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

FOR AID USE ONLY
Batch 70

1. SUBJECT CLASSIFICATION

A. PRIMARY
Food production and nutrition — AE70-0150-G662

B. SECONDARY
Distribution and marketing--Indonesia

2. TITLE AND SUBTITLE
Rice storage,handling and marketing

3. AUTHOR(S)
(101) Weitz-Hettelsater Engineers,Kansas City,Mo.

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1972	66p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Weitz

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(Executive summary

9. ABSTRACT

10. CONTROL NUMBER
PN-AAE-502

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Indonesia
Marketing
Rice
Storage

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/ea-122 GIS

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AE/ea - 122 GTS
PN-AAE-502

WEITZ

EXECUTIVE SUMMARY

OF

ECONOMIC & ENGINEERING STUDY

RICE STORAGE, HANDLING AND MARKETING

THE REPUBLIC OF INDONESIA

SPONSORED BY

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT

OCTOBER, 1972
(DATA COLLECTED NOV. 70 — MAY 71)

WEITZ-HETTELSATER ENGINEERS

A DIVISION OF THE WEITZ COMPANY, INC.
427 WEST 12TH STREET
KANSAS CITY, MISSOURI 64105, U.S.A.

TABLE OF CONTENTS

Title	Page
List of Tables, Figures, and Drawings	ii
Preface	iii

*

1.	The Importance of Rice	1
2.	Solving Marketing Problems	1
3.	Demand for Rice	2
4.	Supply of Rice and the BIMAS Program	4
5.	National Supply and Demand Balances	6
6.	Regional Supply and Demand Balances	9
7.	Existing Transportation Facilities	11
8.	Existing Mechanical Driers	14
9.	Existing Rice Mills	14
10.	Existing Warehouse Storage for Rice	15
11.	Need for New Milling Capacity	15
12.	Need for New Storage Capacity	18
13.	Description of New Storage and Processing Facilities	18
14.	Profitability of New Storage and Processing Facilities	21
15.	Annual Income Statement of New Rice Facilities	22
16.	Benefit/Cost Ratios for New Facilities	26
17.	Economics of Rice Drying	29
18.	Benefit/Cost Ratios for Mechanical Driers	31
19.	Using Price Policies to Encourage Private Investment in New Rice Facilities	33
20.	Import Duties and Tax Policies	35
21.	Credit Policies	35
22.	Cash Flow Statement for Storage and Processing Facilities	37
23.	Effect of Interest Rates and Loan Periods	39
24.	Effects of Inflation	41
25.	Need for Working Capital	42
26.	Programs for Improving the Rice Marketing System	43
27.	A Phased Construction Program for New Facilities	43
28.	Value of the New Rice Facilities Program	46
29.	Complementary Investment Programs	47
30.	An Import Facility for Brown Rice	47
31.	Training Program	49
32.	Technical Services Program	50
33.	Marketing Extension Program	50
34.	Market News Program	51
35.	Grades and Standards Program	52
36.	Marketing Credit Program	52
37.	Implementing the Rice Marketing Programs	52
38.	Implementing the Construction Program	53
39.	Consulting Engineer for the Construction Program	53
40.	Encouragement of Private Investment in New Facilities	55
41.	Implementing Other Marketing Programs	56
42.	Cost Summary for the Marketing Programs	57
43.	Blending Capital Investment and Training Programs	59

* * *

LIST OF TABLES

Title and Table Number		Page
1-S	Medium Projections of Effective Demand for Rice, Indonesia, by Provinces, 1970-1980	3
2-S	Medium Projections of Rice Supplies, Indonesia, by Provinces, 1970-1980	7
3-S	Regional Rice Surplus and Deficits, Indonesia, by Provinces, 1970-1980	12
4-S	Milling Capacity Required by Provinces, Indonesia, 1975	17
5-S	Projected New Storage Facilities Needed by Provinces, Indonesia, 1975	19
6-S	Annual Income Statements for New Storage and Processing Facilities, Indonesia, 1975	24
7-S	Economic Benefits of New Storage Facilities, Indonesia, 1975	28
8-S	The Costs and Benefits of Small Mechanical Driers, Indonesia, 1975	30
9-S	Cash Flow Statement for Self-Contained Mills and Bulk Storage Facilities, Indonesia, 1975	36
10-S	Effect of Interest Rates and Loan Periods on Net Cash Flows, Indonesia, 1975	38
11-S	Storage and Processing Capacity Provided by the Phased Construction Program, Indonesia, 1975-1977	44
12-S	Summary of Program Cost Estimates, Indonesia, 1973-1977	58
11.7	Comparative Technical Specifications of Services Offered in Each of the New "Basic" Facilities and "Modified" Facilities, Indonesia, 1975	413*

LIST OF FIGURES

Title and Figure Number		Page
1-S	Supply and Demand Projections for Rice, Indonesia, 1970-1980	10
12.1	Location of New Facilities by Provinces, Indonesia, 1975-1977	487*

LIST OF DRAWINGS

Title and Drawing Number		Page
03	Self-Contained Rice Mill (JRMU), Vertical Storage (Prototypes E,F and G)	335*
03A	Self-Contained Rice Mill (JRMU), Flat Storage (Prototype G-1)	337*
04	Bulk Satellite, Vertical Storage (Prototypes H and H-1)	339*
04A	Bulk Satellite, Flat Storage (Prototypes H-2,H-3 and H-3C)	341*

* * *

* denotes that these tables, figures and drawings were taken from the main report entitled: Rice Storage, Handling and Marketing: The Republic of Indonesia, Economic and Engineering Study, Weitz-Hettelsater Engineers, K.C., Mo. U.S.A. (October 1972), and have been repeated in this "Executive Summary" for the reader's convenience. Figure 12.1 follows page 46 in the Summary; Table 11.7 and Drawings 03, 03A, 04, and 04A follow page 20 in the Summary.

PREFACE

Indonesia's first Five-Year Development Plan, begun in 1969, was designed to achieve a gross national Product (GNP) of about five percent annually. The Plan's investment targets placed major emphasis on agricultural development in an effort to exploit fully the potential benefits of the "Green Revolution."

Recognizing the crucial role of rice in the success of the Development Plan, on September 1970, the United States Agency for International Development, acting on a request made by the Government of the Republic of Indonesia, retained the Weitz-Hettelsater Engineers as consultants to make a study of rice storage, handling, and marketing in Indonesia. The main objective of this study was to prepare a plan for developing the institutions and physical facilities required to assure the efficient storage, handling, marketing, and distribution of rice during the next decade.

The resulting final report, published in October 1972, is a lengthy, highly technical document. The most important information, conclusions and programs contained in the final report are outlined in this "Executive Summary." The Summary's purpose is to provide decision makers in Indonesia, those with international development agencies, and others, with basic information pertinent to Indonesia on:

(a) what has been happening to rice production and marketing;

(b) what is expected to happen during the next ten years;

(c) the types of programs and facilities that would help Indonesia improve its marketing system; and

(d) the cost of new facilities and market improvement programs and their value to the nation.

Projections of rice supplies and demands are presented first in this "Summary." Estimates of the amount of new storage and processing facilities are developed next. This is followed by a discussion of the cost of new facilities, their expected profitability and estimates

of their value to the nation. Alternative policy actions for encouraging private investment in new facilities are analyzed. A set of inter-related programs to provide the new facilities and trained personnel required for improving Indonesia's rice marketing system is then outlined and general procedures for implementing these programs is discussed.

Those persons who need additional information on the methodology, basic assumptions, and cost estimates should refer to the main report entitled: Rice Storage, Handling and Marketing: The Republic of Indonesia, Economic and Engineering Study, Weitz-Hettelsater Engineers, Kansas City, Missouri, U.S.A., October 1972.

* * *

EXECUTIVE SUMMARY

Indonesia possesses the potential for mounting and sustaining a successful drive toward economic development. The essential ingredients of this potential are Indonesia's industrious people, substantial natural resources, and progressive leadership.

Beginning in 1966, the Government of Indonesia charted and began to implement a long-range development program. Inflation control measures were initiated. External debts were renegotiated in terms of more realistic payback potential. Capital investments were undertaken to build a productive base for economic progress; and new priorities were established for increasing agricultural productivity.

1. The Importance of Rice

Rice was assigned a crucial role in the success of Indonesia's development program. The new high yielding rice varieties provided a unique opportunity to increase rice production rapidly. Total rice production increased by 24 percent between 1967 and 1970. It was obvious that the production problems associated with the "Green Revolution" could be solved. Indonesian rice growers quickly learned to use the new rice varieties and improved production techniques. The increased production began to intensify marketing problems and it was recognized that these problems had to be solved if the rapid increase in production was to continue.

Production problems usually are easier to solve than marketing problems. Farmers are the key to solving production problems. Given production credit, technical assistance and price incentives, progressive farmers will adopt new production technology quickly. The increased use of improved seed, fertilizer and pesticides involves a short-run investment which is paid back rapidly.

2. Solving Marketing Problems

The solutions to marketing problems require the understanding and

cooperation of all parties involved in the marketing process; farmers, merchants, government officials, and consumers. Many of the marketing problems cannot be solved without substantial investments in transportation and in storage and processing facilities. Such facilities require time to plan, finance, and construct. They will prove to be worthwhile investments only if they are supported by price policies, training programs, and marketing institutions designed to insure that they are utilized fully. Most of Indonesia's marketing problems will require many years to solve. Approximately 25 percent of Indonesia's rice enters commercial marketing channels. The rest is consumed on the farm; although an increasing amount of rice is being milled off-farm for on-farm consumption. As rice production increases, the percentage of rice marketed will increase also. The rate of increase in the amount of rice marketed is expected to be greater than the rate of increase in rice production. Suppose, for example, that a farmer has been producing one ton of rice; consuming 75 percent (750 kilograms) and marketing the other 25 percent (250 kilograms). If his production doubles, he will consume more rice. His family's total consumption may increase to one ton; leaving one ton of rice to be marketed. Rice marketings will quadruple. The load on the marketing system will be four times as great as before; requiring four times as many godowns, trucks, and mills. If the marketing system does not expand more rapidly than total production, the result will be lower farm prices and smaller increases in rice production.

3. Demand for Rice

The demand for rice depends primarily on total population. The results of the 1971 Census of Population indicated that Indonesia had a total population of about 119 million persons. Java and Madura accounted for about 64 percent of this total. The average annual rate of population growth during the 1960's was about 2.4 percent. The annual population growth rate for the outer provinces was slightly higher than that for Java and Madura.

Indonesia's total population is expected to be in the range of 128 to 136 million by 1975. Total population in 1980 is projected to be between 143 and 154 million.

Average per capita rice consumption in 1970 was approximately 98.6 kilograms per year. If per capita income increases by 2.5 percent annually, the average per capita rice consumption would increase to about

TABLE 1-S

MEDIUM PROJECTIONS OF EFFECTIVE DEMAND FOR RICE[a]

INDONESIA, BY PROVINCES, 1970-1980

Province	1970 Population	1970 Consumption Per Capita	Base Year 1970	1975	1980
	(1,000)	(kg/yr)	(1,000 tons)		
West Java	20,683	110	2,275	2,732	3,259
Djakarta	4,304	125	538	646	771
Central Java	21,262	80	1,701	2,044	2,438
Jogjakarta	2,439	70	171	205	243
East Java	24,812	80	1,985	2,384	2,846
JAVA/MADURA	73,500	90.6	6,670	8,011	9,557
Atjeh	1,924	150	290	350	442
North Sumatra	6,400	132	840	1,018	1,225
West Sumatra	2,704	132	360	435	523
Riau	1,539	132	200	243	292
Djambi	977	132	130	158	190
South Sumatra	3,339	132	440	533	643
Bengkulu	545	132	70	85	101
Lampung	2,663	100	270	328	395
SUMATRA	20,091	129	2,600	3,150	3,791
West Kalimantan	1,758	140	250	303	364
Central Kalimantan	720	140	100	120	144
South Kalimantan	1,647	140	230	278	334
East Kalimantan	673	140	90	109	131
KALIMANTAN	4,798	140	670	810	973
North Sulawesi	1,647	88	140	169	202
Central Sulawesi	897	88	80	95	114
South/S. E. Sulawesi	5,907	88	520	628	755
SULAWESI	8,451	88	740	892	1,071
Maluku	1,061	18	20	25	30
West Irian	933	18	20	25	30
MALUKU/ WEST IRIAN	1,994	18	40	50	60
Bali	2,065	100	206	249	300
West Nusa Tenggara	2,154	100	215	260	314
East Nusa Tenggara	2,235	100	224	271	325
BALI/NUSA TENGGARA	6,454	100	645	780	939
OUTSIDE JAVA/MADURA	41,788	112.5	4,695	5,682	6,834
INDONESIA	115,288	98.6	11,365	13,693	16,391

a/ Source: Table 8.4, Rice Storage, Handling And Marketing, The Republic Of Indonesia, Weitz-Hettelsater Engineers, October, 1972.

107 kilograms in 1975 and 114.5 kilograms by 1980. Using these estimates of per capita consumption and the previous population projections, total rice consumption at constant prices would be in the following ranges:

Consumption Projection	1975	1980
	(million metric tons of rice)	
Medium Consumption	13.7	16.4
High Consumption	14.5	17.6

Actual consumption could be as much as 10 percent above or below the projected values.

There are substantial differences in per capita rice consumption between regions. Annual per capita consumption in North Sumatra, for example, is estimated to be about 132 kilograms compared to only 18 kilograms in Maluku where sago is the main food. The regional differences in per capita rice consumption are partly due to differences in tastes and partly to differences in the relative prices of substitute foods.

The medium consumption projections for 1975 and 1980 are shown by province in Table 1-S. Java and Madura account for about 58 percent of the total projected demand. Sumatra is the second largest consumption region, accounting for 23 percent of total consumption.

4. Supply of Rice and the BIMAS Program

Nearly all of the rice produced in Indonesia is grown on small farms. Farms of less than 2 hectares in size account for about two-thirds of the total rice area cultivated. About 75 percent of the rice is produced on wet or partly wet fields. The seasonality of production varies between provinces depending on the climate, soil conditions, and the supply of irrigation water. The new rice varieties are changing seasonal production patterns in many areas.

In recent years, the Government of Indonesia has promoted the use of improved seed, fertilizer, pesticides, proper irrigation practices, and modern cultivation methods as a means of increasing farm income and attaining self-sufficiency in rice production. About 25 percent of the rice hectareage was under the Government's mass guidance rice

intensification (BIMAS) program in 1970.

Under the BIMAS program, the government affects the profitability of rice production in several ways. First, it controls the price of rice. Second, it subsidizes the price of fertilizer. Third, it provides low cost credit for the purchase of inputs. Fourth, it subsidizes irrigation water from government systems. Fifth, it supports research, extension programs, and other projects that backstop the BIMAS program.

The extent to which farmers benefit from a given level of subsidization of inputs depends on the level at which the farm price of rice is controlled. The trade-off possibilities between the farm price and the subsidization of input prices are obvious. An increase in the farm price of rice, for example, could be used to offset the effects of higher fertilizer prices. Regional differences in the combinations of subsidies and price supports could be used to obtain different distributions of benefits among farmers.

The availability of bank credit has been an important factor in the BIMAS program. The imports of fertilizer and pesticides sold by the P.N. Pertani agency are financed from bank credits. The Logistical Affairs Board (BULOG) used an estimated Rp. 65,426,000,000 (or US$172,173,684[1/]) of bank credits in 1970 to finance its payments to BIMAS Gotong Rojong contractors[2/], to import rice and to pay for domestic rice procurements. Loans to farmers in 1970, including loans under the BIMAS Gotong Rojong program, were estimated to be about Rp. 17,318,000,000 (or US$45,573,684). In total, an estimated 23 percent of all bank credit was used for various aspects of the BIMAS program in 1970.[3/]

The terms on which production credit has been available have been a strong incentive for farmers to participate in the BIMAS program. The rate at which rice production can be increased in the future will depend to a large extent on the Government's ability to finance the BIMAS program.

The high, medium, and low projections of rice production presented

1/ The exchange rate used throughout this report is US$1.00=Rp. 380 or Rp.100=US$0.263.
2/ The BIMAS Gotong Rojong program was a rice intensification strategy in which foreign private contractors were involved in the supply and distribution of inputs such as fertilizers and pesticides.
3/ Orlando J. Sacay, Study and Evaluation of Rice Production Programs in Indonesia, 1961-1970. Team Leader, the Agricultural Executives, Inc. Manila, Philippines (Draft Report, dated June 10, 1971).

below are based on different sets of assumptions concerning the future effects of the BIMAS program.

Production Projection	1975	1980
	(million metric tons of rice)	
Low	13.2	15.3
Medium	13.9	16.5
High	14.9	18.3

The 1975 medium projections, for example, are based on the assumption that 2,865,000 hectares of new rice varieties will be grown with an average yield of 42.7 quintals per hectare, and that another 6,146,000 hectares of land will be planted to rice with an average yield of 25.2 quintals. The 1980 medium projections are based on the same yields as the 1975 projections, but total hectareages planted to rice is estimated to be 9,820,000 of which 4,910,000 hectares are expected to be technified. In other words, the medium projections for 1975 and 1980 are based on the assumption that approximately 32 percent and 50 percent respectively of the rice hectareage will be in high-yielding rice varieties. These are feasible objectives, but their attainment will require a continued commitment to the BIMAS program.

The regional locations of total production based on the medium projections are shown in Table 2-S. Java and Madura account for about 53 percent of total output. The provinces of Sumatra account for 25 percent. Sulawesi, is the third most important production region and is expected to account for about 9 percent of total production by 1975.

5. National Supply and Demand Balances

Indonesia has the potential to become self-sufficient in rice production by the middle of the decade. To do so will be costly. The BIMAS program will have to be expanded. Continued efforts will be needed to support the farm price of rice at, or above, existing levels. Substantial investments in new and improved marketing facilities will be necessary.

A reduction in rice imports would improve Indonesia's balance of trade over the long run. It also would reduce the government's ability to support the rice intensification program. Most rice imports presently are purchased by the Government of Indonesia and financed with long-term

TABLE 2-S

MEDIUM PROJECTIONS OF RICE SUPPLIES[a/]
INDONESIA, BY PROVINCES, 1970-1980

Province	1970	1975	1980
	(1,000 metric tons of rice)		
West Java and Djakarta	2,371	2,982	3,396
Central Java and Jogjakarta	1,649	2,132	2,437
East Java	1,693	2,287	2,853
JAVA/MADURA	5,713	7,401	8,686
Atjeh	396	502	589
North Sumatra	896	1,199	1,416
West Sumatra	414	618	739
South Sumatra	341	433	523
Lampung	222	293	386
Bengkulu	108	122	145
Riau and Djambi	281	292	352
South Kalimantan	252	338	435
Other Kalimantan	374	378	391
South/S. E. Sulawesi	824	1,143	1,352
Other Sulawesi	155	155	175
Bali and Lombok	502	642	774
Other Provinces	75	365	546
OUTSIDE JAVA/MADURA	4,840	6,480	7,823
INDONESIA	10,553	13,881	16,509

a/ Source: Tables 8.10 and 8.11, Rice Storage, Handling and Marketing, The Republic of Indonesia. Weitz-Hettelsater Engineers, October, 1972.

loans at low interest rates. This rice is sold to BULOG at about Rp. 40 per kilogram. When several hundred thousand tons of rice are imported each year, these sales add a substantial amount to government revenues. As rice imports are reduced, alternative revenue sources will have to be developed or government programs will have to be reduced.

The problems and costs of becoming a rice exporter need to be considered carefully in the decision as to whether or not Indonesia should become self-sufficient in rice production. The relevant question is not: "Can self-sufficiency be attained?" It is: "Do the benefits of self-sufficiency exceed the costs?" The answer to this question will have a substantial impact on future supply and demand balances.

The differences between the various projections of consumption and production are summarized below:

	Projection of:		Supply minus Demand	
	Supply	Demand	1975	1980
			(million metric tons of rice)	
(1)	Low	Medium	(-0.5)	(-1.1)
(2)	Medium	Medium	0.2	0.1
(3)	High	Medium	1.2	2.0
(4)	Low	High	(-1.3)	(-2.3)
(5)	Medium	High	(-0.6)	(-1.1)
(6)	High	High	0.4	0.7

Note: Figures in parenthesis () show imports.

The present (mid-1972) rice situation appears to be consistent with the medium supply and high demand projections. If this situation is projected to 1975, approximately 600,000 tons of rice imports would be required in order to keep relative prices at existing levels. Under the medium supply and medium demand projections, there would be 200,000 tons of rice available for export in 1975.

It is the opinion of the Rice Marketing Study Team that the medium supply projections are most likely to apply to the 1970-1980 period. Actual production may differ from the medium supply projections in any particular year by as much as 600,000 to 800,000 metric tons depending on weather conditions and the level of support for the rice intensification program. Total rice consumption is expected to be between the medium and

high demand projections. Actual consumption may vary by as much as 200,000 to 400,000 tons annually depending on changes in the price of rice relative to other carbohydrate foods. Based on these expectations, Indonesia could export 100,000 to 200,000 tons of rice annually by the middle of the decade. It seems likely, however, that annual rice imports of 200,000 to 500,000 tons may be required during most of the next four to five years. The closeness of the supply and demand situation during the next five years is readily apparent from Figure 1-S.

6. Regional Supply and Demand Balances

The location of production and consumption areas, the seasonality of production and the availability of transportation facilities are the main factors determining regional trade patterns. In the past, few provinces have been consistently surplus or deficit areas. Net out-shipments from any given province seldom have been very large. The largest in-shipments were to Djakarta.

The continued growth of urban areas, changes in the seasonality of production, differences between regions in their ability to utilize new rice varieties, and improved transportation facilities are expected to alter trade patterns during the next decade. Using the medium productions of consumption and production, total rice shipments, including imports, would increase slowly between 1970 and 1975. During this period rice imports would be replaced gradually by domestic production. Total in-shipments to Java and Madura would fall while in-shipments to Kalimantan would increase. Out-shipments from other production areas would increase. Production increases in Java and Madura would reduce total rice deficits of this region by 347,000 tons. Some rice would be available for export from parts of Sumatra and Sulawesi.

Between 1975 and 1980, rice shipments are expected to increase by about 175,000 tons annually.[4/] Total in-shipments to Java and Madura would increase. The demand for rice in the last half of the decade is expected to increase faster than production in West Java, Djakarta, Central Java, and Jogjakarta. Most provinces with rice surpluses (deficits) in 1975 are expected to have even larger surpluses (deficits) in 1980. The main exception is East Java which is expected to have a net surplus of rice by 1980. The deficit in West Java and Djakarta is expected to

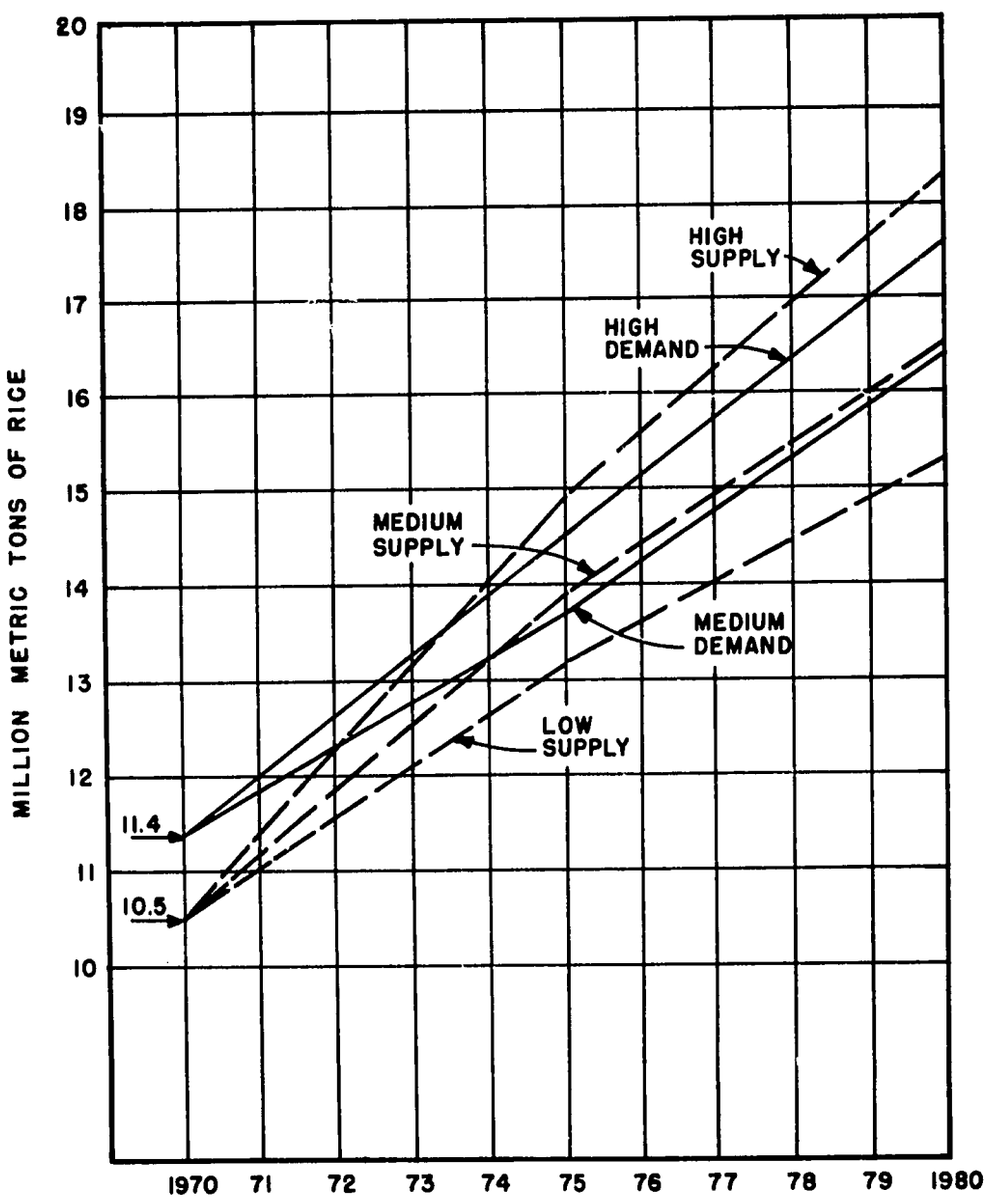
4/ This estimate is based on the medium projections of production and consumption.

FIGURE I-S

SUPPLY AND DEMAND PROJECTIONS FOR RICE

INDONESIA,

1970 - 1980



SOURCE: CHAPTER 8, RICE STORAGE, HANDLING AND MARKETING IN THE REPUBLIC OF INDONESIA, WEITZ - HETTELSATER ENGINEERS, OCTOBER, 1972

increase by 60 percent during the 1975-1980 period. This is due primarily to the growth of population and income in Djakarta. Some rice will still be available for export from parts of Sumatra and Sulawesi in 1980. Projected rice surpluses in North Sumatra would move to Djakarta and West Kalimantan. The surpluses in South Sulawesi would move to Djakarta, and Jogjakarta, as well as to Central and East Kalimantan. Most of the surplus production in Bali and West Nusa Tenggara would move to Jogjakarta.

The estimates of regional rice balances based on the medium projections of consumption and production are shown in Table 3-S. Atjeh, North Sumatra, West Sumatra, and South Sulawesi are the key surplus provinces in 1975. These are also the provinces in which the government's rice marketing and price policies will be especially important factors in affecting rice production during the next five years. Additional storage and processing facilities will be needed in South Sulawesi, for example, to enable the government to support the farm price of rice. If the farm price cannot be supported, the projected rice surpluses will not materialize. This applies to the other surplus provinces as well. Rice growers do not produce surpluses unless they can sell them at profitable prices and profitable prices cannot be maintained unless adequate storage, processing, and transportation facilities are available.

7. Existing Transportation Facilities

Transportation is one of the most troublesome bottlenecks in Indonesia's marketing system. The largest transportation problem is the need to rehabilitate and up-grade the existing road system. There are about 85,000 kilometers of highways in Indonesia. Nearly 40 percent of all roads are dirt roads. Only 2 percent of all roads can handle trucks with axle loads of over 5 metric tons and about 75 percent are limited to 2 tons or less.

The condition of roads varies considerably between provinces. About 80 percent of the government and provincial roads in South Sulawesi are damaged. There are some good bituminous surfaces on the national highways in North Sumatra, West Sumatra, and Lampung. In Java and Bali, the majority of the national and provincial roads have an asphalt surface, but are frequently in poor condition due to lack of maintenance. Flooding causes serious road maintenance problems in West and South Kalimantan.

The deterioration of the highway system has restricted Indonesia's

TABLE 3-S

REGIONAL RICE SURPLUSES AND DEFICITS[a]

INDONESIA, BY PROVINCES, 1970-1980

Province	1970	1975	1980
	(1,000 metric tons of rice) Surplus (+) or Deficie (-)[b]		
West Java and Djakarta	-442	-396	-634
Central Java and Jogjakarta	-223	-117	-244
East Java	-292	-97	+7
JAVA/MADURA	-957	-610	-871
Atjeh	+106	+152	+169
North Sumatra	+56	+181	+191
West Sumatra	+54	+183	+216
South Sumatra	-99	-100	-120
Lampung	-48	-35	-9
Bengkulu	+38	+37	+44
Riau and Djambi	-49	-109	-130
SUMATRA	+58	+309	+361
South Kalimantan	+22	+60	+101
West Kalimantan	-48	-112	-169
Central Kalimantan	-10	-26	-45
East Kalimantan	-8	-16	-34
KALIMANTAN	-44	-94	-147
South/S. E. Sulawesi	+304	+515	+597
North/Central Sulawesi	-65	-109	-141
SULAWESI	+239	+406	+456
Bali and West Nusa Tenggara	+81	+133	+160
Other Provinces	-189	+44	+159
INDONESIA	-812	+188	+118

a/ Source: Tables 8.4, 8.10 and 8.11, Rice Storage, Handling and Marketing, The Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972

b/ Estimates are based on the medium projection of consumption and production.

development. The government is taking action to correct this situation. Work is underway in Sumatra, Java, Nusa Tenggara, and South Sulawesi to rehabilitate roads and to up-grade the highway system as well as to improve road maintenance procedures. A few new roads are under construction in South and Southeast Kalimantan.

There were approximately 299,000 cars, buses, and trucks in Indonesia in 1967. About 70 percent of the total vehicles were on the island of Java. It is estimated that between 20 and 40 percent of the vehicles are usually inoperative because they lack tires and spare parts. Truck operators frequently are an important market outlet for small producers. When trucks are in short supply, transportation costs are increased and farm prices are reduced.

Inter-island shipping is an essential part of Indonesia's transportation system. The total tonnage of commercial vessels in 1969 was about 1,675,000, including oil tankers operated by the P. N. Pertamina group. Commercial vessels engaged in inter-island shipping account for about 43 percent of the total tonnage. The physical condition of the commercial fleet is poor. It has been estimated that 20 percent of the private fleet was inoperable in 1968.

Indonesia has 299 ports. Over half of these are used primarily by coastal vessels engaged in local shipping. Port improvements have been given high priority by the government. The major problems faced by port authorities are the silting of harbors, lack of port services, lack of maintenance of facilities, and the slowness of ship clearance procedures. The solution to these problems will require the close cooperation of private companies, labor groups, and government agencies over a long period of time.

Railroads play only a moderate role in Indonesia's total transportation network. Java is the only island with an extensive rail system. Sumatra has four separate systems, but no connecting railway links. The entire railroad system consists of about 7,100 kilometers of trackage. Most of the track, roadbed, and bridges are in poor repair. About 60 percent of the rolling stock is over 40 years old.

The freight rates for shipping rice by rail are considerably less than the rates for truck shipments. Less rice is being shipped by rail each year, however, because losses are higher than those for truck shipments, time in transit is longer for rail shipments, and the delivery dates of rail shipments frequently are unpredictable. The railroad on

Java carried 400,000 tons of rice in 1960 and only 85,000 tons in 1968. Similarly, in North Sumatra, the railroad carried about 250,000 tons of rice in 1960 and only 48,000 tons in 1969.

8. Existing Mechanical Driers

There are about 873 small batch-type driers and 7 continuous-flow driers located throughout Indonesia. About 69 percent of these are located in Java. Very few of the existing mechanical rice driers are in operation. The total potential capacity of the existing driers is about 250 tons of gabah (rough rice) per hour assuming that the moisture content is to be reduced from 20 down to 14 percent. The higher cost of mechanical drying frequently is cited as the reason for not using mechanical drying. Many of the existing small batch-driers are not used, however, either because millers lack adequate operating instructions or because parts are missing and cannot be replaced readily.

9. Existing Rice Mills

Presently, there are four main types of rice mills commonly used in Indonesia. The multi-stage rice mills (MSRM) consist of a set of individual machines which commonly include a husker, separator, cleaner, polisher, and accessories such as conveyors and elevators. The small self-contained rice mills (SCRM) carry out the operations of husking, separating, cleaning and polishing within a single (self-contained) processing unit. These mills are characterized by their light construction and compactness. Engleberg type hullers (ERM and EP units) are used as huskers and polishers. The Penggilingan Beras Ketjil (PBK) units are small rice mills consisting of flash-huskers and Engleberg type huller/polishers. If required, a thresher is also used at these mills.

The Engleberg type hullers are the most common type of rice milling units in use. There were over 11,000 of these units in operation in 1971. The potential installed milling capacity of the 16,300 rice mills "recorded" in 1971 was approximately 6,888,000 tons of milled rice output per year. Engleberg type hullers accounted for about two-thirds of the total milling capacity. Approximately 95 percent of the "recorded" milling facilities were privately owned.

It has been estimated that about one-third of the installed milling capacity is utilized for commercially marketed rice. In recent years,

there has been an increasing amount of rice processed off-farm for on-farm consumption. This rice never enters commercial marketing channels, but it does increase the utilization levels of existing mills.

There are many reasons why particular facilities may be operated at less than full capacity. Some mills are in a poor state of repair and spare parts frequently are difficult to obtain. Most mills have only limited storage capacity and operate only when farmers are marketing rice. Mills with storage capacity frequently are unable to obtain working capital at low enough interest rates to fully utilize their milling (and storage) capacity. Increasing the amount of working capital available to rice processors and lowering the interest rates would help the larger rice mills increase their level of capacity utilization.

The rice from gabah conversion ratio of the existing milling units generally is low. The existing multi-stage rice mills and small self-contained rice mills have a conversion ratio of 61 to 63 percent. The small rice mills (PBK units) generally have a conversion ratio in the range of 57 to 63 percent depending upon the type of huskers, hullers, and polishers used and their state of repair. Engleberg type hullers commonly have a conversion ratio of 57 to 59 percent. These conversion ratios can be compared to a 66 to 68 percent conversation ratio for a modern multi-stage rice mill, or to a 52 to 57 percent conversion ratio for hand-pounding.

10. Existing Warehouse Storage for Rice

The available data on existing storage facilities are rather sketchy. The only reasonably accurate data are for warehouses owned or rented by BULOG. These data do not include storage capacity at the farm level, in village godowns, at many private processing facilities, or that of rice wholesalers and retailers in urban areas. The 471 warehouses reported by BULOG in 1971 had a total storage capacity of 733,000 tons of gabah. Estimates made by the Rice Marketing Study Team indicate that there was an additional 822,000 tons of gabah storage capacity in off-farm marketing facilities not reported by BULOG. This gives a total existing storage capacity of 1,555,000 tons of gabah in 1971. About two-thirds of this storage capacity is located in Java.

11. Need for New Milling Capacity

The most important factors determining the amount of new storage and

processing facilities needed to handle expected increases in rice production are:

a. the quantity of rice entering commercial marketing channels;

b. the amount of rice shipped from one province to another or stored from one time period to another;

c. the seasonal production patterns; and

d. the amount and location of existing facilities.

Each of these factors has been taken into account when determining the facility requirements.

The first step in estimating the amount of new storage and processing facilities needed during the next decade was to develop monthly supply and demand projections for each province. Linear programming was used next to determine the shipment patterns that would minimize the cost of transporting rice from surplus to deficit provinces. The resulting regional and monthly rice flows were used to determine the monthly requirements for milling, drying, and storage facilities in 1975 and 1980. The existing storage and processing capacities were compared to the required capacities to determine the amount of new facilities needed in each province. Major emphasis was placed on determining the new facilities needed by 1975. The additional facilities needed by 1980 will depend, to a large extent, on changes in the marketing system during the next three to four years.

Estimates of the existing milling capacity by province in 1971 are shown in Table 4-S. About 58 percent of the reported capacity was located in Java. Nearly 30 percent of the total capacity was located in Sumatra and 7 percent in Kalimantan. Sulawesi accounted for only 4 percent of the reported milling capacity.

Most of the provinces appear to have adequate milling capacity to handle the rice expected to enter commercial marketing channels in 1975. The major exceptions are the provinces of Sulawesi, Lampung, Bali, and Lombok. The total amount of milling capacity utilized in many areas is expected to be above the projected 1975 average monthly requirements for marketed production, however, due to increases in the amount of rice milled off-farm for on-farm consumption. Large increases in off-farm milling for on-farm use have already occurred on Java.

TABLE 4-S

MILLING CAPACITY REQUIRED BY PROVINCES[a]
INDONESIA, 1975

Province	Existing Facilities 1971	1975[b] Requirements Based On Average Month	Ratio of Average Month to Existing Facilities
	(tons of gabah per hour)		(R)
West Java and Djakarta	1,987	569	.29
Central Java and Jogjakarta	648	438	.66
East Java	1,125	461	.41
Atjeh	199	163	.82
North Sumatra	747	312	.42
West Sumatra	135	197	.90
South Sumatra	486	86	.18
Lampung	207	58	.28
Bengkulu	22	38	1.73
Riau and Djambi	114	58	.51
South Kalimantan	234	91	.39
Other Kalimantan	194	77	.40
South Sulawesi	246	433	1.76
Other Sulawesi	9	29	3.22
Bali and Lombok	51	183	3.59
Other Provinces	29	87	3.00
TOTAL	6,433	3,270	.51

a/ Source: Table 11.1, Rice Storage, Handling and Marketing, The Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972.

b/ Based on the assumption that milling capacity operates 8 hours per day, 26 days per month; the average month is based on medium projections of production and the basic assumption that 33 percent of the production is marketed.

Except for South Sulawesi and several of the smaller provinces, there does not appear to be a need for large amounts of new milling capacity for commercially marketed rice during the next three to four years. There will continue to be substantial investment in small rice mills and hullers, however, as old mills are replaced or up-dated and as farmers continue to process more of their rice off-farm.

12. Need for New Storage Capacity

Estimates of the amount of new storage capacity needed by 1975 are shown in Table 5-S. These estimates are obtained by subtracting the 1971 existing capacity from the projected total storage required for commercially marketed rice in 1975. The 1975 total storage requirements show the amount of storage capacity needed during peak storage months assuming that no minimum inventory levels are held in other months. If a minimum inventory equal to one month's off-farm off-take is held in all provinces, the total amount of new storage capacity needed would be increased by 773,000 tons of gabah.

The total new storage capacity needed by 1975 without allowing for a minimum inventory level is 1,082,000 metric tons of gabah. This figure does not include the additional storage capacity that may be needed for production increases that are consumed on-farm. There is a need to encourage the construction of new-on-farm storage capacity and to improve the existing facilities, but the magnitude of the need is difficult to determine due to the lack of data.

It seems unlikely that the private sector will be able to anticipate the magnitude of the additional storage capacity that will be required during the next few years. Thus, a large scale government program to promote and finance the construction of new facilities will be necessary in order to provide adequate storage for the expected increases in rice production. Without such a program, increasing amounts of rice will be stored in open storage facilities both on and off-farm. This will result in increased storage losses and lower farm prices. Increased imports will be needed to replace storage losses as well as the reductions in production due to lower prices.

13. Description of New Storage and Processing Facilities

There are many types of storage and processing facilities that could

TABLE 5-S

PROJECTED NEW STORAGE FACILITIES NEEDED, BY PROVINCES[a]

INDONESIA, 1975

Province	Existing Storage 1971	Projected[b] Storage Required Without Inventory 1975	New Storage Required Without Inventory 1975
		(1,000 tons of gabah)	
West Java and Djakarta	610	577	-33
Central Java and Jogjakarta	188	281	93
East Java	226	527	301
JAVA/MADURA	1,024	1,385	361
Atjeh	27	119	92
North Sumatra	73	287	214
West Sumatra	34	153	119
South Sumatra	58	69	11
Lampung	29	51	22
Riau and Djambi	31	34	3
SUMATRA	252	713	461
South Kalimantan	23	45	22
West Kalimantan	23	41	18
Central Kalimantan	5	15	10
East Kalimantan	15	23	8
KALIMANTAN	66	124	58
South Sulawesi	84	166	82
Bali	10	51	41
West Tenggara	11	17	6
Other Provinces	108	181	73
INDONESIA	1,555	2,637	1,082

a/ Source: Table 10.1, Rice Storage, Handling and Marketing, The Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972

b/ Based on medium projections of consumption and production and the basic assumption that 33 percent of production is marketed.

be used to provide the new capacity needed during the next decade. The best type of facility for a particular location would depend on such things as:

a. the amount of rice produced and marketed in the area;
b. the number of facilities already located in the area;
c. the seasonality of rice production;
d. the estimated operating costs;
e. the types of market outlets available; and
f. the expected prices of gabah and rice.

If, for example, rice production in a given area is highly seasonal and there are large differences in the price of gabah during the year, it may be profitable to operate a facility with twice as much storage capacity as milling capacity. In contrast, if rice can be grown throughout the year and there is the potential for harvesting large amounts of rice during the rainy season, a facility with mechanical drying and approximately equal amounts of storage and milling capacity may be more profitable.

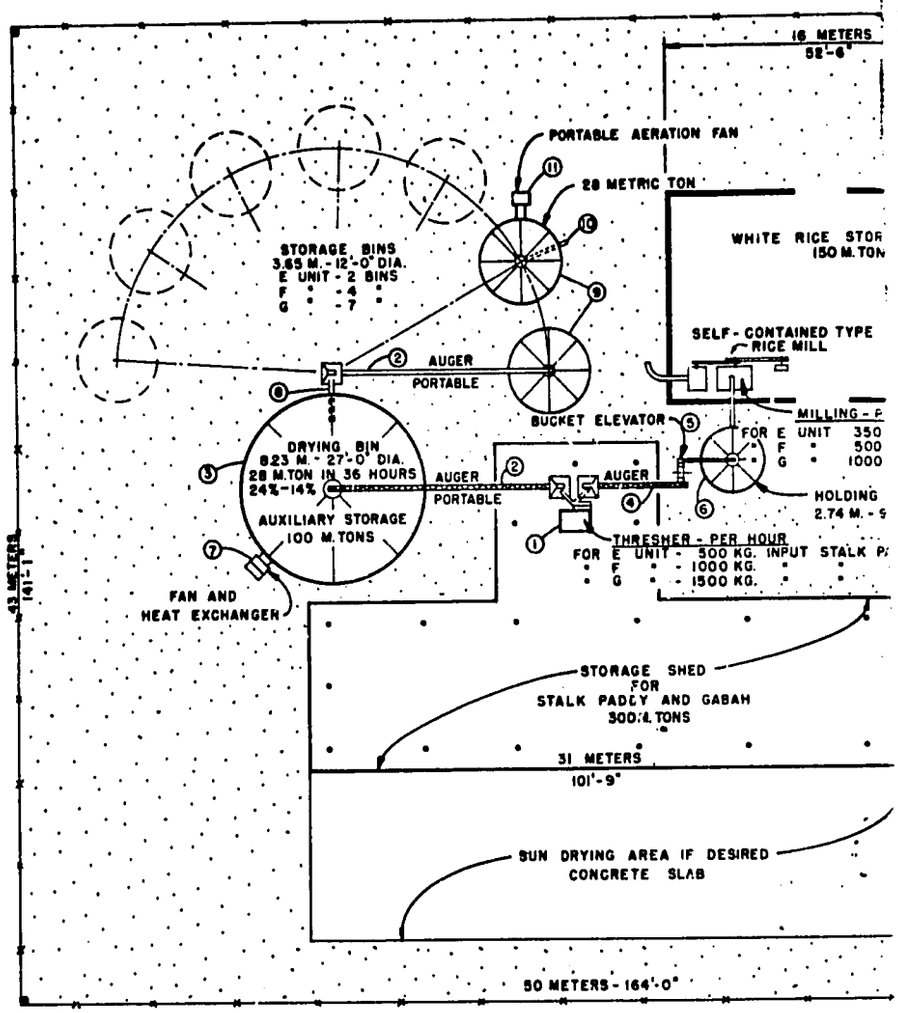
The small size of the typical rice farm, the poor condition of the transportation system, and the high interest cost of investment and working capital tends to favor the use of relatively small rice processing facilities.

Standard bag warehouses require the least investment per ton of storage capacity and appear to be particularly well suited for new small scale rice milling operations, village godown facilities, and for adding storage capacity to existing rice mills.

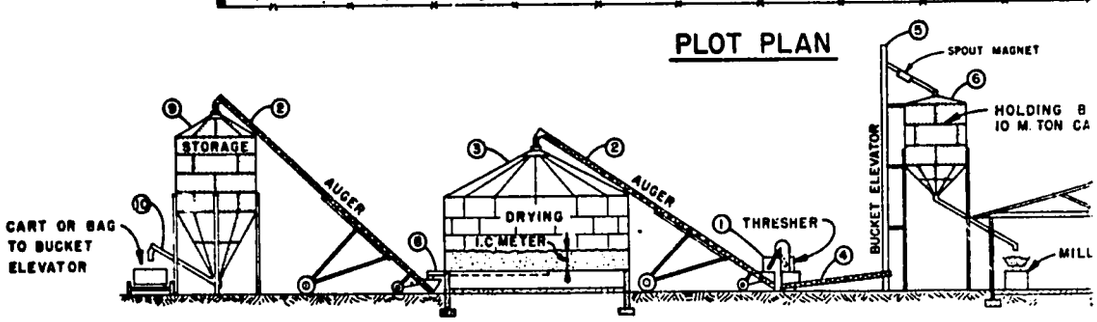
In locations where new facilities are expected to handle between 2,000 and 5,000 tons of gabah annually, storage, and milling units such as those shown in Drawing 03 and 03A are expected to be profitable operations. These units are small one (1) ton-per-hour self-contained rice mills. The Prototype G unit includes a small in-bin type mechanical warm air drier and bin storage. The Prototype G-1 unit uses only sun drying and flat warehouse storage. These units can be modified readily by adding warehouse capacity or substituting multi-stage rice mills for the self-contained mills.

The estimated total cost of constructing a Prototype G facility is approximately Rp. 34,619,000 (or US$91,103). The Prototype G-1 facility without the mechanical rice drier has somewhat less storage capacity and is estimated to cost Rp. 20,188,000 (or US$53,126[4/]).

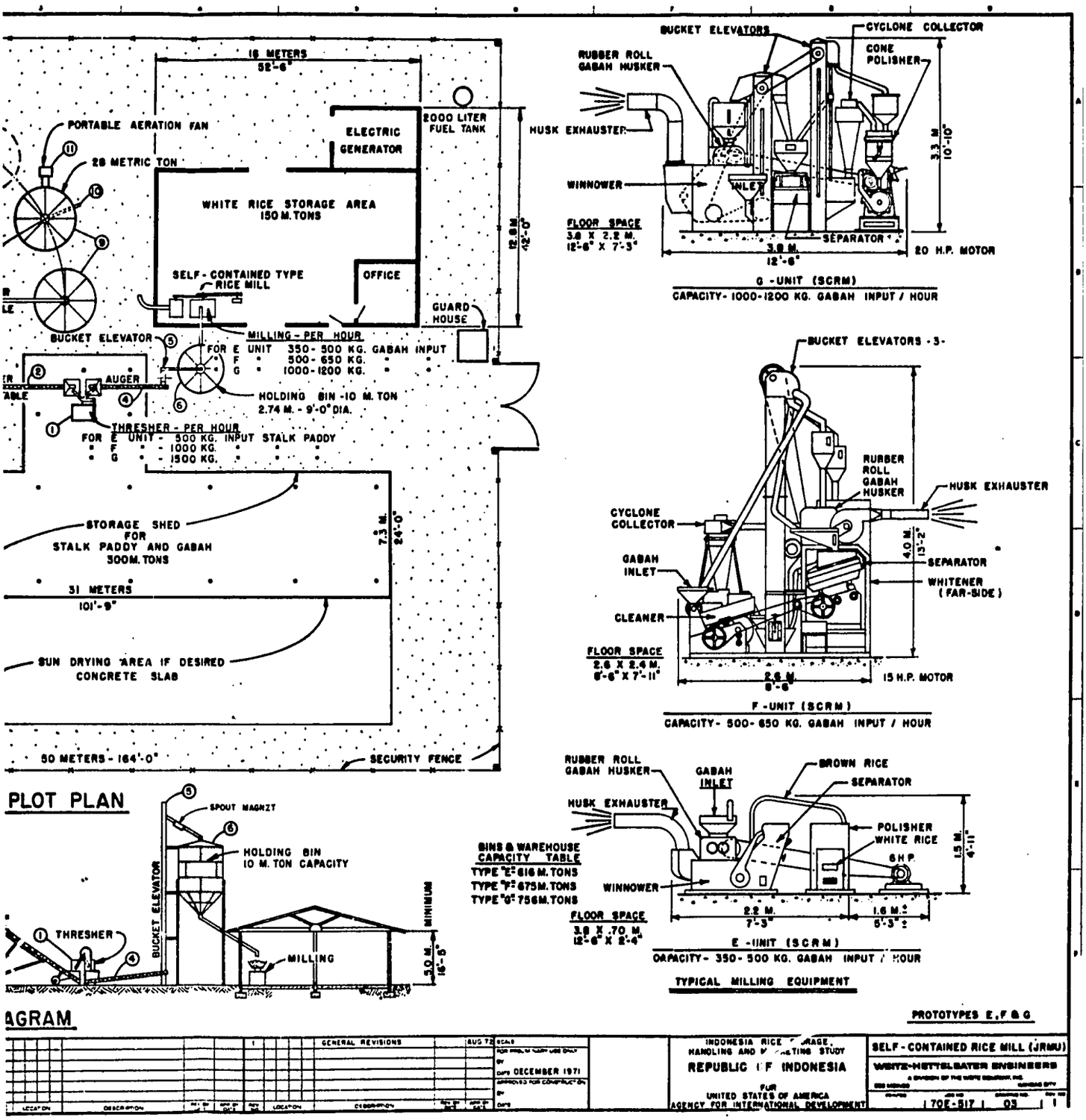
4/ The exchange rate used is US$1.00=Rp. 380 or Rp. 100=US$0.263.

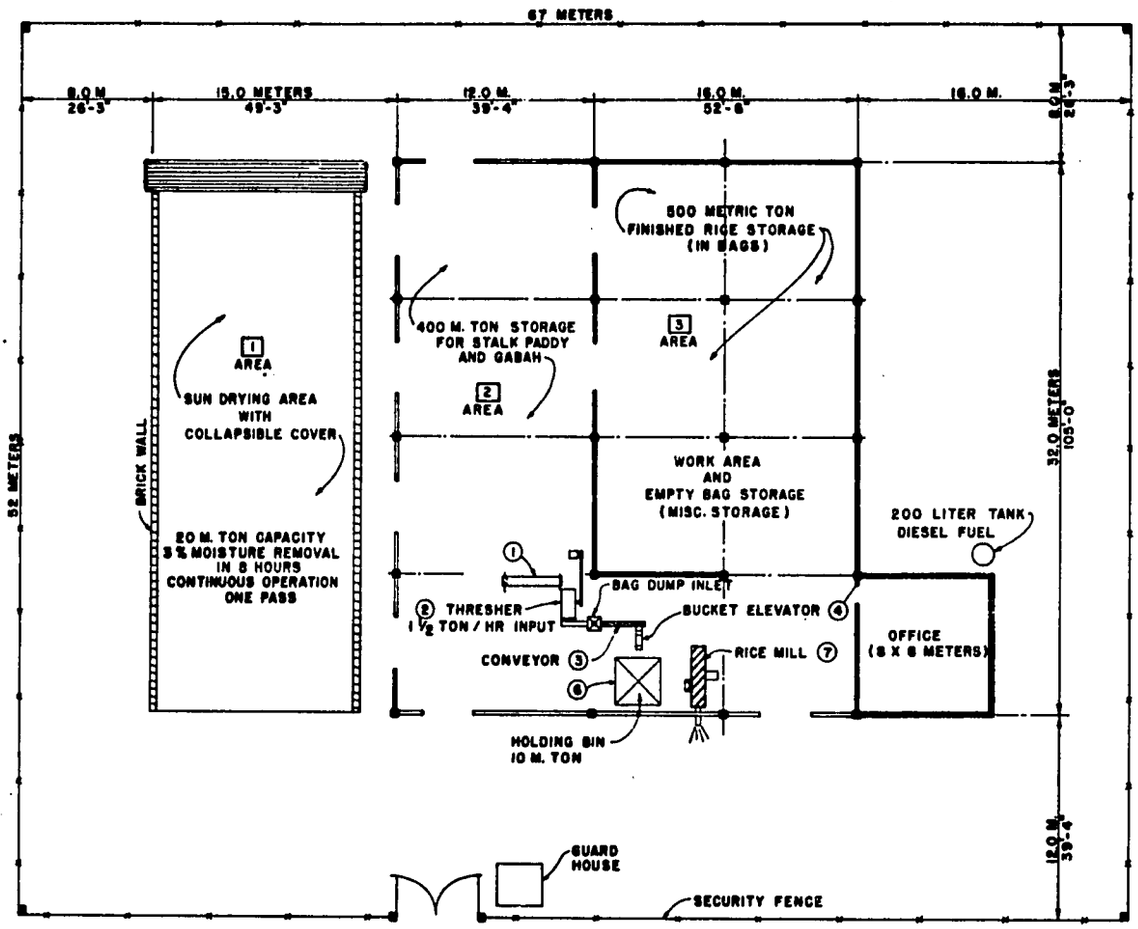


PLOT PLAN

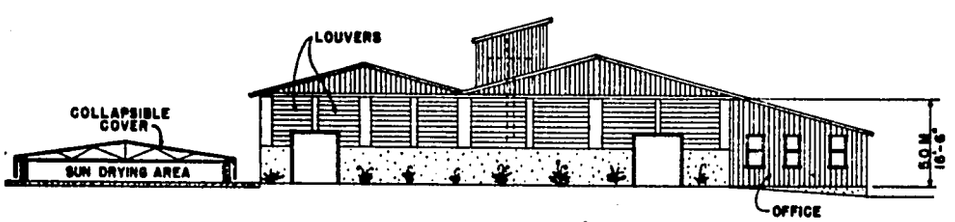


FLOW DIAGRAM


16 METERS
52'-6"
PORTABLE AERATION FAN
28 METRIC TON
ELECTRIC GENERATOR
2000 LITER FUEL TANK
WHITE RICE STORAGE AREA
150 M. TONS
SELF-CONTAINED TYPE RICE MILL
OFFICE
GUARD HOUSE
12.8 M
42'-0"
BUCKET ELEVATOR
MILLING - PER HOUR
FOR E UNIT 350-500 KG. GABAH INPUT
F " 500-650 KG. " "
G " 1000-1200 KG. " "
AUGER
HOLDING BIN -10 M. TON
2.74 M. - 9'-0" DIA.
THRESHER - PER HOUR
FOR E UNIT - 500 KG. INPUT STALK PADDY
F " - 1000 KG. " "
G " - 1500 KG. " "
STORAGE SHED FOR STALK PADDY AND GABAH 300M. TONS
7.3 M.
24'-0"
31 METERS
101'-9"
SUN DRYING AREA IF DESIRED CONCRETE SLAB
50 METERS - 164'-0"
SECURITY FENCE
PLOT PLAN
SPOUT MAGNET
HOLDING BIN 10 M. TON CAPACITY
BUCKET ELEVATOR
THRESHER
MILLING
MINIMUM
5.0 M.
16'-5"
AGRAM
BUCKET ELEVATORS
CYCLONE COLLECTOR
RUBBER ROLL GABAH HUSKER
CONE POLISHER
HUSK EXHAUSTER
WINNOWER
INLET
FLOOR SPACE
3.8 X 2.2 M.
12'-6" X 7'-3"
3.8 M.
12'-6"
SEPARATOR
3.3 M.
10'-10"
20 H.P. MOTOR
G -UNIT (SCRM)
CAPACITY- 1000-1200 KG. GABAH INPUT / HOUR
BUCKET ELEVATORS -3-
RUBBER ROLL GABAH HUSKER
HUSK EXHAUSTER
CYCLONE COLLECTOR
GABAH INLET
4.0 M.
13'-2"
SEPARATOR
WHITENER (FAR-SIDE)
CLEANER
FLOOR SPACE
2.6 X 2.4 M.
8'-6" X 7'-11"
2.6 M.
8'-6"
15 H.P. MOTOR
F -UNIT (SCRM)
CAPACITY- 500-650 KG. GABAH INPUT / HOUR
RUBBER ROLL GABAH HUSKER
GABAH INLET
BROWN RICE
SEPARATOR
HUSK EXHAUSTER
POLISHER
WHITE RICE
6 H.P.
1.5 M.
4'-11"
BINS & WAREHOUSE CAPACITY TABLE
TYPE "E" 616 M. TONS
TYPE "F" 675 M. TONS
TYPE "G" 756 M. TONS
WINNOWER
FLOOR SPACE
3.8 X .70 M.
12'-6" X 2'-4"
2.2 M.
7'-3"
1.6 M.±
5'-3" ±
E -UNIT (SCRM)
CAPACITY- 350-500 KG. GABAH INPUT / HOUR
TYPICAL MILLING EQUIPMENT
PROTOTYPES E, F & G
GENERAL REVISIONS
AUG 72
DECEMBER 1971
INDONESIA RICE STORAGE, HANDLING AND MARKETING STUDY
REPUBLIC OF INDONESIA
FOR
UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
SELF-CONTAINED RICE MILL (JRMU)
WHITE-HETTELSATER ENGINEERS
70E-517
03

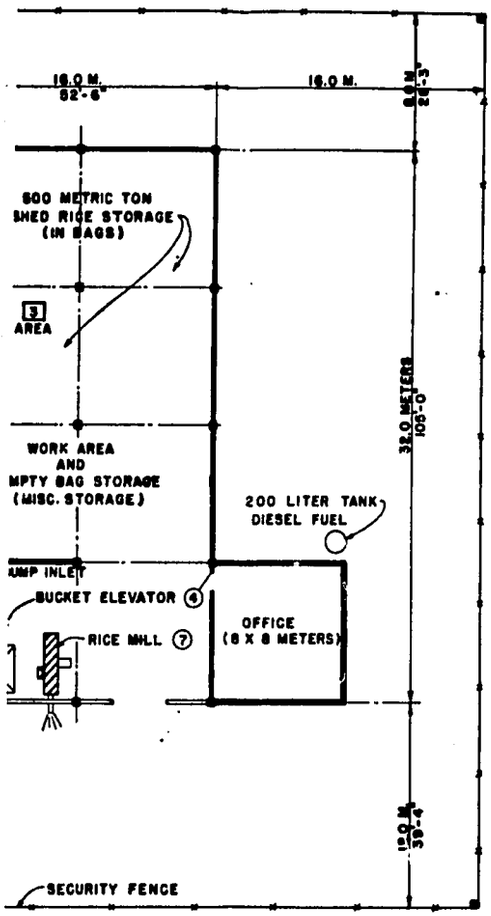


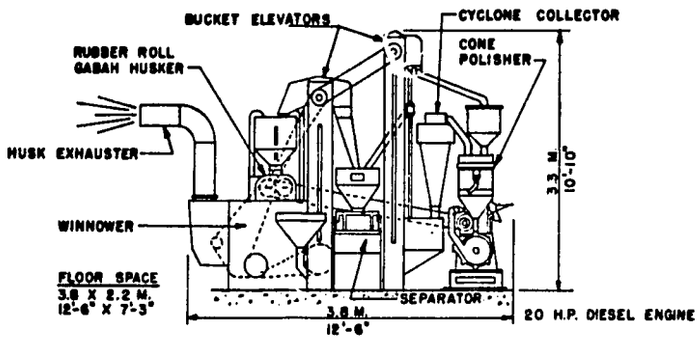
PLOT PLAN



ELEVATION

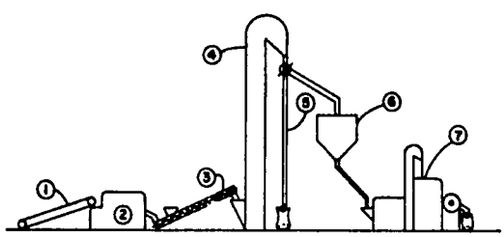
GENERAL REVISIONS





G-1 UNIT (SCRM)

CAPACITY - 1000-1200 KG. GABAH INPUT / HOUR
(SAME AS G - UNIT)

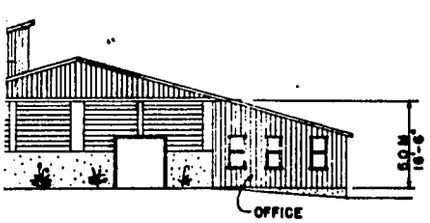


FL(.. DIAGRAM

1. FEEDER CONVEYOR
2. THRESHER
3. CONVEYOR (WITH BAG DUMP)
4. BUCKET ELEVATOR
5. BAGGING SPOUT
6. HOLDING BIN (10 M. TON)
7. SELF CONTAINED RICE MILL

STORAGE CAPACITY TABLE	
AREA 1	20 M. TON
AREA 2	400 M. TON
AREA 3	500 M. TON
TOTAL	920 M. TONS

CAPACITY BASED ON
GABAH - 577 KG/M³ (36 POUNDS/CUBIC FOOT)
RICE - 769 KG/M³ (48 " / " ")
2205 POUNDS = 1 METRIC TON (1000 KG.)



PROTOTYPE G-1

LOCATION	DESCRIPTION	REV. BY DATE	APP. BY DATE	REV. NO.	LOCATION	DESCRIPTION	REV. BY DATE	APP. BY DATE											

GENERAL REVISIONS — AUG 72

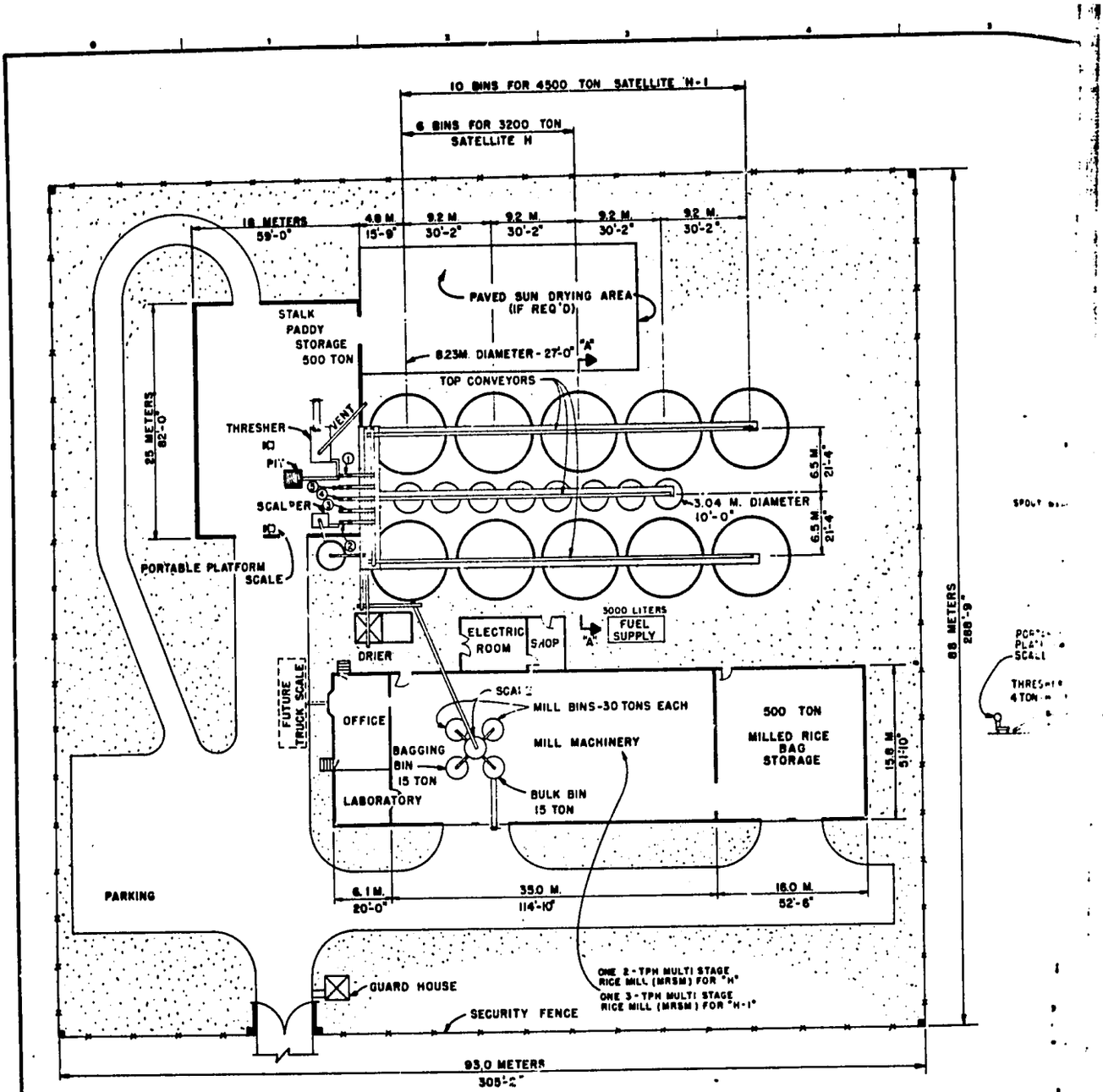
SCALE
FOR PRELIMINARY USE ONLY
BY
DATE AUGUST 1972
APPROVED FOR CONSTRUCTION
BY
DATE

INDONESIA RICE STORAGE, HANDLING AND MARKETING STUDY
REPUBLIC OF INDONESIA
FOR
UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT

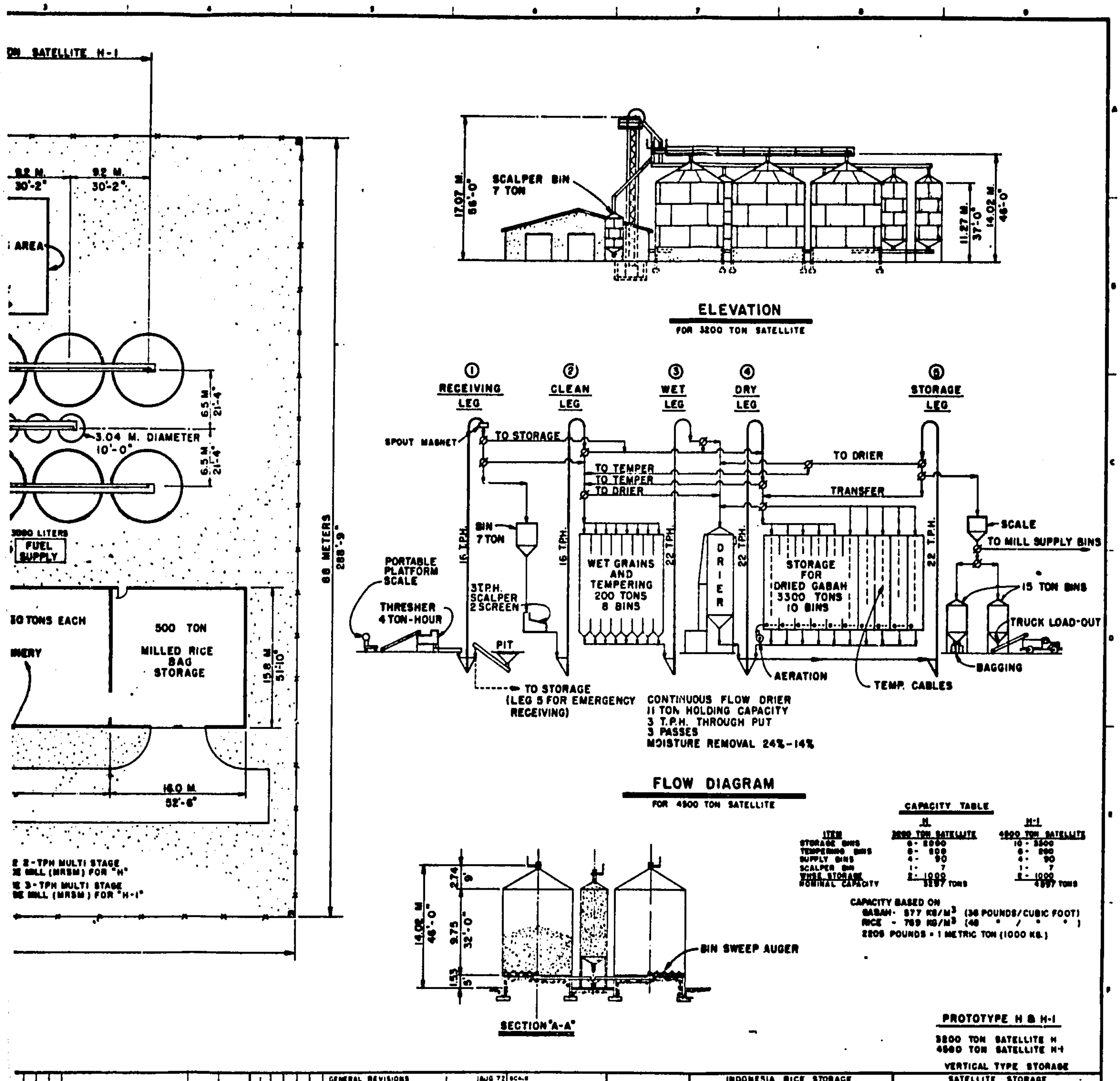
SELF-CONTAINED RICE MILL (JRMU)

WEITZ-HETTELSATER ENGINEERS
A DIVISION OF THE WEITZ COMPANY, INC.
DES MOINES · KANSAS CITY

REV. NO. | JOB NO. 70E-817 | DRAWING NO. 03A | REV. NO. 1


10 BINS FOR 4500 TON SATELLITE 'H-1'
6 BINS FOR 3200 TON SATELLITE H
18 METERS 59'-0"
4.8 M. 15'-9"
9.2 M. 30'-2"
9.2 M. 30'-2"
9.2 M. 30'-2"
9.2 M. 30'-2"
PAVED SUN DRYING AREA (IF REQ'D)
STALK PADDY STORAGE 500 TON
8.23M. DIAMETER - 27'-0"
"A"
TOP CONVEYORS
25 METERS 82'-0"
THRESHER
VENT
PIT
SCALPER
PORTABLE PLATFORM SCALE
6.5 M. 21'-4"
3.04 M. DIAMETER 10'-0"
6.5 M. 21'-4"
88 METERS 288'-9"
3000 LITERS FUEL SUPPLY
ELECTRIC ROOM
SHOP
DRIER
FUTURE TRUCK SCALE
OFFICE
SCALE
MILL BINS-30 TONS EACH
MILL MACHINERY
BAGGING BIN 15 TON
BULK BIN 15 TON
LABORATORY
500 TON MILLED RICE BAG STORAGE
15.8 M. 51'-10"
PARKING
6.1 M. 20'-0"
35.0 M. 114'-10"
16.0 M. 52'-6"
GUARD HOUSE
SECURITY FENCE
ONE 2-TPH MULTI STAGE RICE MILL (MRSM) FOR "H"
ONE 3-TPH MULTI STAGE RICE MILL (MRSM) FOR "H-1"
93.0 METERS 305'-2"

PLOT PLAN



CAPACITY TABLE

ITEM	H 3200 TON SATELLITE	H-1 4900 TON SATELLITE
STORAGE BINS	6 - 2000	10 - 3300
TEMPERING BINS	8 - 100	8 - 200
SUPPLY BINS	4 - 90	4 - 90
SCALPER BIN	1 - 7	1 - 7
WHSE. STORAGE	2 - 1000	2 - 1000
NOMINAL CAPACITY	3297 TONS	4597 TONS

CAPACITY BASED ON
GABAH - 577 KG/M^3 (36 POUNDS/CUBIC FOOT)
RICE - 769 KG/M^3 (48 " / " ")
2205 POUNDS = 1 METRIC TON (1000 KG.)

PROTOTYPE H & H-1

3200 TON SATELLITE H
4900 TON SATELLITE H-1

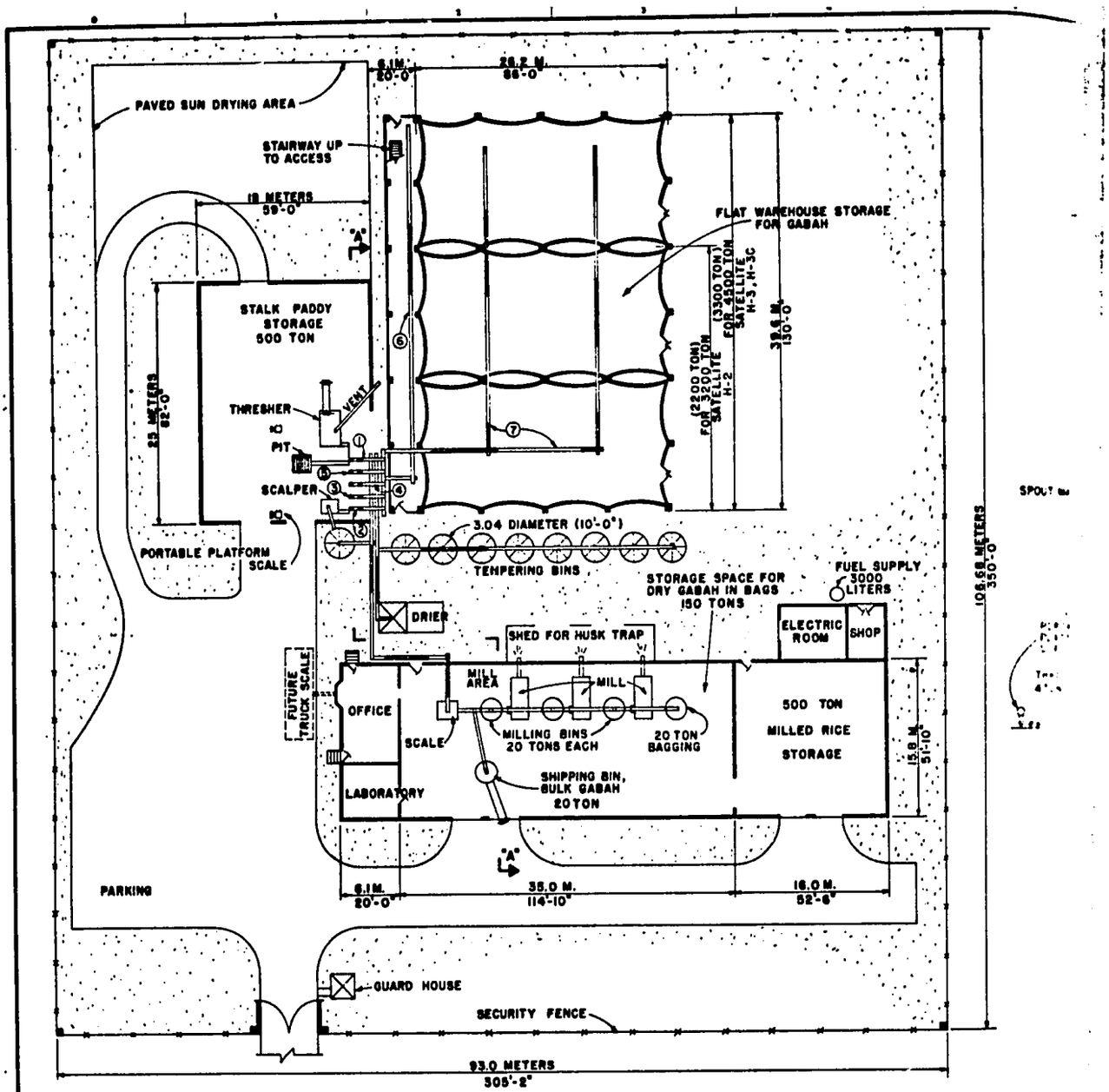
VERTICAL TYPE STORAGE

INDONESIA RICE STORAGE, HANDLING AND MARKETING STUDY
REPUBLIC OF INDONESIA
FOR
UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT

SATELLITE STORAGE WITH DRYING AND MILLING

WEITZ-HETTELSATER ENGINEERS

170E-517 | 04 | 1


PAVED SUN DRYING AREA
6.1M. 20'-0"
26.2 M. 86'-0"
STAIRWAY UP TO ACCESS
18 METERS 59'-0"
FLAT WAREHOUSE STORAGE FOR GABAH
(2200 TON) FOR 3200 TON SATELLITE H-2
(3300 TON) FOR 4500 TON SATELLITE H-3, H-3C
39.6 M. 130'-0"
STALK PADDY STORAGE 500 TON
25 METERS 82'-0"
THRESHER
VENT
PIT
SCALPER
PORTABLE PLATFORM SCALE
3.04 DIAMETER (10'-0")
TEMPERING BINS
STORAGE SPACE FOR DRY GABAH IN BAGS 150 TONS
FUEL SUPPLY 3000 LITERS
DRIER
SHED FOR HUSK TRAP
ELECTRIC ROOM
SHOP
106.68 METERS 350'-0"
SPOUT
FUTURE TRUCK SCALE
OFFICE
MILL AREA
MILL
SCALE
MILLING BINS 20 TONS EACH
20 TON BAGGING
500 TON MILLED RICE STORAGE
15.8 M. 51'-10"
LABORATORY
SHIPPING BIN, BULK GABAH 20 TON
PARKING
6.1M. 20'-0"
35.0 M. 114'-10"
16.0 M. 52'-8"
GUARD HOUSE
SECURITY FENCE
93.0 METERS 305'-2"

PLOT PLAN

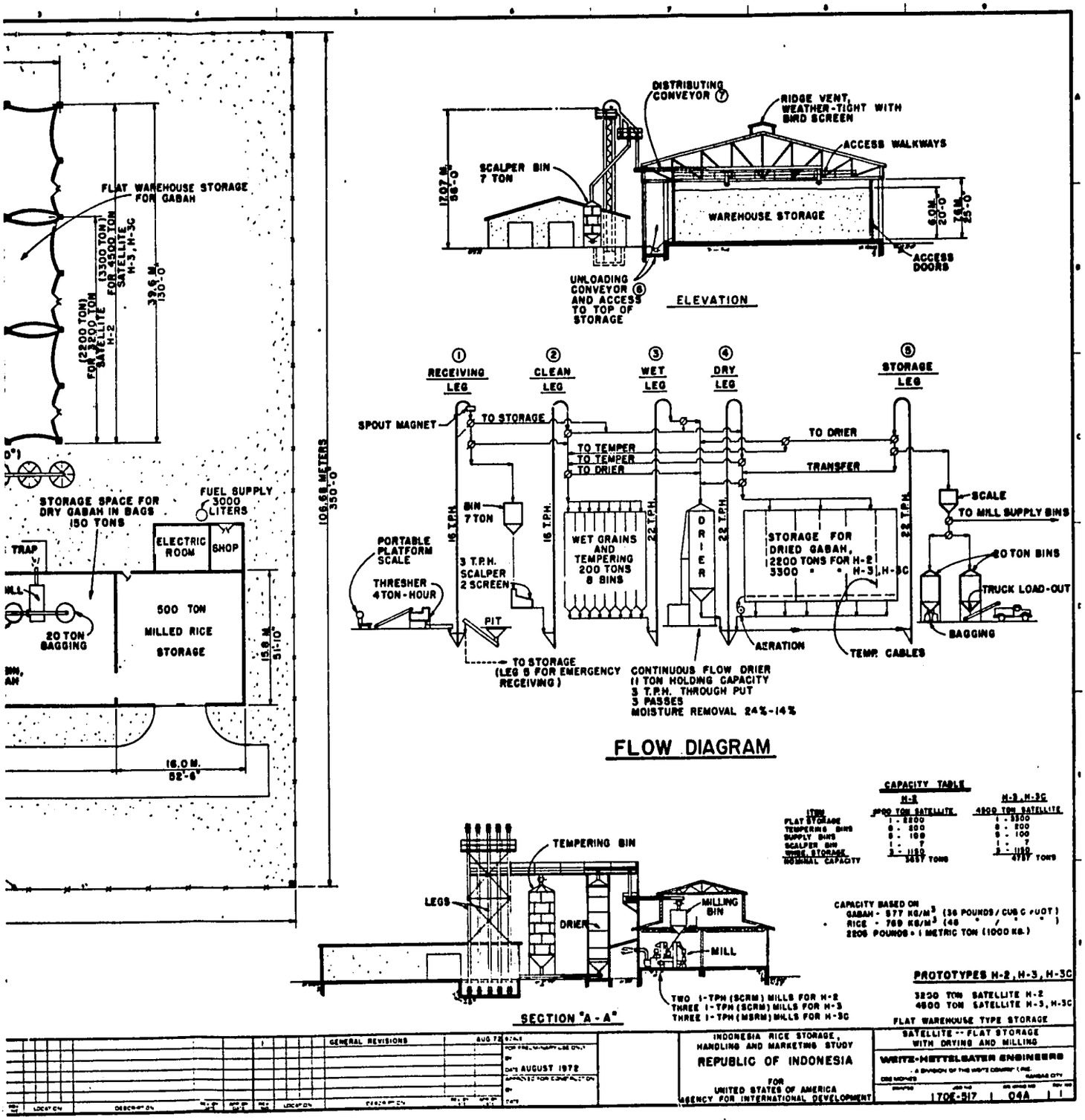

FLAT WAREHOUSE STORAGE FOR GABAH
(2200 TON) FOR 3300 TON SATELLITE H-2
(3300 TON) FOR 4500 TON SATELLITE H-3, H-3C
32.6 M. 130'-0"
106.68 METERS 350'-0"
STORAGE SPACE FOR DRY GABAH IN BAGS 150 TONS
FUEL SUPPLY 3000 LITERS
ELECTRIC ROOM
SHOP
TRAP
500 TON MILLED RICE STORAGE
20 TON BAGGING
15.6 M. 51'-10"
16.0 M. 52'-6"
DISTRIBUTING CONVEYOR 7
RIDGE VENT, WEATHER-TIGHT WITH BIRD SCREEN
ACCESS WALKWAYS
SCALPER BIN 7 TON
17.07 M. 56'-0"
WAREHOUSE STORAGE
6.0 M. 20'-0"
7.6 M. 25'-0"
ACCESS DOORS
UNLOADING CONVEYOR 6 AND ACCESS TO TOP OF STORAGE
ELEVATION
1 RECEIVING LEG
2 CLEAN LEG
3 WET LEG
4 DRY LEG
5 STORAGE LEG
SPOUT MAGNET
TO STORAGE
TO TEMPER
TO TEMPER
TO DRIER
TO DRIER
TRANSFER
SCALE
TO MILL SUPPLY BINS
BIN 7 TON
16 T.P.H.
16 T.P.H.
22 T.P.H.
22 T.P.H.
22 T.P.H.
WET GRAINS AND TEMPERING 200 TONS 8 BINS
DRIER
STORAGE FOR DRIED GABAH, 2200 TONS FOR H-2 3300 " " H-3, H-3C
20 TON BINS
TRUCK LOAD-OUT
PORTABLE PLATFORM SCALE
THRESHER 4 TON-HOUR
3 T.P.H. SCALPER 2 SCREEN
PIT
BAGGING
AERATION
TEMP. CABLES
TO STORAGE (LEG 6 FOR EMERGENCY RECEIVING)
CONTINUOUS FLOW DRIER
11 TON HOLDING CAPACITY
3 T.P.H. THROUGH PUT
3 PASSES
MOISTURE REMOVAL 24%-14%
FLOW DIAGRAM
CAPACITY TABLE
H-2 3300 TON SATELLITE
H-3, H-3C 4500 TON SATELLITE
ITEM
FLAT STORAGE 1 - 2200 1 - 3300
TEMPERING BINS 8 - 200 8 - 200
SUPPLY BINS 8 - 100 8 - 100
SCALPER BIN 1 - 7 1 - 7
BAGGE STORAGE 3 - 1150 3 - 1150
NOMINAL CAPACITY 3457 TONS 4757 TONS
TEMPERING BIN
LEGS
DRIER
MILLING BIN
MILL
SECTION "A-A"
TWO 1-TPH (SCRM) MILLS FOR H-2
THREE 1-TPH (SCRM) MILLS FOR H-3
THREE 1-TPH (MSRM) MILLS FOR H-3C
CAPACITY BASED ON
GABAH - 577 KG/M3 (36 POUNDS/CUBIC FOOT)
RICE - 769 KG/M3 (48 " / " ")
2206 POUNDS = 1 METRIC TON (1000 KG.)
PROTOTYPES H-2, H-3, H-3C
3300 TON SATELLITE H-2
4500 TON SATELLITE H-3, H-3C
FLAT WAREHOUSE TYPE STORAGE
GENERAL REVISIONS
AUGUST 1972
INDONESIA RICE STORAGE, HANDLING AND MARKETING STUDY
REPUBLIC OF INDONESIA
FOR
UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
SATELLITE -- FLAT STORAGE WITH DRYING AND MILLING
WRIGHT-HETTELSATER ENGINEERS
170E-517
04A

TABLE 11.7

COMPARATIVE TECHNICAL SPECIFICATIONS OF SERVICES OFFERED IN EACH OF THE NEW "BASI
INDONESIA, 1975

Prototype Number	Drawing Number	Facility	Nominal Storage[b/] Capacity In Tons		Milling, KG Or Tons/Hour Gabah		Mecha- In-
			Flat	Vertical	Huller Type Mills	SCRM Or MSRM Mills[c/]	
		I. Huller Type Rice Mills					
A	01	Two-Pass Huller (ERM)	-	-	250/300 KG	-	-
B	02	Huller/Polisher (EP)	-	-	450/500 KG	-	-
C	02	Flash Husker & Huller/Polisher (PBK)	-	-	750/1,000 KG	-	-
C-1	-	Flash Husker & Huller/Polisher (PBK)	600 Ton	-	750/1,000 KG	-	-
D	02	One-Pass Rice Mill	-	-	160/210 KG	-	-
		II. Small Facilities					
E	03	Self-Contained Mill (JRMU)	150 Ton	466 Ton	-	425 KG (SCRM)	3.4
F	03	Self-Contained Mill (JRMU)	150 Ton	525 Ton	-	550 KG (SCRM)	3 4
G	03	Self-Contained Mill (JRMU)	150 Ton	606 Ton	-	1,100 KG (SCRM)	3 1
G-1	03A	Self-Contained Mill (JRMU)	920 Ton	-	-	1,100 KG (SCRM)	
		III. Bulk Satellite Facilities					
H	04	3,200 Ton Bulk Satellite (Vert)	1,000 Ton	2,297 Ton	-	One 2-TPH (MSRM)	
H-1	04	4,500 Ton Bulk Satellite (Vert)	1,000 Ton	3,597 Ton	-	One 3-TPH (MSRM)	
H-2	04A	3,200 Ton Bulk Satellite (Flat)	3,350 Ton	307 Ton	-	Two 1-TPH (SCRM)	
H-3	04A	4,500 Ton Bulk Satellite (Flat)	4,450 Ton	307 Ton	-	Three 1-TPH (SCRM)	
		IV. Bulk Terminal Facilities					
K	07	10,000 Ton Bulk Terminal (Vert)	1,700 Ton	10,456 Ton	-	Two 3-TPH (MSRM)	
K-1	07	15,000 Ton Bulk Terminal (Vert)	1,700 Ton	15,456 Ton	-	Two 4 1/2-TPH (MSRM)	
K-2	07A	10,000 Ton Bulk Terminal (Flat)	8,030 Ton	4,126 Ton	-	Two 3-TPH(MSRM)	
K-3	07A	15,000 Ton Bulk Terminal (Flat)	13,030 Ton	4,126 Ton	-	Two 4 1/2-TPH (MSRM)	
		V. Modified Facilities					
G-B	-	Self-Contained Mill (JRMU)	1,150 Ton	606 Ton	-	Two 1-TPH (SCRM)	3 4
G-B1	-	Self-Contained Mill (JRMU)	3,150 Ton	606 Ton	-	One 1-TPH (SCRM)	3 4
G-B2	-	Multi-Stage Mill	3,150 Ton	606 Ton	-	Two 1-TPH (MSRM)	3 4
G-B3	-	Multi-Stage Mill	1,150 Ton	606 Ton	-	Two 1-TPH (MSRM)	3 1
G-1A	-	Self-Contained Mill (JRMU)	1,920 Ton	-	-	One 1-TPM (SCRM)	
G-1B	-	Self-Contained Mill (JRMU)	1,920 Ton	-	-	Two 1-TPH (SCRM)	
H-2A	-	3,200 Ton Bulk Satellite (Flat)	3,350 Ton	307 Ton	-	Two 1-TPH (MSRM)	
H-3A	-	8,000 Ton Bulk Satellite (Flat)	7,950 Ton	307 Ton	-	Three 1-TPH (SCRM)	
H-3B	-	8,000 Ton Bulk Satellite (Flat)	7,950 Ton	307 Ton	-	One 3-TPH (MSRM)	
H-3C	-	4,500 Ton Bulk Satellite (Flat)	4,450 Ton	307 Ton	-	Three 1-TPH (MSRM)	
K-3A	-	15,000 Ton Bulk Terminal (Flat)	13,030 Ton	4,126 Ton	-	Two 3-TPH (MSRM)	
C-A	-	Flash Husker & Huller/Polisher (PBK)	100 Ton	-	750/1,000 KG	-	

a/ This table shows the comparative capacities of storage, milling and drying offered in each of the basic facilities and
b/ These are "nominal" design capacities on the basis of being liquid full. Effective "working" capacities are 10 to 15
c/ "SCRM" is a self-contained type rice mill unit. "MSRM" is a multi-state type rice mill unit.
d/ Sun drying pads are included at all facilities.
e/ The estimated construction cost of the "basic" facilities are taken from table 10.6; the construction cost of the "modifi
ratio, Rp 380 equals US$1.00).
f/ The estimated basic construction cost of the bulk terminals do not include cost of marine handling nor rail handling

TABLE 11.7

ITIONS OF SERVICES OFFERED IN EACH OF THE NEW "BASIC" FACILITIES AND "MODIFIED" FACILITIES[a]

INDONESIA, 1975

	Milling, KG Or Tons/Hour Gabah		Drying Tons/Hour Gabah			Cost Of Construction[e] Each Facility		Total Cost Equivalent[e] Each Facility			
	Huller Type Mills	SCRM Or MSRM Mills[c]	Mechanical In-Bin	Mechanical Continuous	Sun Dry[d]	Foreign Currency Portion	Local Currency Portion	Total In Foreign Currency	Total In Local Currency	Prototype Number	Drawing Number
ical						(US$)	(Rp 1,000)	(US$)	(Rp 1,000)		
-	250/300 KG	-	-	-	x	2,787	1,543	6,847	2,602	A	01
-	450/500 KG	-	-	-	x	2,722	1,712	7,173	2,726	B	02
-	750/1,000 KG	-	-	-	x	3,104	1,903	8,113	3,083	C	02
-	750/1,000 KG	-	-	-	x	4,466	5,886	19,955	7,583	C-1	-
-	160/210 KG	-	-	-	x	2,724	1,506	6,687	2,541	D	02
Ton	-	425 KG (SCRM)	3/4 Ton	-	x	37,949	10,159	65,276	24,805	E	03
Ton	-	550 KG (SCRM)	3/4 Ton	-	x	46,828	11,126	76,118	28,925	F	03
Ton	-	1,100 KG (SCRM)	3/4 Ton	-	x	58,929	12,226	91,103	34,619	G	03
-	-	1,100 KG (SCRM)	-	-	x	14,620	14,632	53,126	20,188	G-1	03A
Ton	-	One 2-TPH (MSRM)	-	3 Ton	x	259,897	45,692	380,139	144,453	H	04
Ton	-	One 3-TPH (MSRM)	-	3 Ton	x	316,485	52,801	455,384	173,046	H-1	04
Ton	-	Two 1-TPH (SCRM)	-	3 Ton	x	177,859	48,649	305,884	116,236	H-2	04A
Ton	-	Three 1-TPH (SCRM)	-	3 Ton	x	188,942	56,020	336,365	127,819	H-3	04A
Ton	-	Two 3-TPH (MSRM)	-	20 Ton	x	1,333,322	151,592	1,732,250	658,400[f]	K	07
Ton	-	Two 4 1/2-TPH (MSRM)	-	20 Ton	x	1,711,362	184,899	2,197,937	835,400[f]	K-1	07
Ton	-	Two 3-TPH(MSRM)	-	20 Ton	x	991,980	153,031	1,394,693	530,100[f]	K-2	07A
Ton	-	Two 4 1/2-TPH (MSRM)	-	20 Ton	x	1,094,737	188,127	1,587,808	603,500[f]	K-3	07A
Ton	-	Two 1-TPH (SCRM)	3/4 Ton	-	x	67,835	18,813	117,343	44,600	G-B	-
Ton	-	One 1-TPH (SCRM)	3/4 Ton	-	x	58,929	27,596	131,550	50,000	G-B1	-
Ton	-	Two 1-TPH (MSRM)	3/4 Ton	-	x	136,803	23,998	199,956	76,000	G-B2	-
Ton	-	Two 1-TPH (MSRM)	3/4 Ton	-	x	136,803	14,200	174,172	66,200	G-B3	-
-	-	One 1-TPM (SCRM)	-	-	x	14,620	21,338	70,774	26,900	G-1A	-
-	-	Two 1-TPH (SCRM)	-	-	x	23,526	21,333	79,666	30,280	G-1B	-
Ton	-	Two 1-TPH (MSRM)	-	3 Ton	x	246,827	48,584	374,680	142,410	H-2A	-
Ton	-	Three 1-TPH (SCRM)	-	3 Ton	x	197,848	79,884	408,068	155,100	H-3A	-
Ton	-	One 3-TPH (MSRM)	-	3 Ton	x	258,407	83,265	477,526	181,500	H-3B	-
Ton	-	Three 1-TPH (MSRM)	-	3 Ton	x	320,240	45,392	439,693	167,120	H-3C	-
Ton	-	Two 3-TPH (MSRM)	-	20 Ton	x	998,524	187,436	1,491,777	567,000	K-3A	-
-	750/1,000 KG	-	-	-	x	3,104	2,720	10,260	3,900	C-A	-

offered in each of the basic facilities and modified facilities discussed in Chapters X, XI, XII.
Effective "working" capacities are 10 to 15 percent less.
rpe rice mill unit.

able 10.6; the construction cost of the "modified" facilities are estimated from the "basic costs" plus or minus modifications. (Conversion

cost of a -ine handling nor rail handling equipment.

In areas where it is possible for a new facility to handle from 7,000 to 15,000 tons of gabah annually, small bulk storage facilities such as those shown in Drawings 04 and 04A can be profitable investments at existing price levels provided that the units are operated on a two-shift basis. The Prototype H and H-1 units shown in Drawing 04 have multi-stage rice mills, continuous-flow mechanical driers and metal vertical bulk storage bins. These are highly sophisticated, modern rice processing plants capable of producing the highest quality rice. These facilities would be particularly well suited for handling exported rice. The Prototype H facility has 2-tons-per-hour (gabah input) milling capacity and 3,200 tons of storage capacity. The Prototype H-1 unit has 3-tons-per-hour of milling capacity and 4,500 tons of storage capacity.

The Prototype H-2 and H-3 facilities shown in Drawing 04A are similar to the H and H-1 units except that the vertical storage bins have been replaced with flat bulk storage warehouse capacity. These units can be equipped with either self-contained or multi-stage rice mills. All of the H-type bulk storage units can be modified readily by adjusting the storage and milling capacity to location conditions.

The estimated costs of the Prototype H and H-1 units are Rp. 144,453,000 (or US$380,129) and Rp. 173,046,000 (or US$455,384) respectively. Replacing the vertical bulk storage bins with flat bulk warehouse capacity and replacing the multi-stage rice mills with self-contained mills reduces the cost of the Prototype H-2 and H-3 units to Rp. 116,238,000 (or US$305,824) and Rp. 127,819,000 (or US$336,365) respectively.[5/]

14. Profitability of New Storage and Processing Facilities

Estimates of the profitability of new facilities must, by necessity, be based on a large number of assumptions about such matters as wage rates, utilization levels, conversion ratios, expected useful life, rice prices, and interest rates. It is estimated that self-contained rice mills, such as those used with the G-type facilities, have an average rice from gabah conversion ratio of 63 percent compared to a 66 percent conversion ratio for multi-stage rice mills. The expected average bran

5/ Refer to Table 11.7 taken from the main report, but attached herein for technical specifications and cost estimates of the basic and modified new facilities (Chapter XI, Rice Storage, Handling and Marketing: The Republic of Indonesia, Economic and Engineering Study, Weitz-Hettelsater Engineers, K.C., Mo., U.S.A., October 1972).

from gabah conversion ratio is 2 percent for self-contained mills and 7 percent for multi-stage mills. Rice bran presently sells for Rp. 5 to Rp. 10 per kilogram. Multi-stage rice mills produce a high quality rice whereas self-contained rice mills produce an average quality rice. There is very little difference in price between rice qualities. It is estimated that the average wholesale price of rice at the mill is approximately Rp. 38 per kilogram for high quality rice and Rp. 36 per kilo for average quality rice. At the present time (mid-1972), mills should be able to purchase gabah at an average price in the range of Rp. 17 to Rp. 18 per kilogram.

The cost of working capital is assumed to be 24 percent per year compared to 12 percent per year for investment capital. These interest rates are low compared to existing levels. It is assumed that the government would use incentive interest rates in any program to encourage private investment in new marketing facilities.

The key assumption in any profitability analysis is the quantity of rice processed annually. In general, the larger and more complex the processing facility, the higher the annual fixed cost. As a result, larger facilities have to be used more intensely in order to be profitable. It is assumed that the small G-type facilities will be operated on a single-shift basis, 8 hours per day, 312 days per year.

At the existing marketing margins and with the small price differences allowed for high quality rice, the small bulk storage (H-type) units would be less profitable than other investment opportunities unless they can be operated on a 2-shift basis. The bulk, H-type facilities are fully equipped with diesel electric generators for both power and lighting, and can be operated 24 hours daily. For the present analysis, it is assumed that the H-type facilities will be operated 16 hours per day, 312 days per year.

15. Annual Income Statement of New Rice Facilities

Annual income statements for G-type small self-contained rice mills and H-type vertical bulk storage units with multi-stage rice mills are presented in Table 6-S. The self-contained rice mills are modified versions of the G-type facilities shown in Drawings 03 and 03A. The Prototype G-B facility has 1,756 tons of gabah storage capacity, two 1-ton-per-hour self-contained rice mills and uses sun drying.

The small self-contained rice mill with sun drying (Prototype G-1B)

and the 4,500-ton vertical bulk storage unit (Prototype H-1) are about equally profitable under the assumed operating conditions. The Prototype G-1B has an annual rate of return on investment of 38 percent compared to 34 percent for the Prototype H-1 facility.

A fairly small increase in wholesale rice prices can have a substantial impact on the profitability of rice milling facilities. As an illustrative example, assume that the wholesale price of rice is increased by about 10 percent, from Rp. 38 to Rp. 42 per kilogram for top quality rice. At the new price, a 4,500-ton bulk storage and processing facility (Prototype H-1) would earn a 57 percent rate of return on investment if operated on a 2-shift basis, or a 37 percent rate of return if operated on a 1.5-shift basis annually. A 10 percent increase in the wholesale price, other prices remaining constant, increases the gross margin by about 32 percent and the net rate of return on investment, at a 2-shift operating level, by about 66 percent.

If a given facility is expected to handle a fixed amount of rice, it would be more profitable to operate a small facility intensively rather than a larger facility at a lower level of its milling capacity. If, for example, 9,000 tons of gabah were processed with a 3,200-ton, H-type, vertical storage unit, net profits are estimated to be Rp. 27,148,000 giving a 19 percent rate of return on investment. The same quantity of rice processed by a 4,500-ton, H-type, vertical bulk storage facility would generate a net profit of Rp. 24,102,000 giving a net rate of return on investment equal to 14 percent.

In most parts of Indonesia, the seasonality of production is such that the average turn-over rate for storage facilities would be about 3.0. Thus, it appears unlikely that the average 3,200-ton, H-type bulk storage unit would store and process more than about 10,000 tons of gabah per year even though the units have enough milling capacity to handle up to nearly 15,000 tons of gabah if operated under ideal conditions 24 hours per day. As a rough rule of thumb, the 3,200-ton, H-type units, would be used if the expected volume of gabah to be processed annually at a given location was in the range of 7,000 to 10,000 tons. The 4,500-ton, H-type, bulk storage facility would be used for processing volumes in the 10,000 to 15,000-ton range.

Assuming that farmers market about 25 percent of their gabah, and that the average yield is 2 tons of gabah per hectare, it would take 2 hectares to provide each ton of gabah processed off-farm. Thus, a 3,200-ton, H-type bulk storage facility processing 9,000 tons of gabah annually

TABLE 6-S

ANNUAL INCOME STATEMENTS FOR NEW STORAGE AND PROCESSING FACILITIES[a/]

INDONESIA, 1975

Row Or Line Number	Item		Prototype Numbers: Modified Self-Contained Type Facilities (SCRM) G-B	G-1B	Vertical Bulk Storage Facilities With Multi-Stage Mills (MSRM) H	H-1
A.	Storage Capacity (tons of gabah)		1,756	1,920	3,200	4,500
1.	Average Farm Price of Gabah	(1,000 Rp)	17.0	17.4	17.0	17.0
2.	Average Wholesale Price of Rice	(1,000 Rp)	36.0	36.0	38.0	38.0
3.	Gross Margin Per Ton of Gabah	(Rp)	5,780	5,380	8,430	8,430
4.	Number of Shifts Operated		1.0	1.0	2.0	2.0
5.	Tons of Gabah Processed		5,000	4,700	9,000	14,000
6.	Gross Profits On Sales	(1,000 Rp)	28,900	25,286	75,870	118,020
			(All Figures Below in 1,000 Rp)			
7.						
	a. Operative Payroll		2,826	2,826	8,382	8,382
	b. Fuel		314	314	629	664
	c. Fumigants	(Rp 60/ton gabah)	300	282	540	840
	d. Bags		1,000	900	900	1,400
	Total Variable Costs		4,400	4,362	10,451	11,286
8.	Annual Fixed Costs Other Than Depreciation and Interest					
	a. Administrative Payroll		593	593	1,526	1,526
	b. Maintenance and Repair	(1%/yr.)	446	303	1,445	1,730
	c. Insurance	(1%/yr.)	446	303	1,445	1,730
	Total Fixed Costs Other Than Depreciation and Interest		1,485	1,199	4,416	4,986
9.	Net Profit Before Depreciation and Interest		22,975	19,725	61,003	101,748
	a. Depreciation: Mech/Elec	(10%/yr.)	1,699	1,047	8,904	10,231
	b. Depreciation: Bldg/Bins	(4%/yr.)	891	783	2,211	2,829
10.	Net Profit Before Interest		20,385	17,895	49,888	88,688
	a. Interest On Total Investment	(12%/yr.)	5,362	3,636	17,340	20,760
	b. Interest On Working Capital	(24%/yr.)	3,000	2,820	5,400	8,400
11.	Net Profit		12,023	11,439	27,148	59,528
12.	Rate of Return On Investment (Percent)		27	38	19	34

a/ Source: Tables 11.3 and 11.4, Rice Storage, Handling and Marketing, The Republic Of Indonesia, Weitz-Hettelsater Engineers, October, 1972
Conversion Ratio, Rp 380 equals US$1.00.

could have handled the marketed surplus of approximately 18,000 hectares in 1970. If average yields increase to 2.5 tons of gabah per hectare and the percentage of rice marketed increases to 35 percent, only 10,285 hectares will be needed to supply 9,000 tons of gabah for a bulk storage facility. The harvested rice area for East Java in 1970 was 1,175,000 hectares. This area could have supported about 65 of the 3,000 ton, H-type, bulk storage facilities operating on a 2-shift basis. In areas where rice production is fairly intensive, and where there are some processing facilities in existence, the bulk storage facilities would be expected to draw rice from an area of anywhere from 20 to 50 kilometers around the facilities. Thus, these units would have to be located in areas where the road system would support truck transportation during most of the year.

Several generalizations can be made about the cost structure of rice processing in Indonesia. First, except for the very smallest facilities, the average variable cost per ton of gabah is less than Rp. 2,000. Second, average fixed costs for operating facilities with over 1,000 tons of storage capacity generally are greater than average variable costs. Third, the ratio of fixed costs to variable costs tends to increase with the size of the facility as processing technologies producing higher quality rice are introduced.

The high fixed costs associated with large processing units tend to increase the risks involved in investing in such facilities. These risks are increased further when operating profits are highly sensitive to changes in the government's rice price policies.

The existing price margins and interest rates favor investments in rice milling rather than rice storage. This is part of the reason for the apparent abundance of milling capacity and the shortage of adequate storage facilities. There is very little incentive to build new storage capacity unless it can be used as part of a milling operation. Based on an average grain storage turn-over ratio of 3.0, a rice mill should have approximately 3 tons of annual milling capacity for each ton of storage. Thus, a 1-ton-per-hour rice mill operated on a single-shift basis has an annual milling capacity of about 2,496 tons of gabah and should be supplemented with approximately 800 tons of storage capacity. The same mill operated on a 2-shift basis would require 1,600 tons of storage capacity.

Of all the facilities considered, modified versions of the G and G-1 facilities appear to be best suited to existing conditions in most parts of Indonesia. These facilities can operate profitably with an annual

production volume of from 2,000 to 5,000 tons and generally would not require a supply area with a radius greater than 25 kilometers in areas of intensive rice production. The G-type facilities with mechanical driers have a great deal of potential value to the nation in areas where wet season rice can be grown on a large scale. These facilities can be attractive investments to private operators when expected volume reaches about 4,000 tons of gabah. At this volume, the profitability of the G-type facilities can be increased by replacing the self-contained rice mills with multi-stage rice mills.

The bulk storage facilities such as Prototypes H and H-1 will become increasingly worthwhile investments as Indonesia approaches self-sufficiency in rice production. This type of facility will be needed to produce the quality of rice required by the world export markets. The profitability of these units will increase as the road system is improved, as the price difference between average and high quality rice widens, and as the demand for rice milling by-products increases.

There is no single facility that is best, or most profitable, for all operating levels and market conditions. Thus, any program to encourage private investment in new storage and processing facilities must provide the private investor with considerable flexibility in selecting the type of facility that appears to be the best suited for the area in which it is to be located. Any program which provides investment capital for only one or two particular types of facilities is unlikely to meet the needs of many private investors.

16. Benefit/Cost Ratios for New Facilities

Benefit/Cost ratios are useful for anlyzing the economic feasibility of investment projects because they summarize large amounts of information. The following illustration explains how Benefit/Cost ratios are constructed.

It is estimated that a well managed off-farm storage facility will result in grain savings equal to 4 percent of the gabah handled by the facility. Thus, a 1,000-ton warehouse, with an annual turn-over rate of 3.0, would save 120 tons of gabah that would be lost otherwise. Using a farm price of Rp. 17,400 per ton of gabah, the market value of the grain saved is Rp. 2,088,000 annually. A standard bag storage warehouse is expected to realize savings of this magnitude for 15 years. Discounting the expected savings over a 15-year period at a 12 percent discount rate,

the total discounted value of the grain saved is Rp. 14,223,456. If a 1,000-ton standard bag warehouse costs Rp. 6,692,000 to construct, the Benefit/Cost (B/C) ratio based on the grain saved is:

$$\frac{\text{Benefits}}{\text{Cost}} = \frac{14,223,456}{6,692,000} = 2.12$$

In other words, the grain saved by the new warehouse has a present value of Rp. 2.12 per Rupiah invested in the facility.

Discounting future savings is done because a ton of gabah saved next year is not worth as much to society as a ton of gabah saved this year. Suppose, for example, that a ton of gabah saved two years from now has a market value of Rp. 17,400. The discounted value (or present value) of Rp. 17,400 two years from now is only Rp. 13,868 if the discount rate is 12 percent annually. If Rp. 13,868 was invested for 1 year at 12 percent, the interest earnings would be Rp. 1,664. The investor, therefore, has Rp. 15,532 to invest during the second year. At 12 percent, the interest earnings on Rp. 15,532 are Rp. 1,864; thus, by the end of the second year, the investor's total net worth has increased from Rp. 13,868 to approximately Rp. 17,400. The discounted value of Rp. 17,400 received at the end of each year for two years is therefore equal to the sum of present value of Rp. 17,400 at the end of year one (which is Rp. 15,532) and the present value of Rp. 15,532 at the end of the year two (which is Rp. 13,868) giving a total discounted value of Rp. 29,400. This is considerably less than 2 (17,400) = Rp. 34,800; the amount received by the investor.

From the standpoint of the private operator an investment in a new grain processing facility is worthwhile only if the prices of inputs and outputs allow him to cover depreciation costs and to earn a reasonable rate of return on his investment. Benefit/Cost ratios based on discounted net profits are, therefore, of considerably more interest to private investors than B/C ratios based on expected grain savings.

Benefit/Cost ratios based on discounted net profits are presented in Table 7-S for several different types of small self-contained rice mills as well as vertical and flat bulk storage facilities. The procedure used to obtain these B/C ratios was to: (a) discount the annual net profits before depreciation and interest charges over the expected lifetime of the facilities and then (b) divide the total discounts profits by the investment cost of the facilities. Discount rates of 12 and 24 percent were used. The net profit estimates are based on the data and assumptions used to obtain Table 6-S.

TABLE 7-S

ECONOMIC BENEFITS OF NEW STORAGE FACILITIES[a/]

INDONESIA, 1975

Proto-type	Description Of Facilities	Capacity, Metric Tons: Storage	Milling Gabah/Hour	Drying Gabah/Hour	Discount Period (Years)	Annual Net Profit Before Depreciation & Interest	Tons Of Gabah Processed	Discounted Net Profits (Total Economics Benefits) 12%	24%	Ratio Of Economic Benefits To Investment Cost 12%	24%
						(1,000 Rp)		(Million Rp)	(Million Rp)		
Small Self-Contained Mill Facilities											
G	With Self-Contained (SCRM) Rice Mill Units	756 Ton	1-1 Ton (SCRM)[b/]	3/4 Ton	15	10,000	2,500	68.0	40.0	1.97	1.16
G-B	With Self-Contained (SCRM) Rice Mill Units	1,756 Ton	2-1 Ton (SCRM)[b/]	3/4 Ton	15	22,975	5,000	156.5	91.9	3.50	2.06
G-1	With Self-Contained (SCRM) Rice Mill Units	920 Ton	1-1 Ton (SCRM)[b/]	Sun Dry	15	9,066	2,350	61.7	36.3	3.65	2.14
G-1B	With Self-Contained (SCRM) Rice Mill Units	1,920 Ton	2-1 Ton (SCRM)[b/]	Sun Dry	15	19,725	4,700	134.3	78.9	4.43	2.60
Bulk Storage Facilities											
H	3,200 Ton (Vert. Storage) 2-Shifts	3,200 Ton	1-2 Ton (MSRM)[c/]	3 Ton	20	61,003	9,000	456	251	3.15	1.73
H-2	3,200 Ton (Flat Storage) 2-Shifts	3,200 Ton	2-1 Ton (SCRM)[b/]	3 Ton	20	36,473	9,000	272	150	2.35	1.29
H-1	4,500 Ton (Vert. Storage) 2-Shifts	4,500 Ton	1-3 Ton (MSRM)[c/]	3 Ton	20	101,748	14,000	760	418	4.39	2.41
H-3	4,500 Ton (Flat Storage) 2-Shifts	4,500 Ton	3-1 Ton (SCRM)[b/]	3 Ton	20	64,306	14,000	480	264	3.76	2.07

a/ Source: Table 11.12, Rice Storage, Handling and Marketing, The Republic of Indonesia. Weitz-Hettelsater Engineers, October, 1972.
b/ "SCRM" is a self-contained rice mill.
c/ "MSRM" is a multi-stage rice mill.
Conversion Ratio, Rp 380 equals US$1.00.

All of the facilities considered have Benefit/Cost ratios greater than 1.0 even at a discount rate as high as 24 percent. The small self-contained rice mills with sun-drying (Prototypes G-1 and G-1B) and the 4,500-ton bulk storage units (Prototypes H-1 and H-3) have the highest B/C ratios. The B/C ratio for the 4,500-ton flat bulk unit (Prototype H-3) could be increased to about 2.50 (using a 24 percent discount rate) by replacing the self-contained mills with multi-stage mills to obtain a higher quality rice.

17. Economics of Rice Drying

If Indonesia is to realize the full benefits of the new high yielding rice varieties, it will have to increase the use of mechanical rice driers. The first step in this process has already been taken in an attempt to introduce small batch-driers.

The average cost of sun drying a ton of gabah (rough rice) off-farm is approximately Rp. 300. This cost is almost entirely a variable cost. If a rice mill has a mechanical drier, it would be profitable to use the drier only if its variable costs were less than the costs of sun drying. This would be the case when weather conditions prevent sun drying. If a mill does not have a mechanical drier, it would be profitable to invest in one only if it could be used sufficiently to cover both fixed and variable costs.

The costs of operating four types of small mechanical driers are shown in Table 8-S. The "Pelita" batch-drier is the smallest of the four types considered. It has a potential drying capacity of 250 kilograms of gabah input per hour. The "Diesel-Engine" batch-drier is a portable warm air drier which utilizes the heat produced by an air cooled diesel-engine. It has a drying capacity of 500 kilograms of gabah per hour. The "Kongskilde" batch-drier consists of a circular wood bin and a heat exchanger with a fan that forces warm air into a plenum chamber surrounded by rice. It has a potential drying capacity of about 750 kilograms of gabah per hour. The "In-Bin" batch-drier is used in the Prototype G and G-B facilities shown in Drawing 03. It has a drying capacity of 750 kilograms of gabah per hour.

The average variable costs of the "Pelita", "Diesel-Engine", and "Kongskilde" driers are higher than the cost of sun drying. These driers would be used only when sun drying was not possible. The potential drying period for the "Diesel-Engine" and "Kongskilde" driers is assumed to be about 90 days per year. The "Pelita" batch-drier has a much higher

TABLE 8-S

THE COSTS AND BENEFITS OF SMALL MECHANICAL DRIERS[a]

INDONESIA, 1975

Row or Line Number	Item	Type Of Drier: "Pelita" Batch Drier	"Diesel-Engine" Batch Drier	"Kongskilde" Batch Drier	"In-Bin" Batch Drier
1.	Average Variable Costs (Rp/ton gabah)	566	340	341	221
2.	Total Fixed Costs (1,000 Rp)	408	434	2,114	2,326
3.	Average Fixed Costs (Rp/ton gabah)	907	402	1,305	587
4.	Average Total Costs (Rp/ton gabah)[b]	1,473	742	1.646	808
5.	Tons of Gabah Dried	450	1,080	1,620	3,960
6.	Days Worked	75	90	90	220
7.	Tons of Gabah Saved In Days Worked	180	360	540	540
8.	Benefit/Cost Ratio (Based on 12% Discount Rate)	10.8	20.4	6.3	5.7

a/ Source: Tables 11.13 and 11.14, Rice Storage, Handling and Marketing in the Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972.

b/ Average total costs are equal to the sum of average variable costs plus average fixed costs.

Conversion Ratio, Rp 380 equals US$1.00.

average variable cost and would not be used more than about 75 days per year.

The "In-Bin" drier is the most efficient of the four units considered. Its average variable cost is less than that of sun drying. Thus, it would be used to dry a large portion of the total grain received by the facility in which it is installed.

At the assumed operating levels, the "Pelita" and "Kongskilde" driers have the highest average total costs. The cost of drying rice with these units is approximately 4 to 5 times greater than the average cost of sun drying -- when sun drying is possible. The cost of drying rice with the "Diesel-Engine" and "In-Bin" driers is approximately 2 to 2.5 times higher than that of sun drying. The conclusion is that mechanical rice driers will be worthwhile investments only if there is rice to be dried when sun drying is impossible or very costly.

18. Benefit/Cost Ratios for Mechanical Driers

In many areas, rice can and would be grown for harvest during the rainy season if mechanical rice driers were available. Assuming that a rice drier would save all of the grain it can process during 30 days of each year, a "Pelita" batch-drier would save 180 tons of gabah with an estimated market value of Rp. 3,132,000. From the standpoint of the nation, this drier would have to save only 100 tons of gabah in order to pay for itself in its first year of operation. This is certainly feasible once mill owners learn how to operate these driers and how to keep them in a good state of repair.

A small batch-drier when operated less than 3 months each year should have an expected useful life of at least 10 years. The present value of Rp. 3,132,000 discounted at 12 percent over a 10-year period is Rp. 17,699,000. Dividing the present value by the cost of the "Pelita" drier results in a Benefit/Cost ratio of 10.8. In other words, each Rupiah invested in the drier is worth about Rp. 10.8 to the nation if the drier is used at the assumed levels.

Under the same assumptions, the "Diesel-Engine" drier has a Benefit/Cost ratio of 20.4; the highest of all driers analyzed. There is much to be said for encouraging the use of this type of drier by existing warehouse operators handling at least 2,000 to 3,000 tons of gabah annually.

All of the driers have Benefit/Cost ratios greater than 1.0 even at the minimum expected levels of grain savings and when interest rates are as high as 24 percent per year. Increased use of small mechanical rice driers definitely would be beneficial.

If a ton of gabah with a 14 percent moisture content is worth Rp. 17,400, the value of a ton of gabah with 24 percent moisture is only Rp. 15,666 minus the cost of drying the rice to a 14 percent moisture content. The full cost of drying the rice with a "Kongskilde" drier is estimated to be about Rp. 1,646 per ton of gabah. Thus, a mill operator could not pay more than about Rp. 14,020 per ton of gabah without losing money on the drying operation.

If the operator of a "Kongskilde" drier could purchase rice at Rp. 13,400 and process a total of 1,620 tons per year, he would earn about 12 percent on his total investment after allowing for an interest rate of 12 percent on the purchase of the drier. At existing interest rates and expected rates of return, it appears likely that mill operators would have to be confident that they could purchase at least 1,500 tons of 24 percent moisture gabah at about Rp. 12,000 per ton before they would seriously consider investing in a "Kongskilde" drier.

Investment in a "Diesel-Engine" drier should prove attractive to private operators if they could be confident of buying at least 1,000 tons of 24 percent moisture gabah at market prices about Rp. 3,000 below the market price for 14 percent moisture gabah. In areas where substantial quantities of rice can be harvested during the rainy season, a mill operator should be able to obtain 1,000 tons of gabah from an area within 5 to 10 kilometers of his mill.

Operators of "Pelita" driers probably would not need a supply area with a radius greater than 5 kilometers, but they might find it difficult to compete with other mills bidding for the farmers' gabah. Mill operators with "Diesel-Engine" driers should be able to pay farmers at least Rp. 500 to Rp. 800 per ton more for their gabah than operators using "Pelita" driers.

Using a base price of Rp. 17,400 per ton of gabah and assuming competitive bidding among mill operators for rainy season rice, farmers should be able to earn a profit on gabah harvested during the rainy season if mechanical driers are available within 5 to 10 kilometers from their rice fields. Without the availability of mechanical driers, few farmers would be able to save enough rice to allow profitable production

of rice harvested during the rainy season. Mill operators, on the other hand, are reluctant to invest in mechanical driers when very little rice is harvested during the rainy season. It seems unlikely that this situation can be changed without the Government of Indonesia initially subsidizing the introduction of mechanical drying facilities.

19. Using Price Policies to Encourage Private Investment in New Rice Facilities

There are a wide variety of actions which the Government of Indonesia could take to encourage private investment in new rice marketing facilities. The actions differ with respect to their speed and directionality of impact on investment decisions.

The profitability of investments in new rice storage and processing facilities will depend on the price structures that exist during the entire life of the facility. As a result, changes in price policies affect investment decisions by changing expectations about future price structures. Price policies can be changed rapidly and have greater impact on near term expectations. The shorter the expected useful life of a facility, the greater the effect of a price policy change on investment decisions. If marketing margins are widened, for example, this affects decisions to invest in small rice hullers more than it affects investment decisions involving multi-stage mills with storage facilites.

Price policies can be used to provide signals to potential investors concerning the direction of the changes in government goals. Thus, a small increase in marketing margins would serve to indicate an increased government interest in encouraging additional investments in rice marketing facilities.

With careful planning, price signals can be introduced prior to introduction of other programs and thereby help lengthen the planning horizon of private investors. A government credit program to encourage construction of new storage, for example, would require at least a year to finance and develop. During this development period, the government could widen marketing margins and encourage wider participation of rice merchants in price policy decisions. This would increase private investors confidence in the profitability of new investments and their awareness of the changes taking place in national objectives.

The government support price for gabah reflects the importance

assigned to the goal of self-sufficiency. If the support price is increased, the value of rice storage and processing facilities (as measured by the value of grain saved) tends to increase.

As an illustration, if a 4,500-ton bulk storage facility (Prototype H-1) processes 14,000 tons of gabah each year, it is expected to save about 2,520 tons of gabah compared to on-farm processing. If the farm price of gabah is Rp. 17,400 per ton, the Benefit/Cost ratio for the facility based only on grain saved, using a 12 percent discount rate, is 1.89. If the farm price of gabah is increased to Rp. 20,000 in an effort to achieve self-sufficiency, the Benefit/Cost ratio for the 4,500-ton bulk storage facility increases to 2.18. In other words, the more importance assigned to the goal of self-sufficiency, the greater the value of new storage and processing facilities to the nation. The value of new facilities to private investors, on the other hand, will be reduced unless the wholesale price of rice is adjusted upward to offset the higher farm prices.

Price policies usually are "costly" policies for encouraging new investments in grain marketing facilities. Widening marketing margins, for example, benefits existing facilities as well as encouraging the construction of new facilities. Suppose, for example, that marketing margins per ton of gabah were increased by Rp. 2,000 in an effort to encourage investment in new storage and processing facilities. Roughly 3,000,000 tons of gabah were marketed in 1971. At this level of rice marketings, existing middlemen would receive an additional Rp. 6,000,000,000 from farmers and consumers for their efforts. A Rp. 6,000,000,000 government program for the construction of new warehouse capacity (not including machinery) would finance about 850,000 tons of new storage capacity. It seems very unlikely that private operators would respond to a Rp. 2,000 increase in the marketing margin by building 850,000 tons of new warehouse capacity. Even if they re-invested half of the Rp. 6,000,000,000 increase in profits, only part of it would go to storage capacity investments. Much of it probably would go for increased purchases of small rice mills, with the expectation that the increased margins would not be maintained for more than two or three years.

In summary, price policies can be used to signal changes in government objectives, but they are an expensive way to obtain private investments in new marketing facilities. In a situation where the government has a general idea of the type of facilities which it would like to see constructed, the magnitude of the storage requirements, and the location of priority areas, it would generally be better to rely on other, more

directional, policies to promote private investment.

20. Import Duties and Tax Policies

Import duties were not considered in estimating investment costs for the self-contained rice mills and bulk storage facilities discussed previously. Such duties would increase the fixed costs of facilities using imported equipment and construction materials. This would reduce expected profits and tend to discourage investment in facilities using a high proportion of imported items.

The local currency portion of the total investment cost for small hullers and flash-huskers (such as PBK units) is about 60 percent. For larger facilities such as the self-contained rice mills (Prototype G) and the bulk storage facilities (Prototype H), the local currency portion of the total investment cost ranges from 25 to 35 percent depending on the type of construction. Import duties established as a percentage of cost therefore favor the use of small, locally produced mills.

The disadvantages of eliminating import duties designed to protect existing manufacturers of small rice milling equipment probably would outweigh the advantages. On the other hand, any revenues lost by eliminating import duties on multi-stage rice mills, mechanical driers, and grain conveying equipment would probably be more than offset over the long run in foreign exchange savings on imported rice or foreign exchange earnings on exported rice.

Any reduction in income and transactions taxes on existing (or new) rice merchants would tend to encourage investment in new marketing facilities. General tax reductions probably would cost more than they were worth if their main purpose was to encourage new investments. Special tax exemptions on a large number of new facilities may be effective, but are likely to be troublesome to administer and control. Thus, it appears unlikely that changes in tax structures would be a particularly effective means of encouraging new investment in grain marketing facilities.

21. Credit Policies

Credit policies and lending programs offer the greatest potential for promoting new private investment in rice storage and processing facilities. Given existing interest rates in Indonesia and the

TABLE 9-S

CASH FLOW STATEMENTS FOR SELF-CONTAINED RICE MILLS AND BULK STORAGE FACILITIES[a/]

INDONESIA, 1975

Row Or Line Number	Item	Self-Contained Rice Mills[b/]						Bulk Storage Facilities[c/]					
		G-B, Mech Drying Year			G-1B, Sun Drying Year			H Vert. 3,200 Ton Year			H-1 Vert. 4,500 Ton Year		
		1	2	3-16	1	2	3-16	1&2	3	4-23	1&2	3	4-23
		(Figures in 1,000 Rp)											
1.	Source Of Funds												
	a. Loans	35,695	--	--	24,240	--	--	65,025	--	--	77,850	--	--
	b. Borrower's Equity[b/]	8,924	--	--	6,060	--	--	7,225	--	--	8,650	--	--
	c. Net Profit Before Depreciation and Interest	--	9,175	22,975	--	9,082	19,725	--	27,979	61,003	--	42,738	101,748
	Total Sources	44,619	9,175	22,975	30,300	9,082	19,725	72,250	27,979	61,003	86,500	42,738	101,748
2.	Applications Of Funds												
	a. Payment on Loans[d/]	--	5,144	5,144	--	3,493	3,493	--	17.198	17,198	--	20,590	20,590
	b. Interest On Working Capital	--	1,500	3,000	--	1,410	2,820	--	2,700	5,400	--	4,200	8,400
	c. Facility Cost	44,619	--	--	30,300	--	--	72,250	--	--	86,500	--	--
	Total Applications	44,619	6,644	8,144	30,300	4,903	6,313	72,250	19,898	22,598	86,500	24,790	28,990
3.	Net Cash Flow	--	2,531	14,831	--	4,179	13,412	--	8,081	38,405	--	17,948	72,758
4.	Cash Flow/Borrower's Equity (%)	--	28	166	--	69	221	--	56	266	--	104	420

a/ Source: Tables 11.19 and 11.20, Rice Storage, Handling and Marketing, The Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972
b/ Borrower's equity is 20 percent of total investment.
c/ Borrower's equity is 10 percent of total investment.
d/ Based on monthly payments for a fully amortized loan at 12 percent interest.
Conversion Ratio, Rp 380 equals US$1.00.

assumption that any large scale grain marketing program would have substantial backing from international lending agencies, the government should be able to offer private investors relatively attractive loan terms.

There are three elements of a loan that are of prime importance to private investors. These are:

(1) the interest rate;
(2) the length (or time period) of the loan; and
(3) the security (or percentage of total investment cost) that the borrower must provide to obtain the loan.

A lending agency can increase the profitability by reducing its interest rates. The degree of risk involved in an investment can be reduced by lengthening the loan period. The attractiveness of an investment can be increased by reducing the amount of money which the borrower has to provide from other sources to obtain the loan.

A fourth element of a loan, which is important in some cases, is the "grace period" or length of time that the borrower is allowed to use loan funds before having to make any loan payments. The length of the grace period is especially important for projects which require a long time to complete. In some cases, reductions in the equity requirements of a loan can be used to offset reductions in the length of the grace period. As a general rule, the grace period should be long enough to allow a facility to be in operation for at least six months before the first loan payment is due. The grace period on a small facility may be as short as one year. Larger facilities, with a longer construction period, may need a grace period of three to four years.

22. Cash Flow Statement for Storage and Processing Facilities

Cash flow statements for several facilities are presented in Table 9-S. The loan payments used in this table are based on fully amortized loans at a 12 percent annual interest rate. The length of the amortization period varies depending on the type of facility. All facilities are assumed to operate at one-half of their expected operating levels during their first year of operation and at full operating levels during the remainder of the loan period.

The small self-contained rice mill with a mechanical drier (Prototype G-B) provides an annual rate of return of 166 percent on the borrower's

TABLE 10-S

EFFECT OF INTEREST RATES AND LOAN PERIODS ON NET CASH FLOW[a/]

INDONESIA, 1975

Prototype								
		Line Item -- Years	5	10	15	5	10	15
		Line Item -- % Equity	20	20	20	20	20	20
		Line Item -- % Interest	12	12	12	18	18	18
G-B	Self-Contained Mill With Mechanical Drier							
	1. Net Cash Flow	(1,000 Rp)	10,445	13,828	14,831	9,095	12,256	13,075
	2. Cash Flow/Equity	(%)	117	155	166	102	137	146
G-1B	Self-Contained Mill With Sun-Drying							
	1. Net Cash Flow	(1,000 Rp)	10,433	12,731	13,412	9,517	11,663	12,219
	2. Cash Flow/Equity	(%)	172	210	221	157	192	202
H	3,200 Ton Vertical Bulk Storage Facility							
	1. Net Cash Flow	(1,000 Rp)	24,738	35,697	38,943	20,368	30,606	33,255
	2. Cash Flow/Equity	(%)	86	124	135	70	106	115
H-1	4,500 Ton Vertical Bulk Storage Facility							
	1. Net Cash Flow	(1,000 Rp)	56,395	69,516	73,400	51,164	63,420	66,593
	2. Cash Flow/Equity	(%)	163	201	212	148	183	192

a/ Source: Table 11.22, Rice Storage Handling and Marketing, The Republic of Indonesia, Weitz Hettelsater Engineers, October, 1972. Conversion Ratio, Rp 380 equals US$1.00.

equity of Rp. 8,924,000. This rate of return is based on a 15-year loan, at a 12 percent interest rate assuming the borrower's equity is 20 percent of the total cost of the facility. The net profit before depreciation and interest is computed on the assumption that the facility is operated at full capacity on a single-shift basis (see Table 6-S for basic cost data used). The comparable rate of return on the borrower's equity for a small self-contained rice mill with sun drying (Prototype G-1B) is 221 percent once the facility is in full operation.

The cash flow statements for the vertical bulk storage units (Prototypes H and H-1) are based on 20-year loans with a 10 percent borrower's equity and a 12 percent annual interest rate. The key assumption is that these facilities would be operated on a 2-shift basis when they are in full operation. Under these conditions, both the 3,200-ton and 4,500-ton bulk storage units would be attractive investments.

23. Effect of Interest Rates and Loan Periods

The effect of different interest rates and amortization periods on the net cash flow of selected facilities is shown in Table 10-S. Other things being equal, the ratio of the net cash flow to the borrower's equity declines as:

a. interest rates increase;

b. the amortization period declines; and

c. the borrower's equity decreases.

In general, small facilities using more traditional processing technology are less risky investments than large facilities using modern grain processing equipment. Thus, the expected profitability or the expected rate of return on the borrower's equity would have to be higher on large, complex facilities than on small traditional units.

An annual rate of return on the borrower's equity of 100 to 150 percent should be adequate to attract the interest of private investors in the small self-contained rice mills such as Prototypes G-B and G-1B. Such rates of return could be obtained with 5 to 10-year loans with 20 percent borrower's equity and interest rates in the range of 12 to 18 percent annually. These facilities are small enough that a 20 percent equity requirement should not substantially reduce the number of potential borrowers.

It was pointed out earlier that subsidization of mechanical drying by the Government of Indonesia would be needed to break the "vicious circle" of: farmers not growing rice during the wet season when driers are not available, and mill operators not investing in driers when wet season rice is not grown. Credit terms provide an almost costless way for the government to "subsidize" the introduction of mechanical driers. Faced with the possibility of borrowing at:

(a) 18 percent interest, on a 10-year loan with a 20 percent equity requirement, for a Prototype G-1B facility with sun drying

versus:

(b) 12 percent interest, on a 15-year loan with a 15 percent equity requirement, for a Prototype G-B facility with mechanical drying

many investors would select the Prototype G-B unit. The actual cost to the government would depend on its cost of borrowing and administering loan funds and the opportunity cost of using the funds elsewhere. Regardless of the cost assigned to government funds, it is obvious that the adjustment of credit terms can be an extremely simple and effective way to induce investment in certain types of facilities.

In situations where enough rice can be collected to support a 4,500-bulk storage unit operating on a 2-shift basis, the facility should be attractive to private investors even if loan terms were 10 years, at 12 (or 18) percent interest rates and 20 percent equity. The 4,500-ton facilities are expected to be considerably more profitable than the 3,200-ton units provided that 2-shift operation can be achieved.

The bulk storage and processing units are costly facilities. As a result, the establishment of an equity requirement of 20 percent or higher will limit the number of potential investors interested in this type of facility. The attractiveness of these facilities to private investors could be increased by reducing the equity requirement to 10 percent of the total investment cost.

The "net cash flow as a percentage of borrower's equity" should not be confused with the "rate of return on total investment." Private investors generally would be more interested in net cash flows and loan terms than in the "profitability" of an investment as determined by the

"full cost" procedures used in Table 6-S. The private investor benefits in the long run only if he can earn more on the total investment cost of a facility than he pays for the money to build the facility. If he can do so, and personal funds are used to finance only a small part of the total investment cost, he is well rewarded for his risk-taking and managerial efforts. In other words, a profitable facility which is heavily leveraged can increase the net worth of the borrower substantially in a very few years.

By the same token, a heavily leveraged facility which is unprofitable can reduce an investor's net worth rapidly. Heavy leverage (a low equity requirement) simply magnifies the potential rewards and losses of an investment. A successful investor is one who can find "profitable" investments and leverage them heavily without losing control of the net cash flows or potential capital gains. The Government of Indonesia can rely on private investors to identify potential "profitable" investments in grain marketing facilities if it provides credit terms that will allow the private investors to leverage their investments at favorable interest rates. The Government of Indonesia can minimize its lending risks and the possibility of losses to borrowers by requiring adequate feasibility studies by the borrowers, and by developing its own expertise to judge the reasonableness of these studies.

24. Effects of Inflation

Inflation is a potential source of capital gains and profits that has not been considered in Table 10-S. In an inflationary situation, a borrower receives a Rupiah with more purchasing power than the one used to make loan payments later. Although inflation is considered to be "under control" in Indonesia at the present time (1972), a great deal could change during the expected operating life of a major grain storage facility. The possibility of future inflation can be taken into account in several ways. One way would be to set interest rates somewhat higher than they might be set if prices were expected to remain stable. Another way would be to build an inflation adjustment factor into the terms of the loan. [illegible] annual interest rate could be increased by one-half of the expected [illegible] increase in the consumer's price index, for example. A third option is to assume that prices will remain relatively stable during the loan period and allow borrowers to receive the full benefits of any inflation that might occur. A fourth approach is to reduce the length of the loan period.

25. Need for Working Capital

Potential investors in new storage and processing facilities will need assurance of the availability of working capital before they can estimate the expected operating levels and profitability of their investment. The estimated cost of the 4,500-ton bulk storage and processing facility (Prototype H-1) is approximately Rp. 173,046,000 (or US$455,384). If the price of gabah is Rp. 17,000 per ton, it would cost Rp. 76,500,000 (or US$201,000) to purchase the 4,500 tons of gabah required to fill the facility's storage capacity. The "working capital" requirements in this case are roughly 45 percent of the facility's cost. Actual working capital requirements for other facilities may be less than this estimate. Nevertheless, it is obvious that working capital requirements can be very important considerations in deciding on the type and size of facilities that are suited to a private investor's financial situation.

The interest costs on working capital loans can have a substantial effect on the profitability of a facility. The length of the working capital loan also can influence a merchant's decisions on when to buy gabah and when to sell rice.

Working capital requirements are difficult for a lending agency to estimate and to verify. They also change rapidly during the year for any particular facility depending on the balance of its purchases and sales.

If working capital loans are made at interest rates substantially below the market rate of interest, grain merchants will tend to borrow more than they need and to postpone payments as long as possible. The result can be costly to lending agencies if "postponed repayments" become uncollectable debts.

Although low cost working capital loans would help encourage new investments in storage facilities, they are likely to be "costly" loans from the government's standpoint. An alternative approach would be to assure private investors that working capital loans would be available at going interest rates (at say 18 to 24 percent) and then use any "profits" on lending operations to lower interest rates on long-term capital investment loans. This approach changes the relative prices of inputs in favor of more capital intensive technology.

The profitability analysis in Table 6-S and the flow-of-funds analysis in Tables 9-S and 10-S are based on the assumption that the

cost of working capital is 24 percent. It is obvious that the credit terms for long-term capital investment can be made attractive enough to offset the high interest rates on working capital if investors are assured that working capital is available at these rates.

26. Programs for Improving the Rice Marketing System

Indonesia will need about a million tons of new off-farm rice storage capacity by 1975 in order to handle the expected increases in rice production. An additional million tons would be needed between 1975 and 1980. It seems unlikely that the private sector will be able to provide the facilities needed without a major effort by the Government of Indonesia to improve the existing rice marketing system. This will require the development of an integrated set of marketing programs. New facilities become useless and remain unused unless supported by appropriate policies and institutions, and by people knowledgeable in their use, maintenance and management. Likewise, policies and institutions become platitudes and equally useless unless supported by the needed facilities.

One set of marketing programs is outlined here. These programs may need to be modified due to capital limitations, the lack of qualified personnel to carry them out, or to take account of facts that may not have been considered. They, nevertheless, provide a starting point for discussion, a clear idea of the types of programs that are needed, and a better understanding of the magnitude of the task of improving Indonesia's rice marketing system.

27. A Phased Construction Program for New Facilities

A five-year, phased construction program for new rice storage and processing facilities is outlined in Table 11-S. The complete program would provide approximately 613,000 tons of new storage capacity by 1977. The total cost of the program is expected to be approximately Rp. 13,000,000,000 (or US$35,000,000) depending on the types of facilities selected.

Three classes of facilities are included in the construction program. The "G-type" small self-contained rice mills represent the main part of the program. The exact modification of the "G-type" facilities that would be constructed in a particular location would depend on such things as the seasonality of production, the road system and the types of

TABLE 11-S

STORAGE AND PROCESSING CAPACITY PROVIDED BY THE PHASED CONSTRUCTION PROGRAM[a/]
INDONESIA, 1975-1977

Item	Storage Capacity	Milling Capacity	Drying Capacity	Cost Of Construction: Foreign Currency Portion	Cost Of Construction: Local Currency Portion	Cost Equivalent[b/]: Total In Foreign Currency	Cost Equivalent[b/]: Total In Local Currency	Cost Equivalent[b/]: Percent Of Total Cost
	(Tons)	(TPH Gabah)	(TPH Gabah)	(US$)	(Rp 1,000)	(US$)	(Rp 1,000)	
I. 1975 Components								
1. "G" - Type Facilities	158,800	180	38	6,069,600	1,724,500	10,607,757	4,030,948	31
2. New Bag Warehouses	100,000	--	--	--	640,869	1,686,498	640,869	5
1975 Totals	258,800	180	38	6,069,600	2,365,369	12,294,255	4,671,817	36
II. 1977 Components								
1. "H" - Type Facilities	127,367	81	95	8,015,323	1,541,041	12,070,694	4,586,864	35
2. "G" - Type Facilities	127,040	144	30	4,855,680	1,379,600	8,486,206	3,224,758	24
3. New Bag Warehouses	100,000	--	--	--	640,869	1,686,498	640,869	5
1977 Totals	354,407	225	125	12,871,003	3,561,510	22,243,399	8,452,493	64
Grand Totals 1975-77	613,207	405	163	18,940,603	5,926,879	34,537,654	13,124,310	100

a/ Based on costs and capacities of the "Average" Facilities in Table 12.1, Rice Storage, Handling and Marketing In The Republic of Indonesia, Weitz-Hettelsater Engineers, October, 1972.
b/ Conversion Ratio, Rp 380 equals US$1.00.

markets available. These factors would be analyzed in a combination loan proposal/feasibility study for each facility.

Standard bag warehouse facilities account for about one-third of the total storage capacity in the program. This warehouse capacity could be added in different ways. Part of it could be constructed to provide medium term storage for price stabilization purposes. Some of the new warehouse capacity could be added to existing rice mills. Other warehouse facilities could be constructed as part of a village go-down program. This would be particularly useful in areas where milling capacity is adequate, but storage capacity is lacking.

A total of 31 small bulk storage and processing facilities, such as shown in Drawings 04 and 04A, are included in the construction program. The particular prototypes selected would be based on feasibility studies for the locations finally selected. In the event that private operators find some of these units to be too risky for investments or that the individual feasibility studies indicate that 2-shift operation is not possible in some locations, an equivalent capacity of "G-type" facilities could be financed to replace the bulk units not constructed. All of the bulk facilities are included in the 1977 phase of construction program. The bulk facilities account for about 20 percent of new milling capacity and 60 percent of the mechanical drying capacity included in the program.

Using 1971 as the base year, the construction program would increase Indonesia's off-farm storage capacity by about 40 percent over a five-year period. The milling capacity added by the program is approximately 6 percent of the 1971 milling capacity. This is far short of the amount of existing milling capacity that is expected to be replaced by 1977. The small amount of new milling capacity provided by the program would allow existing mills to be utilized more fully, permit the introduction of new small mills outside of the program, and allow the up-dating of old rice mills.

There is no very meaningful 1971 basis for comparing the amount of new mechanical drying capacity added by the construction program. If all of the drying capacity was used on a full 2-shift basis, the total amount of gabah processed with mechanical rice driers would be about 815,000 tons, once the facilities were in full operation. This is 4 percent of the total production of gabah projected for 1977. Small as this percentage may seem, it represents a substantial and important change in rice processing techniques in Indonesia.

The construction program outlined in Table 11-S is designed to allow

the gradual modernization of Indonesia's rice marketing system over the next 10 years. The bulk storage and processing facilities indicated for 1977 account for only 21 percent of the new storage capacity in the program. These units are designed to process approximately 380,000 tons of gabah annually. This type of facility would be essential to the success of any rice production program designed to allow Indonesia to export high quality rice by the end of the decade. The 31 bulk storage and processing units represent a small, conservative step towards the use of bulk storage and continuous-flow mechanical grain drying.

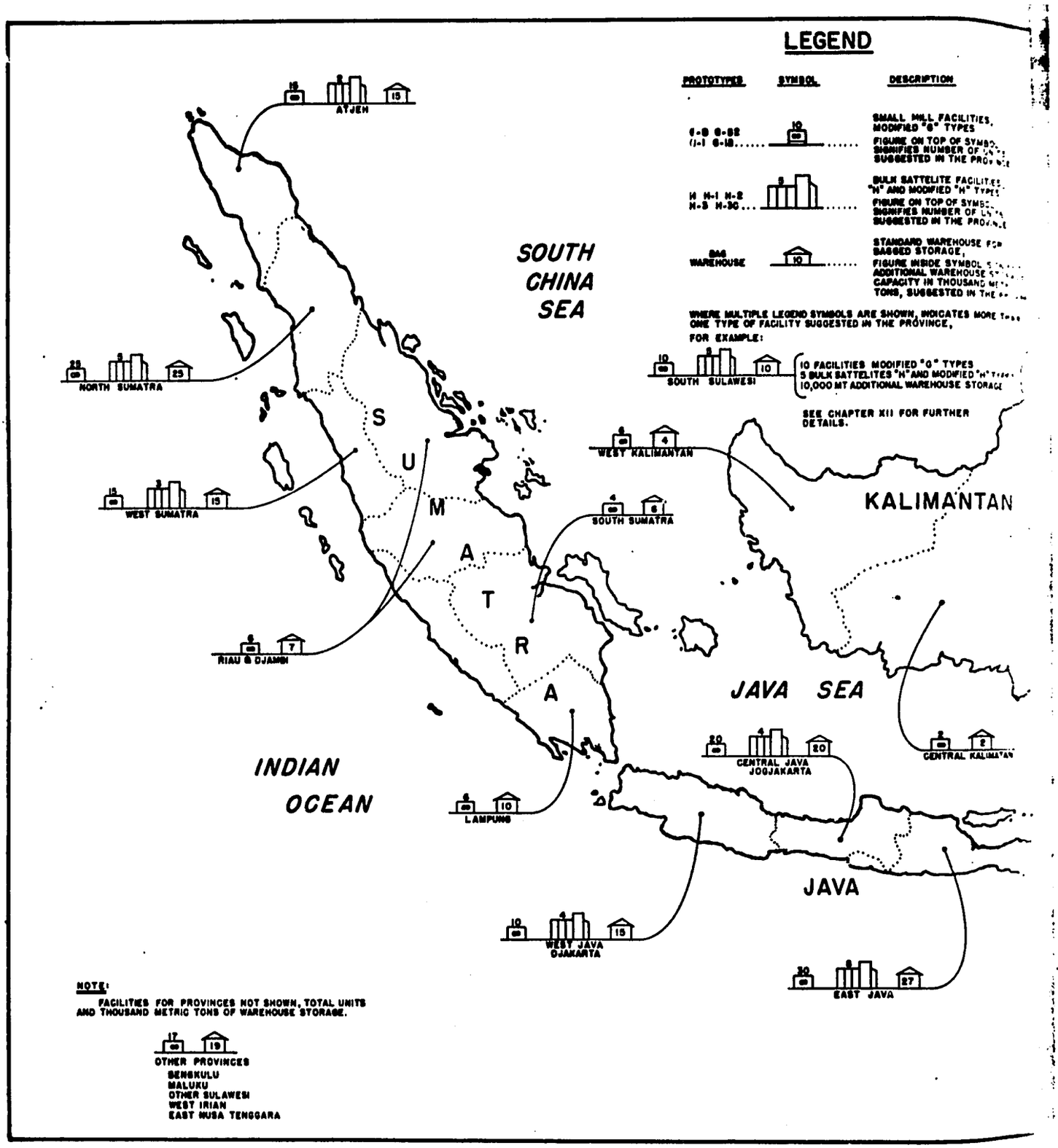
Flexibility is the key to the success of any program designed to encourage private investment in grain storage facilities. All of the facility types included in Table 11-S can be profitable investments. Which type of facility is likely to be most profitable will depend on the particular operator and the facility's exact location. This type of information could be included in a brief feasibility study supporting individual loan applications. A well designed program would be flexible enough to use new information generated by potential investors to modify the basic program during the early stages of implementation and before actual construction begins. Any program that allows the construction of only one or two particular types of facilities, say only Prototypes H-1 and G-B facilities, would greatly reduce private sector participation.

The regional location of the new facilities is shown in Figure 12.1.[6/] This regional distribution is based on the information used to estimate the additional storage capacity needed, as shown in Table 5-S.

28. Value of the New Rice Facilities Program

If all of the facilities listed in Table 11-S were constructed and operated at full capacity, Indonesia would save, on the average, approximately 200,000 tons of gabah annually. Using a farm price of Rp. 17,600 per ton of gabah, the value of the rice saved would be Rp. 3,520,000,000. In other words, the value of the gabah saved annually is worth approximately 25 percent of the total cost of constructing the facilities. In this case, the ratio of economic benefits to investment costs for the entire storage program in Table 11-S is approximately 3.40. This ratio

6/ Figure 12.1 taken from Chapter XII ("Improving Indonesia's Rice Marketing System") of the main report entitled: Rice Storage, Handl- and Marketing: The Republic of Indonesia, Economic and Engineering Study, Weitz-Hettelsater Engineers, K.C., Mo. U.S.A; Oct. 1972, p.487.


LEGEND
PROTOTYPES
SYMBOL
DESCRIPTION
SMALL MILL FACILITIES, MODIFIED "O" TYPES
FIGURE ON TOP OF SYMBOL SIGNIFIES NUMBER OF UNITS SUGGESTED IN THE PROVINCE
BULK SATTELITE FACILITIES "H" AND MODIFIED "H" TYPES
FIGURE ON TOP OF SYMBOL SIGNIFIES NUMBER OF UNITS SUGGESTED IN THE PROVINCE
BAG WAREHOUSE
STANDARD WAREHOUSE FOR BAGGED STORAGE,
FIGURE INSIDE SYMBOL ADDITIONAL WAREHOUSE CAPACITY IN THOUSAND METRIC TONS, SUGGESTED IN THE PROVINCE
WHERE MULTIPLE LEGEND SYMBOLS ARE SHOWN, INDICATES MORE THAN ONE TYPE OF FACILITY SUGGESTED IN THE PROVINCE,
FOR EXAMPLE:
SOUTH SULAWESI
10 FACILITIES MODIFIED "O" TYPES
5 BULK SATTELITES "H" AND MODIFIED "H" TYPES
10,000 MT ADDITIONAL WAREHOUSE STORAGE
SEE CHAPTER XII FOR FURTHER DETAILS.
SOUTH CHINA SEA
INDIAN OCEAN
JAVA SEA
KALIMANTAN
JAVA
S U M A T R A
ATJEH
NORTH SUMATRA
WEST SUMATRA
RIAU & DJAMBI
SOUTH SUMATRA
WEST KALIMANTAN
CENTRAL KALIMATAN
CENTRAL JAVA JOGJAKARTA
LAMPUNG
WEST JAVA DJAKARTA
EAST JAVA
NOTE:
FACILITIES FOR PROVINCES NOT SHOWN, TOTAL UNITS AND THOUSAND METRIC TONS OF WAREHOUSE STORAGE.
OTHER PROVINCES
BENGKULU
MALUKU
OTHER SULAWESI
WEST IRIAN
EAST NUSA TENGGARA

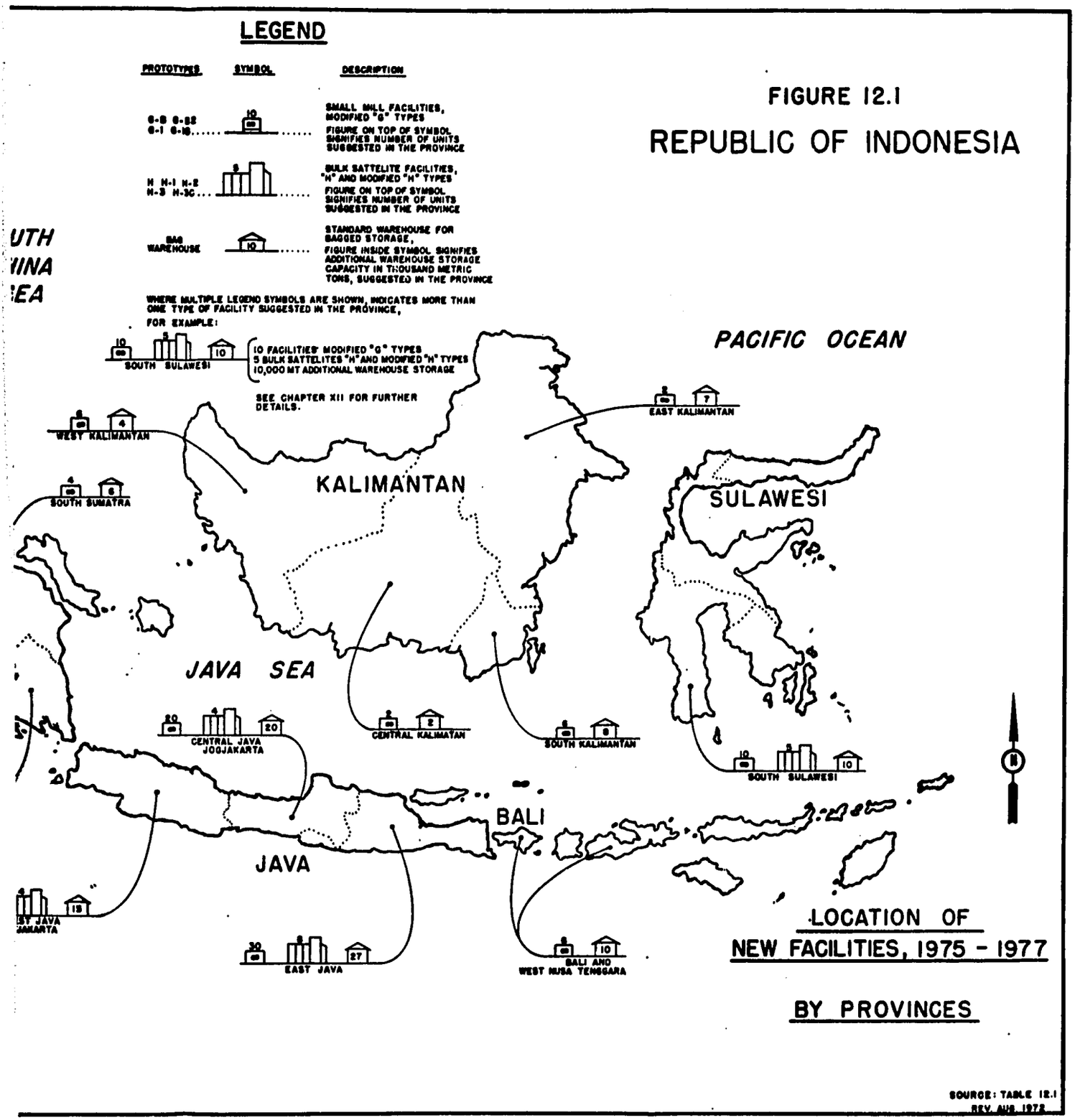


FIGURE 12.1

REPUBLIC OF INDONESIA

LOCATION OF NEW FACILITIES, 1975 - 1977

BY PROVINCES

SOURCE: TABLE 12.1
REV. AUG. 1978

is based on a 12 percent discount rate and the important assumption that the bulk storage facility (H-type) will be operated on a 2-shift basis. It indicates that, on the average, every rupiah invested in the program will generate Rp. 3.40 in discounted net profits during the expected lifetime of the facilities.

These results show that the general storage program would be worthwhile, both from the standpoint of the individual private investors and the nation. The extent to which private operators can be interested in the program will depend on the type of funding provided and the flexibility built into the program. The success of any program to modernize gradually Indonesia's rice processing facilities will depend to a large extent on the type of educational, extension, and technical services programs which are established to assist rice mill operators.

29. Complementary Investment Programs

There are several capital investment programs in addition to the major construction program that may need government support. Two programs that deserve special attention are:

a. a program to up-date the facilities of existing small rice mills, and

b. a program to provide part of the trucks needed to support the new storage facilities.

The total cost of up-dating about 1,100 small rice mills over a four to five-year period is estimated to be approximately Rp. 928,000,000 (or US$2,441,000).

It is estimated that a total of 313, 4-ton heavy-duty trucks and 251, 1-ton pick-up trucks would be needed to provide roughly 60 percent of the transportation services for the new facilities. The total cost of these trucks is approximately Rp. 1,048,000,000 or about U.S.$2,757,000.

30. An Import Facility for Brown Rice

There has been some discussion during the past several years of the possibility of constructing an import facility in Djakarta for handling brown rice. Total imports of rice during the 1965-1970 period averaged

about 440,000 tons annually. Much of this rice went directly to Djakarta. If rice imports remain at this level, on the average, during the 1970's, there would be a great deal to be said for a brown rice handling facility.

The decision to build, or not to build, an import facility for brown rice depends to a large extent on whether or not Indonesia decides to continue its full scale efforts to become self-sufficient in rice production. If the decision is made to continue to import 300,000 to 400,000 tons annually during the 1974-1980 period, serious consideration should be given to constructing a bulk facility for importing brown rice at the Port of Tandjung Priok in Djakarta. It does not appear likely that such a facility would handle very much, if any, domestically produced brown rice during the 1970's. If the facility is constructed and used for imported rice during the late 1970's, it probably will induce some investment in domestic processing and transportation facilities for handling brown rice during the 1980's, however.

If the goal of self-sufficiency is modified, it would not be unreasonable to expect Djakarta to import 30 to 35 percent of its annual requirements during the late 1970's. This is equivalent to approximately 220,000 tons of brown rice. It should be possible to obtain an annual storage turnover of 10 with an import facility. Using this turnover ratio, a facility with 22,000 tons of storage capacity should be adequate for handling brown rice imports. The estimated cost of such a facility is Rp. 758,605,780 which equals to US$1,996,331 at the conversion rate of Rp. 380=US$1.00.

The value of a brown rice milling facility depends on the price difference between brown rice in the bulk and milled rice in bags. The main difference in the prices of the delivered products is due to differences in freight rates. The prices of United States rice delivered in Djakarta in early 1972 were approximately US$194 per ton of milled white rice in bags and US$186 per ton of brown rice in the bulk.

The costs of processing brown rice using a 22,000 ton, flat bulk facility processing 220,000 tons of brown rice annually is approximately US$3.90 per ton of white rice obtained. At the prices in early 1972 and the assumed operating levels, the total cost saving of the brown rice import facility would be about US$858,000 annually. Under these conditions, the import facility would pay for itself in less than three years.

Additional in-depth study of the feasibility of constructing a bulk

facility for brown rice imports appears to be justified. Such a study would require the close cooperation of the Government of Indonesia in specifying long term policies for rice imports. The planning and construction of an import facility could be completed in approximately three years if it is handled as a special project. Thus, the value of the facility would depend on the government's import policies during the 1976-1980 period. Given the uncertainties about future import and price policies for rice, private operators may not be particularly interested in constructing this type of import facility. The profitability of the facility would depend on the retail rice prices in Djakarta and the terms on which brown rice imports were financed. It seems likely that the government will continue to try to provide consumers in Djakarta with low price rice. In this case, an import facility for brown rice would have to be government owned and operated.

31. Training Program

The efficient operation of a rice handling, processing and storage facility is dependent largely on its operating people. A training program in rice processing is essential to the success of any program to improve Indonesia's rice marketing system during the next few years.

The main purpose of such a program should be to assure that adequately trained people are available for responsible positions in both new and existing facilities. A second important function would be to train the grain marketing specialists who will work with the government agencies having grain marketing programs. These specialists would help farmers, rice wholesalers and retailers, as well as rice mill operators, to improve their grain handling, processing and storage procedures.

Such a training program could be carried out at the Agricultural and Technical schools located in Jogjakarta, Bogor, and Bandung. The program should be made available to all persons interested in grain marketing. The rapid development of a complete university program in grain makreting will require that a number of Indonesian technicians be trained abroad.

The estimated cost of a four-year project to establish a university training program in grain marketing is approximately Rp. 1,219,000,000 (or US$3,207,000). This is a sizable program, but it is essential to the success of the construction and up-dating programs discussed previously.

32. Technical Services Program

A small technical services group will be needed to assist in carrying out the construction and up-dating programs. This group would help the banks to evaluate loan requests related to investments in new storage and processing facilities, carry out research on ways to improve grain processing operations, and assist government agencies with technical problems related to grain marketing. The range of activities under this program would be broadened as marketing specialists are trained.

The total budget for the first four years of the technical services program is estimated to be approximately Rp. 261,000,000 or about US$688,000. About 25 percent of the total funds would be used for training Indonesians abroad. The heaviest draw-down on program funds would take place after 1975.

33. Marketing Extension Program

The results of the BIMAS program have demonstrated the value of a concentrated extension program in the field of production. A similar extension program is now needed in the field of marketing.

The marketing extension program would carry on a "grass-roots" type of training program for farmers and small rice merchants. Most of the field personnel participating in this program would be trained in Indonesia. During the first part of this program, emphasis would be placed on helping small mill operators up-date their facilities, increase their rice from gabah conversion ratios, and reduce their storage losses. The programs would be broadened gradually as more grain marketing specialists are trained.

Most provinces already have one or more persons in a governmental capacity assigned to rice marketing. In most cases, these persons are concerned primarily with such things as collecting taxes; issuing licenses, and assuring that rice processors are aware of and obey the regulations on rice storage, movements, and prices.

Marketing extension specialists would be more concerned with the technical aspects of marketing than with the government administration aspects. They would help in the development of a market new system. They would explain to farmers and merchants the differences between rice grades. They would demonstrate the use of rice grading and grain testing

equipment. They would help rice processors to obtain information on new mechinery and to learn how to use it once it was installed (this would be an especially important factor in the introduction of mechanical rice drying equipment). They would help rice millers obtain spare parts when there are breakdowns. They would assist both farmers and processors in obtaining operating capital and keep them informed on the latest credit programs. They would carry out programs designed to increase rice merchants' awareness of the sources of rice losses, the costs off the losses, and the value of improving their rice handling procedures. They would help farmers to reduce their marketing losses both in on-farm storage and in the movement of rice from farm to mill. These are just a few examples of the many things which need to be done. It is obvious that such a program could play an extremely important role in the modernization of Indonesia's rice marketing system.

The total cost of the first four years of the marketing extension program is estimated to be approximately Rp. 596,000,000 (or US$1,569,000). This program would be expanded gradually as extension specialists were trained.

34. Market News Program

Indonesia's market news system is still in an early stage of development. Price information presently is collected daily in a number of markets, but in most cases this information is not being disseminated rapidly enough to be of much value to farmers.

The need to expand and improve the marketing news system will continue to increase as farmers produce more surpluses for the commercial market. An expanded market news system should concentrate initially on providing farmers and merchants better information on rice prices. This will require the collection of more price information and the development of an improved communications system. The market news program should be expanded gradually to include crop forecasting and outlook information. This is a more technical type of work. Some foreign training will be required to provide the type of personnel needed for undertaking the sampling and statistical analysis required in crop forecasting.

The total cost of expanding the existing market news system over a four to five year period is estimated to be approximately Rp. 246,000,000 (or about US$648,000).

35. Grades and Standards Program

A small grades and standards program will be needed during the next few years. The immediate need is to develop a grading system for the market news and price reporting programs. Some modifications of the grading system used for rice price policies may be needed if BULOG places more emphasis on price incentives for rice quality differences. As Indonesia approaches self-sufficiency in rice production it will need to develop a grading system for export rice.

The total cost of a grades and standards program over a four-year period is estimated to be approximately Rp. 108,000,000 (or US$285,000). This is not a large program, but it is important that some work is continuously undertaken in this area.

36. Marketing Credit Program

The importance of adequate working capital for private grain merchants has been stressed previously. It is estimated that a working capital fund of approximately Rp. 7,600,000,000 (or US$20,000,000) would be adequate to assist investors in new storage and processing facilities to finance their inventories. At least part of this fund should be available by 1975 and the remainder by 1977.

37. Implementing the Rice Marketing Programs

The implementation of the programs and policies that have been discussed will require the close and coordinated cooperation of a large number of public, quasi-public, and private agencies. This coordination could be provided by BAPPENAS or by delegating authority to some other agency. The initial discussions with international lending agencies need to be started immediately. The universities and Ministry of Agriculture should be assigned the tasks of developing preliminary proposals for training programs and extension services programs. The major banks should be invited to provide suggestions concerning the financing of the various capital investment programs that have been identified. Preliminary discussions conerning the market news, marketing extension, technical services, and grades and standards programs should be gotten underway. These discussions would serve to identify the groups, or agencies, most capable of undertaking the various programs. Detailed plans for these programs could then be developed by the end of 1973.

The exact steps in the implementation and coordination of the various programs will depend on what programs are finally decided upon. Rather than speculate on these matters, it is more useful to assume that a set of projects similar to those discussed in this "Summary" will be undertaken and to outline the actions needed to implement the programs. Emphasis will be placed on the steps required to implement the construction program for new rice storage and processing facilities.

38. Implementing the Construction Program

The first step in implementing the construction program is for BAPPENAS, BULOG, the BRI, and other interested government agencies, to review the basic studies on rice production and marketing which have been completed during the 1970-1972 period, and to decide on the type of program that they feel best suits Indonesia's needs. Several of the international lending agencies should be contacted at this point. The agencies (or agency) interested in financing part (or all) of the program should be invited to assist in the development of the complete investment program. It is estimated that it will take about eight months to develop the project, to have it reviewed by the international lending agencies involved and to complete the loan agreements. It is assumed that the BRI will be the principal administering agency for the resulting project.

The Bank Rakjat Indonesia (BRI) presently lacks specialized technicians who are knowledgeable concerning the construction and operation of modern rice storage and processing facilities. It will, therefore, have to establish a "Technical Section" of rice storage and processing specialists, and to supplement this group with foreign consultants having experience in the design, operation, and economics of modern grain handling facilities. This "Technical Section" would be established in the main offices of the BRI in Djakarta and would be charged with the administration and execution of the investment program.

39. Consulting Engineer for the Construction Program

Most international lending agencies require that foreign consulting engineers be retained by the loan administrating agency. The cost of the services of the consulting engineers should be funded as part of the project loan. There are several structural engineers in Indonesia with intensive experience in designing commercial buildings, but their

knowledge of modern rice processing, handling, and storage facilities is limited. It is desirable that the foreign consulting engineers act in association with an Indonesian engineering firm in order that knowledge of local conditions and customs is brought to bear on the conction projects undertaken.

The consulting engineers used in the construction program would provide two types of services. Initially they would assist the BRI in the selection of owner/operators and the exact location of the facilities. This would include undertaking survey work, soils analysis, preparation of contract documents with drawings and specifications, prequalification of bidders, evaluation of bids, and awarding of construction contracts.

The second phase of the consulting engineer's work would include the supervision of all work on the construction of facilities and the installation of equipment. The main duties of the consulting engineer shall be to make certain that all work performed by the contractor and all materials furnished are in strict accordance with contract documents, drawings, and specifications.

The process of engaging a consulting engineer should be underway within three or four months after the international lending agencies begin their review of the project. The final arrangements with the consulting engineer should be made by the time the loan agreement is signed. If this is done, it should be possible to begin to implement the loan within eight months from the time the international lending agencies start their review of the project.

The general assistance phase of the consulting engineer's work should be completed within one year after the project has begun. The analysis of the bids and the award of contracts will require about five months' time after the bidding period is closed. The supervision of construction will require about 30 months. The run-in and testing of the facilities can begin as soon as some of the units are completed. The run-in and testing program is expected to extend to the end of the construction period.

Assuming that this time schedule could be maintained, the engineering consulting services required to implement the construction program would cost approximately US$5,200,000 including all local currency costs. This is about 15 percent of the total cost of facilities constructed. The cost of supervising the construction of the new facilities is somewhat higher than might be expected because of the large number of

of facilities included in the program and the fact that these facilities are located widely throughout the country.

40. Encouragement of Private Investment in New Facilities

The success of any program to encourage private investment in new rice storage and processing facilities will depend heavily on the financial agency administering the project. Credit policies have been identified as the single most powerful tool available for encouraging new private investments. If the international financing agencies in cooperation with the BRI can:

1. provide private investors a great deal of flexibility in the type of facilities to be financed;
2. maintain reasonable interest rates on capital investments;
3. allow reasonably long loan periods;
4. permit investors to borrow a high percentage of the total cost of the facilities;
5. assure private investors that adequate amounts of working capital will be available at reasonable interest rates once the facilities are in operation;
6. not try to pass on to private investors the direct costs of other marketing programs and engineering consultants;

then private investors should be very interested in identifying where the program funds can be most productively used.

The references to private owner/operators are not meant to rule out the possibility that public agencies, local government groups, or quasi-public agencies may borrow funds from the BRI for the construction of rice processing facilities. BULOG, for example, may wish to own and operate several of the units or may find it necessary to construct several units and lease them to private operators as part of its price stabilization program. Some of the government plantations may wish to construct small mills to supply their own rice requirements, especially if the rice distributions by BULOG to plantations are discontinued. All such possibilities should be evaluated by the BRI "Technical Section" with the same care and consideration as that given to loan requests from private operators.

41. Implementing Other Marketing Programs

The program for up-dating existing facilities would be supervised by the lending agency administering the loan funds. This would require the help of a small technical services division within the lending agency and the close cooperation of the marketing extension service which has been proposed. This program could be carried out by the BRI and coordinated with the construction program for new storage and processing units. The program probably would require six to eight months to plan and finance before implementation was started. Draw-downs on this program could be fairly small at first until the field work of the lending agency or extension service became effective.

The program to provide trucks for the new storage and processing facilities should be administered by the financial institute supervising the construction program. This program is a relatively simple one and should move fairly rapidly once the number of trucks to be imported is specified. Work on the program would not have to be started until about twelve months before the first facilities are completed. Most of the trucks would be imported over about a two-year period.

Work on the university training program should be started immediately. Most of the work during the first year will involve planning the program and selecting people for foreign training.

The first year of the training program would cover the general aspects of grain marketing. The second year of the program would emphasize the management of small facilities. Many of the students trained in this program would become managers of the "G-type" facilities included in the general construction program.

A sequence of courses on the management of bulk storage facilities could be initiated during the third year of the program. This program would be developed as the technicians return from their long-term foreign training. The goal would be to train people to move into management position in the "H-type" bulk storage and processing facilities as they are completed beginning in 1976 and 1977.

The technical services program is to be directed towards new investments in marketing facilities. It should be planned and implemented by the financial agencies that will administer the funds for up-dating the existing facilities and constructing new storage and processing facilities. If the construction program is implemented as outlined previously,

the BRI would take the lead in planning the technical services program and selecting Indonesian technicians for foreign training in grain marketing. The technicians selected would then return to the BRI and become part of its technical services department. The activities of this department would be broadened as more well-trained technicians were added.

Work in the development of a marketing extension program should be underway simultaneously with the development of the university grain marketing program. The marketing extension program would eventually recruit personnel trained in the university program. Thus, the extension program and university training program must be closely coordinated. Most of the work during the first year of this program will involve planning and some short-term foreign training. If possible, the marketing extension service should try to undertake some field work during the first year of the program's development. This will help develop a better understanding of the interests of its future clients. One possibility would be to develop a small program to inform mill operators of the advantages of up-dating their facilities. The emphasis of this program could gradually be broadened to include a wide range of programs designed to reduce marketing losses.

Work on the implementation of the market news program and the grades and standards program could be postponed until the initial planning on the university training program and the marketing extension program was completed. The development of these programs would lag that of the other marketing services programs by about six months to one year. The market news program and grades and standards program would have many common interests during the early development stages. While there is no need to coordinate these programs closely, there is a need to assure that communication channels are opened between the agencies developing the programs.

42. Cost Summary for the Marketing Programs

The costs of the programs to improve Indonesia's rice marketing system over a five-year period are summarized in Table 12-S. The total cost of the major investment projects is Rp. 15,100,000,000 (or US$39,736,000). The supporting programs consisting of the university training, technical services, marketing extension, market news, and the grades and standards program are estimated to cost about Rp. 2,430,000,000 (or US$6,397,000). This is about 16 percent of the total cost of the major investment projects. The total cost of the

TABLE 12-S

SUMMARY OF PROGRAM COST ESTIMATES, INDONESIA, 1973-1977

Project	Foreign Currency Portion	Local Currency Portion	Total Cost Equivalent in: Foreign Currency	Total Cost Equivalent in: Local Currency
	(1,000 US$)	(million Rp.)	(1,000 US$)	(million Rp.)
A. MAJOR PROJECTS				
1. New Storage and Processing Facilities (Table 12.1)	18,941	5,919	34,538	13,124
2. Up-Dating Existing Milling Facilities (Table 12.4)	2,052	148	2,441	928
3. New Transport Trucks (Table 12.5)	2,757	---	2,757	1,048
Sub-Total	23,750	6,067	39,736	15,100
B. SUPPORTING PROGRAMS AND PROJECTS:				
1. Training Program (Table 12.7)	1,074	810	3,207	1,219
2. Technical Services (Table 12.9)	290	151	688	261
3. Marketing Extension (Table 12.9)	516	400	1,569	596
4. Market News (Table 12.9)	323	124	648	246
5. Grades and Standards (Table 12.9)	133	58	285	108
6. Working Capital Fund (Table 12.10)	10,000	2,800	20,000	7,600
7. Brown Rice Facility (Table 12.3)	1,312	260	1,996	759
8. Consulting Engineering Service (Table 12.6)	3,100	798	5,200	1,976
Sub-Total	16,748	6,401	33,593	12,765
GRAND TOTAL	40,498	12,468	73,329	27,865

Source: Chapter XII, Rice Storage, Handling and Marketing: The Republic of Indonesia, Economic and Engineering Study, Weitz-Hettelsater Engineers, Kansas City, Mo. U.S.A., October 1972.
Note: All figures are in round numbers (conversion rate: Rp. 380 equals US$1.00).

the working capital fund, the brown rice import facility, and the services of consulting engineers is Rp. 10,335,000,000 (or US$27,196,000). The working capital fund is a revolving fund and accounts for Rp. 7,600,000,000 (or US$20,000,000) of this total.

The grand total costs of the program are Rp. 27,865,000,000 (or US $73,329,000). The investment programs plus the cost of consulting engineering services and a brown rice import facility account for 64 percent of the grand total. The marketing services and training programs make up about 9 percent of the total program costs. The working capital fund accounts for the remaining 27 percent.

Total expenditures on the investment programs would be very small during the first year which is basically a planning period. The foreign currency expenditure during years 2 and 3 would be about US$4,200,000. This would increase to about US$7,640,000 during years 4 and 5. The new storage and processing facilities would account for most of these expenditures.

Most of the funds used during the first year of the marketing services and training programs would be devoted to planning, short-term foreign training, and foreign technical services. Long-term foreign training and equipment purchases would be important cost items during years 2 and 3. Foreign currency costs would fall during year 4 and local currency expenditures would continue to increase.

Total expenditures for the entire set of programs would reach their maximum level in year 4 and then decline as the construction program was completed in year 5. Total program expenditures during year 4 are estimated to be approximately US$11,724,000 plus Rp. 3,603,000,000. Total expenditures on marketing facilities and programs after year 5 would have to be maintained at approximately the year 3 levels in order to keep up with the expected increases in rice production during the last half of the decade.

43. Blending Capital Investment and Training Programs

Marketing investment and services programs such as those outlined above will require strong government support if it is to be implemented. The Government of Indonesia will have to take the initiative in obtaining the loan funds and in setting up a program whereby new facilities can be constructed rapidly and efficiently. The government will also have to support training programs, make a number of changes in marketing

institutions, adjust its price policies, and provide favorable loan terms if private investors are to be encouraged to invest in the new facilities.

The success of the marketing services and training programs will depend on the people who make up the programs. Adequate long-term financing will be needed to encourage capable Indonesians to make long-term commitments towards improving Indonesia's grain makreting system.

The marketing services and training programs must be thought of as long-term programs. They are, in a broad sense, institutional building programs with heavy initial investments in human capital. The start-up funding for these programs needs to be assured for at least two or three years. In general, the full value of these programs would not be realized until about 1977; assuming that they were underway by the end of 1973.

The marketing programs which have been outlined are ambitious programs. They will require substantial investments in human capital as well as in new marketing facilities. The programs are needed if Indonesia is to continue to increase its rice production rapidly. Indonesia has the potential human resources to carry out the programs successfully. The international lending agencies can speed the implementation and successful completion of the programs by providing adequate and flexible financing for a coordinated marketing program.

* * *