smaller capacity units than 3,000 and 5,000 M.T. should be an aid in solving part of the collection and distribution problem. Here again analysis has not been provided for location and sizing of warehouses. This is to be accomplished by separate feasibility studies for each situation.

The utilization of additional flat storage for bagged grain at satellite installations and small G-type units could, as stated, increase the use of available milling capacity. In addition this type of storage will facilitate the handling of grain in local areas where bulk handling is non-existant.

It is assumed that the construction of the flat warehouses would be similar to that of the warehouses

shown in conjunction with the larger mills; i.e. masonary walls and metal roofs. This construction should be satisfactory.

Including mechanical dryer facilities at warehouses used in a village go-down program might be an addition worth considering. Probably some type of equipment for drying rice in sacks would be most practical in order to eliminate the need for emptying and refilling bags.

- The recommendation that $2.44 million dollars be spent for updating existing rice mills appears to be justified. It includes replacing Engelberg hullers with self-contained rice mills which are nearly twice as expensive but improve yield and quality. However, the report analysis shows that the modernized PBK units (prototype C and C-1) are much more profitable at small capacities than the self-contained mills. In addition they have the advantage of being purchased locally. It appears more feasible to replace the 200 ERM and E-P units each year for four years with PBK units rather than the self-contained mills.

  Updating the 50 PBK units each year for four years appears to be sound as is the updating of the 25 CMRM units each year for four years.

- We have no basis to determine whether 251 1-ton pick-up and 313 4-ton new trucks are needed for this program. Existing transportation is provided by the private sector. It is reasonable to assume that some supplemental transportation may be required until privately financed transportation could be provided. The authors base the recommendation for trucks on mills providing 60% of their own transportation. The reviewers feel that this precentage of elevator owned trucks would be competitivie with private transportation and

needlessly duplicate facilities. Probably the most efficient way of getting additional transportation would be to finance private transportation.

- We support the recommendation for the GOI to promote the up-dating and repair of existing warehouses and warehousing procedures.

- Supporting Services

Effectiveness of the various programs will depend on the manner in which they are organized and conducted. The reviewers are in general agreement with the contractor's recommendations for services to support the rice storage and marketing system.

- Establishment of training programs to assure adequately trained personnel for operating new and existing facilities is a necessity. The $3.2 million budget seems to be adequate for training purposes; however, considerable thought must be given to developing and implementing the training programs.

The reviewers feel that two dimensions of training are needed for a program as proposed by the authors. A university training program for managerial and university personnel plus an on-the-job training program for operational personnel. We feel that the budget and program proposed will meet the university training program for university and managerial personnel. We would suggest that time alloted for foreign training of university and managerial personnel be reserved, i.e. 10 man-years for university and 20 man-years for managerial personnel.

The report does not deal specifically with training for the facilities operating personnel, such as mill operators, warehouse-

men, bookkeepers, etc. Most effective type of training for this component of the program would be apprenticeship type training in new facilities as they are developed. This can be programmed with the programming of construction of new facilities. Emphasis should be given to several months' on-the-job training in local areas under capable and experience supervision.

- Establishment of a marketing extension service is certainly needed. In addition, the marketing extension services should be closely coordinated with the training and technical services programs. The building of a marketing extension program is a major undertaking and $1.6 million over a four-year period is certainly none too much for training extension workers, organizing offices, and implementing educational programs over the entire country.

- The Weitz-Hettelsater report recommends $20 million for a revolving fund to finance additional working capital, starting in 1974. The figure is based on 50 percent of the value of the estimated average rice inventories in the recommended new facilities. No evaluation is made of the availability of short-term loans from the private banking industry in Indonesia. The economic analysis does show that if favorable terms are given on long-term loans to finance the new facilities, private borrowers can pay prevailing interest rates on working capital loans and still operate the new facilities profitably. The reviewers agree that additional funds will be needed for financing inventories to support the recommended program, but believe that a large percentage of these funds may be

available through private banks in the country. Perhaps $10 or $12 million in additional funds through an outside loan would be enough to supplement available local short-term loan funds. Consideration should be given to extending credit funds to farmers and existing storage operations in addition to rice mills. The recommended $20 million (to start in 1975) should not necessarily be tied to recommended new facilities.

Establishment of a long-term rice storage and marketing research program is advisable. In addition, we feel short-term rice marketing research programs, such as studies on go-down-versus-larger storage, bulk-versus-bag handling, and collection of data needed for planning farm-to-regional marketing systems, should be initiated immediately. Financing the recommended research should be an integral part of the contractor's total recommended program. Based upon an Research and Development budget of 1% of sales (about normal for industries of this type) about $8 million for the four-year period should be allocated. Proper research is necessary to insure the success of the future rice marketing program in Indonesia.

The reviewers agree with the need and recommended procedures to improve the existing marketing news system for rice and other major crops. Incorporation of livestock news with the existing crop reporting system would serve to stimulate an interest in production of livestock and should be encouraged. Adding other crop and livestock data should not proportionately increase costs.

- Development of a grading system for rice is a necessity for orderly marketing. We agree with the recommendations of the contractor and emphasize that development of the grading system be given priority as one of the first steps in improving rice marketing in Indonesia. The recommended $285,000 over a four-year period, is adequate only for starting a program.

- In addition, a detailed weather data collecting and reporting system throughout Indonesia should be provided. This information will serve not only grain producers but also grain processors and storage operators in the effective design and scheduling of drying, aeration, and handling operations.

- Government Price and Marketing Policy

The recommendations concerning the Government programs and rice pricing policies need to be evaluated carefully. Without the full background knowledge and understanding of the ramifications for Indonesia, the reviewers are not in position to provide a full evaluation. However, questions can be raised regarding certain of the policy recommendations, while others appear to be sound on the basis of the information presented in the report.

- Uniform Price Supports. The recommended uniform price support level throughout Indonesia is debatable and needs to be evaluated on the basis of probable production responses. As the report suggests, if marketing prices remain close to support levels, the uniform support price may restrict or dampen price differentials which reflect economic differences in location, quality, and seasonality. Without geographic price differences, grain transport

cannot be self-supporting. Without seasonal price differences, grain storage (without associated milling) cannot be self-supporting. Drying, cleaning, and blending cannot be self-supporting without price differentials for quality. If there are not adequate differentials in the market prices at both the farm level and the consumer level then either (1) the rice milling margin must be wide enough to offset part of the costs of transport, storage, and conditioning, or (2) some of the rice marketing costs will have to be subsidized by the Government in one way or another.

- Marketing Margin. The recommendations to maintain support prices at present levels and increase the retail ceiling price in order to increase marketing margins appears to be valid on the basis of supporting data provided in the report. Marketing margins must be adequate to provide an anticipated return on investment in order to induce private millers and handlers to invest in the needed improvements in the marketing system. The recommended uniform ceiling price over the country can be questioned on the same grounds as the recommended uniform farm support price.

- Distribution of Rice to GOI Employees. The recommended phasing out of this practice by BULOG seems to be sound on the basis of the information presented. Both the BULOG rice marketing program and the public servant programs can be evaluated more effectively in relation to costs if they each stand on their own. The recommended increase in prices charged by BULOG to military and civil servants during the phase-out period appears to be warranted on the basis of marketing costs and competitive market prices.

In fact, there seems to be evidence to indicate the recommended price increase of Rp. 1 to 2 per kilogram may be low, especially if the retail ceiling price is raised by Rp. 2 to 4 per kilogram.

- Regional Restrictions on Rice Movements. The recommendations to remove the artificial regional restrictions on rice movements certainly is economically sound if it can be done. Such restrictions impede the normal market flows and add to the costs and problems of marketing rice in Indonesia. The amount of the added marketing costs caused by these restrictions could be determined quite accurately with the transportation model formulation recommended by the reviewers in Transportation Model Formulation section.

- Utilization of Grain By-products. In the body of the report (6.5.3 and Appendix IV) the contractor has recommended policies to develop the livestock industry by using grain by-products. The reviewers strongly support this type of recommendation. There are three major sources of benefit which could be derived by use of the grain by-products. First, a reduction in rice milling and marketing costs through recovery of revenue from the by-products can be realized. Secondly, the elimination of a major economic waste by failure to utilize a substantial portion of the rice grain. And thirdly, the improved conversion of forages into marketable livestock products and animal power.