

REPORT
ON
THE FEASIBILITY STUDY PHASE II ON
THE COMPREHENSIVE STORAGE FACILITIES
DEVELOPMENT PROJECT
IN
THE KINGDOM OF THAILAND

VOLUME 1
(MAIN REPORT)

June, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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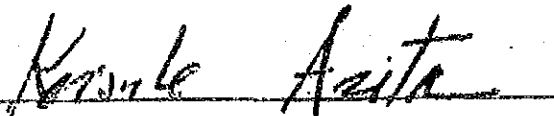
In response to the request of the Government of the Kingdom of Thailand, the Japanese Government decided to conduct a Feasibility Study on the Comprehensive Storage Facilities Development Project Phase II and entrusted the study to the Japan International Cooperation Agency. The J.I.C.A. sent to Thailand a survey team headed by Mr. K. Aida from October 10 to December 9, 1984.

The team exchanged views on the Project with the officials concerned of the Government of the Kingdom of Thailand and conducted a field survey in the Project area. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

June, 1985

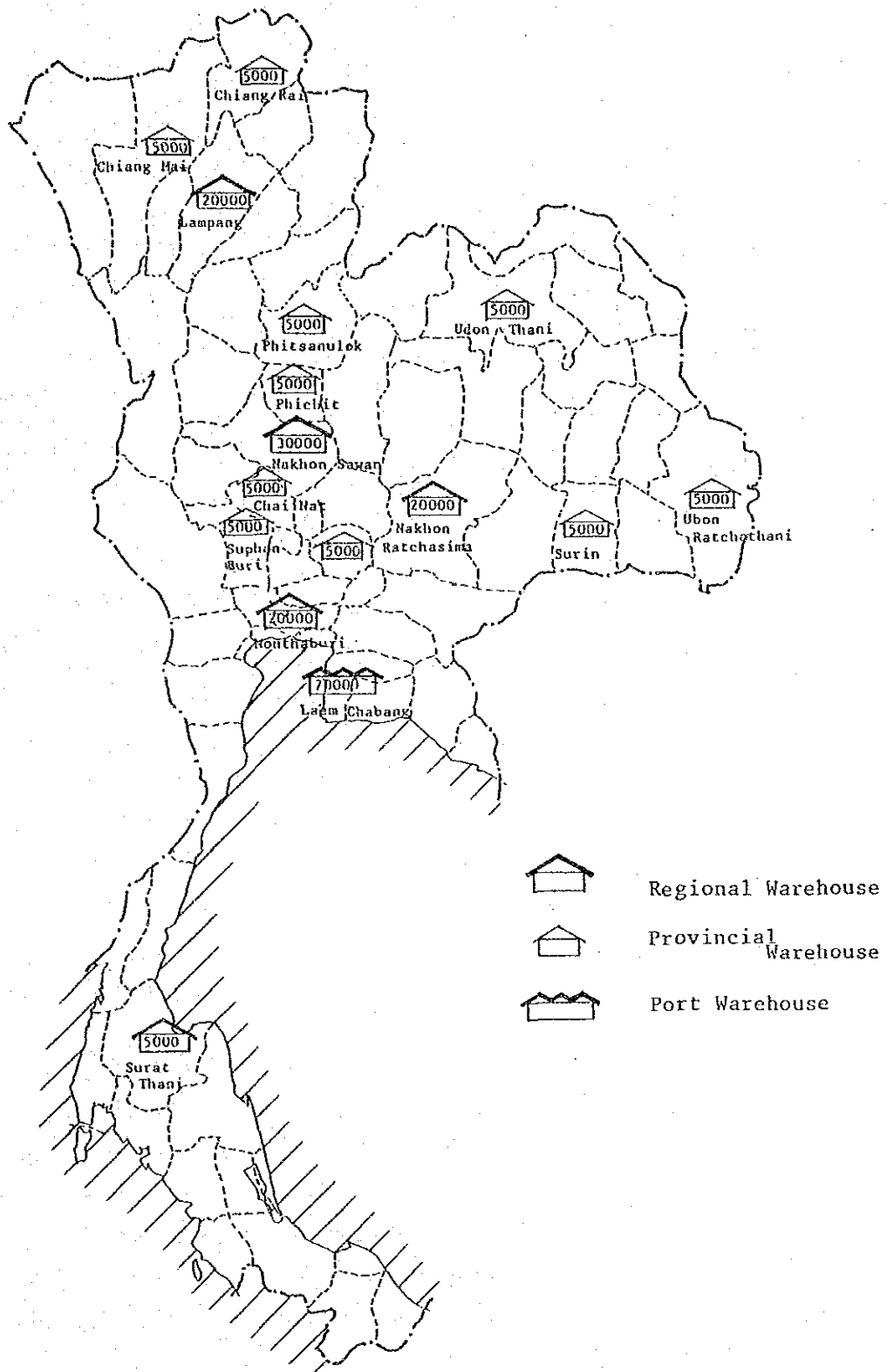
A handwritten signature in dark ink, appearing to read 'Keisuke Arita', is written over a horizontal line.

Keisuke Arita

President

Japan International Cooperation Agency

CONSTRUCTION OF WAREHOUSE PROPOSED



THE COMPREHENSIVE STORAGE FACILITIES DEVELOPMENT PROJECT
IN THAILAND

THE FEASIBILITY STUDY PHASE II

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ABBREVIATION

ACFT	Agricultural Cooperatives Federation of Thailand
BAAC	Bank for Agriculture and Agricultural Cooperatives
BOT	Board of Trade of Thailand
CIF	Cost, Insurance and Freight
CIPO	Center for Integrated Plan of Operations
CPD	Cooperatives Promotion Department
EGAT	Electric Generating Authority of Thailand
EIRR	Economic Internal Rate of Return
FAO	Food and Agriculture Organization
FIRR	Financial Internal Rate of Return
FOB	Free on Board
GNP	Gross National Product
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
MEA	Metropolitan Electricity Authority
MOF	Marketing Organization for Farmers
NESDB	National Economic and Social Development Board
PEA	Provincial Electricity Authority
PWO	Public Warehouse Organization, Thailand

SUMMARY AND RECOMMENDATION

THE COMPREHENSIVE STORAGE FACILITIES DEVELOPMENT PROJECT IN THAILAND

PHASE II FEASIBILITY STUDY

SUMMARY AND RECOMMENDATION

I. Summary

(Agricultural Production)

1. During the past 20 years, the annual growth of agricultural production in Thailand has maintained a high and stable rate at about 5% because of the steady growth of rice harvests and the introduction of a variety of cash crops. Exports of agricultural products from Thailand also achieved notable increases in the same period.
2. Rice production represents approximately 1/10 of Thailand's GNP, approximately 2/5 of the total agricultural production value, and 1/5 of total exports. The agricultural production of Thailand has become diverse through the introduction of cassava, maize, and other marketable crops. Nevertheless, rice is still the mainstay of the national economy. Approximately 70% of the total labor force of Thailand, 15.6 million people is engaged in agriculture putting great emphasis on rice. Thus, rice is the important crop for Thailand in terms of social and economic relations with the people and state.
3. According to a recent announcement made by the Ministry of Agriculture and Co-operatives, the production of paddy in the 1983/1984 crop year was 19.2 million tons, of which breakdown was estimated to be 16.5 million tons for the major crop and 2.7 million tons for the second crop. According to this announcement, exports of rice in

1984 were estimated at 4.5 million tons, which was a surprisingly high figure.

(Problems and Countermeasures)

4. Though rice occupies an important position for Thailand as mentioned above, there are many current problems to be solved related to the processing of post-harvest works, marketing, and export of rice. Farmers' income has not increased so much as anticipated. It did not proportionate to the increase in production.

Losses and wastages of rice and high distribution costs remain unimproved. In addition, foreign exchange earnings have not proportionately increased while the quantitative growth of rice exports have been substantial.

5. In general, farmers, who do not have the appropriate facilities and technology to process or store their crops used to sell almost all of their paddy at one time, immediately after harvest. This is the obvious cause for the low market price of paddy at the harvest season.

6. Storage facilities are one of the important elements in efficient marketing of agricultural products. According to a study made by the Bank of Thailand in 1979, the storage capacity for agricultural products in Thailand at that time was approximately 14 million tons. Out of this, approximately four million tons were used for paddy and milled rice. Most of these storage facilities belong to rice mills in rice producing areas.

These warehouses of rice mills are mostly outmoded facilities originally built to store paddy and are practically not suitable for storing milled rice safely for a long time under the unfavorable climatic conditions in the tropics. Milled rice easily deteriorates and is vulnerable to insects damage during storage, consequently, considerable storage losses are inevitable under the prevailing conditions.

The survey made by the study team verified that the average quantitative loss was 3%. In addition the loss due to quality deterioration could be 15%, in case milled rice is stored in an substandard warehouse for more than six months without proper care.

7. In recent years, exports of rice from Thailand have increased steadily. However, the present world rice market is becoming a buyer's market and highly quality oriented. For this reason, it is imperative for Thailand to improve quality of rice for export to sustain its traditional markets and also to develop new markets. Besides, modernized ship-loading facilities, including efficient packing and weighing systems are important for the promotion of rice trade.
8. The basic policy of the Government of Thailand in agricultural development in the past was mainly based on the quantitative expansion. However, in the Sixth Five-Year Economic Development Plan (1987 to 1991), the Government of Thailand officially expressed the intention to encourage qualitative improvement as well, realizing significance of quality problems in the recent international trade, especially in the rice market.

The final goals are to be an increase of farmers' income and improvement of quality of products. This can be achieved by real improvement of post-harvest systems regarding the processing, storage, transport and handling of rice, besides, reduction of related costs and modernization of facilities.

(PWO Activities)

9. In view of the above, the activities of PWO, which is under the administration of the Ministry of Commerce, are of vital importance. The PWO's objective is "To operate its business to maintain the quantity and quality of rice, other agricultural products, and general materials, at an appropriate level and sufficiently meet the demand of the State and consumers."

10. However, PWO, a public enterprise which operates warehouses, does not have enough warehouses in producing areas of agricultural products. It does not have sufficient export facilities in ports neither. As a result, its activities are limited and the PWO's operations, aimed to follow the direction given by the Government, could not insure success and caused heavy deficits.

(Project Objective)

11. The objective of this project is the modernization and expansion of the PWO's storage facilities under the integrated program at the principal places of production, marketing, and export of agricultural products, particularly for rice. The project aims at making product procurement, storage, and export operation more efficient and evolving various types of business in line with the national interest. Great benefit mentioned below can be obtained from the Project.

- 1) Increase of farmers' income and improvement of their living standard
- 2) Efficient implementation of a paddy price supporting policy and rice price stabilization
- 3) Promotion of rice export, taking advantage of high quality resulted from a modernized storage system.
- 4) Improvement of rice loading efficiency in ports
- 5) Reduction of losses and wastages

(Components of the Project)

12. Taking account of important role of rice marketing in the society and economy of Thailand, and also urgent needs to be filled in order to solve various problems aforementioned, this project should focus

on rice under the control of PWO. As described in Survey Report Phase I, the target of rice to be handled by PWO would be 450,000 tons. This amount is equal to approximately 10% of the rice to be traded in domestic and export market in Thailand. Out of this amount it is estimated that 350,000 tons would be for export and 100,000 tons for domestic consumption.

13. The following describes the warehouses needed to be built and machinery and equipment to be installed to permit PWO to functionally and economically accomplish its public enterprises in line with its objectives.

- 1) Provincial Warehouses

Considering the convenient location to farmers and actual performance of the PWO's work, medium size new warehouses (5,000 tons per unit) will be constructed at the principal places in rice producing areas, i.e. provincial level storage. With these warehouses at provincial level, PWO would be able to effect impacts on increase of farmers' income and other interest.

- 2) Regional Warehouses

Five large warehouses (20,000 to 30,000 tons per unit) will be constructed at the agricultural products marketing centers of five regions, i.e. Central, Lower-Northern, Upper-Northern, Northeastern, and Southern regions.

- (3) Port Warehouses

It is necessary for PWO to transport smoothly its rice procured in producing area to satisfy a demand. First, the existing storage facilities at Rajburana and Nonthaburi, which are in river port, should be modernized and expanded so as to facilitate smooth export business. Secondly, to solve congestion at

the Bangkok port, which is a river port, this project includes a large size of warehouse and modern rice processing facilities for export purpose, in the seaport at Laem Chabang.

The following warehouses are planned at provinces, regions and port.

<u>Warehouse</u>	<u>Region</u>	<u>Location</u>	<u>Capacity</u> (Unit: ton)
Provincial warehouse	Central	Suphan Buri	5,000
		Chai Nat	5,000
		Saraburi	5,000
	Upper North	Chiang Mai	5,000
		Chiang Rai	5,000
	Lower North	Phitsanulok	5,000
		Phichit	5,000
	Northeast	Udon Thani	5,000
		Surin	5,000
		Ubon Ratchathani	5,000
Subtotal		<u>50,000</u>	
Regional warehouse	Central	Nonthaburi	20,000
	Upper North	Lampang	20,000
	Lower North	Nakhon Sawan	30,000
	Northeast	Nakhon Ratchasima	20,000
	South	Surat Thani	5,000
Subtotal		<u>95,000</u>	
Port warehouse		Laem Chabang	<u>70,000</u>
Total warehouse capacity projected		<u>215,000</u>	

(2) Annexed Facilities

Grain Processing Facilities

The installation of advanced grain processing facilities, centering on paddy will improve the quality of stored grains and contribute to the smooth transaction in the market.

Grading and Packing Facilities of Rice for Domestic Sale

The grading and packing facilities to improve milled rice for domestic sale by PWO will be attached to the new regional warehouses and the existing Bukkaloo warehouse in Bangkok.

Processing Facilities of Rice for Export

Processing facilities employing modern technology to upgrade rice for export will be constructed in the warehouse compound at the river port and seaport. These facilities would give great benefit to enhance the value of Thai rice in foreign markets.

Machinery and equipment to be attached to the warehouses in each project site are shown below.

<u>Machinery and Equipment</u>	<u>Location</u>	<u>Function and Activities</u>
Grain Processing Facilities	Nakhon Sawan	Drying and cleaning
	Nakhon Ratchasima	"
	Lampang	"
Grading and Packing Facilities	Bukkaloo (existing warehouse)	Domestic sales, 90,000 tons per year
	Regional warehouse	Domestic sales, 10,000 tons per year
	<u>River Port</u>	
Export Rice Processing Facilities	Nonthaburi	Exporting quality rice, 40,000 per year
	Rajburana (existing warehouse)	Exporting quality rice, 110,000 tons per year
	<u>Sea Port</u>	
	Laem Chabang	Exporting quality rice, 200,000 ton per year

(3) Storage Technology Improvement and Training Center

Modernized facilities only could not be fully utilized if appropriate technology would not be available in time. Therefore, the Storage Technology Training Center is necessary to achieve the objectives of the Project. This training center will consist of the following sections:

- a. Storage control section
- b. Quality control section
- c. Engineering section
- d. Training section

A warehouse will be built adjacent to the Center to perform various storage tests. To demonstrate modernized handling system of paddy, a model installation will be built at Chai Nat, that is located in one of the largest area of two-cropping of rice.

(Project Implementation Plan)

14. In implementation of the Project, the following plan in three phases would be recommendable taking every factors involved into careful consideration.

Phase 1

1. Construction of Storage Technology Improvement and Training Center
2. Construction of Regional Warehouses (65,000 tons)

Nonthaburi	20,000 tons w/h and related facilities
Nakhon Sawan	20,000 tons w/h and related facilities
Lampang	10,000 tons w/h and related facilities
Nakhon Ratchasima	10,000 tons w/h and related facilities
Surat Thani	5,000 tons w/h and related facilities

Phase II

1. Construction of Regional Warehouses (30,000 tons)

Nakhon Sawan	10,000 tons w/h
Lampang	10,000 tons w/h
Nakhon Ratchasima	10,000 tons w/h

2. Construction of All Provincial Warehouses (50,000 tons)

Phase III

1. Construction of port warehouses (70,000 tons) and rice processing facilities

(Executing Agency)

15. PWO is the executing agency of this project. The managing director of PWO will actually be responsible for implementing the plans. Of these plans, business related to the port operations at both river and seaports should be entrusted to "A Corporation for Shipping Operation" to be newly formed and headed by the managing director of PWO. This corporation should consider efficient functioning, harmony with the private sector, and smooth relations with other public corporations.

(Project Costs)

16. The total investment costs for the project in local and foreign currency are as follows. The cost is estimated on the basis of price as of December, 1984, when the study was conducted. The ratio between local and foreign currencies is 48:52.

1) Costs of Warehouse and Related Facilities

(Unit: 1,000 Bahts)

<u>Item</u>	<u>Warehouse</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
I. Civil Work and building	Provincial warehouses	33,298	86,931	120,229
	Regional warehouses	72,552	143,862	316,414
	Port warehouses	57,480	126,284	183,764
II. Machines and equipment	Provincial	5,290	1,032	6,322
	Regional warehouses	70,945	13,658	84,603
	Port warehouses	188,270	43,569	231,839
Subtotal (I + II)		427,835	415,336	843,171

<u>Item</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
III. Land Aquisition	-	15,288	15,288
IV. General administration	-	16,863	16,863
V. Technical fees	24,468	9,250	33,718
Subtotal (I - V)	452,303	456,737	909,040
VI. Price escalation	141,656	142,834	284,490
VII. Contingency	59,396	59,958	119,354
Total (I - VII)	653,354	659,530	1,312,884

2) Costs of Storage Technology Improvement and Training Center

<u>Item</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
I. Civil work and building	46,209	8,071	54,280
II. Machinery and equipment	31,104	-	31,104
III. Design and management	10,745	3,429	14,174
Total	88,058	11,500	99,558

3) Total Cost of the Project

<u>Item</u>	<u>Foreign Currency</u>	<u>Local Currency</u>	<u>Total</u>
Warehouse construction and related facilities	653,354	659,530	1,312,884
Storage Technology Improvement and Training center	88,058	11,500	99,558
Grand Total	741,412 (52%)	671,030 (48%)	1,412,442 (100%)

(Financial and Economic Evaluation)

17. This evaluation consists of two aspects; financial evaluation from the standpoint of the PWO's management, and economic evaluation from the standpoint of national economy.

Careful studies on financial and economic advantages on the basis of cost and benefit of the Project was made taking account of alternatives. Particular attention was paid to a port warehouse at the river port of Nonthaburi and the seaport of Laem Chabang.

Benefit available from the Project would be as follows. These benefits were justified on the basis of quantified merits and their monetary value.

- 1) Reduction of storage losses and wastages of rice
- 2) Saving of storage cost by running of the PWO's own warehouse in place of renting private warehouse
- 3) Proceeds from rent to outsiders by full utilization of storage space depending on the seasonable fluctuation of stored products
- 4) Increase of export earnings by upgraded rice

The followings are internal rate of return calculated on the basis of annual cash flow computed from benefit and cost. Alternative I was made on the presumption that Nonthaburi would be the location

for a river port warehouse while Alternative II was made that Laem Chabang would be the location for the seaport warehouse.

Financial Internal Rate of Return

Alternative I	11.0%
Alternative II	12.1%

Economic Internal Rate of Return

Alternative I	12.0%
Alternative II	13.1%

(Socio-economic Impact)

18. The modernization and expansion of agricultural products storage facilities, particularly for rice, by PWO as mentioned above, will give a practical and powerful support to the Thai Government in facilitation of its socio-economic measures. Especially, PWO would be able to contribute the increase of farmers' income by providing proper storage space for their crop in their neighborhood.

Moreover, PWO would be able to stabilize the price of harvested rice for farmers through its efficient strategy taking advantage of its own rice storage facilities at the principal places in the rice producing regions.

By upgrading of rice for export at the processing facilities in the ports with advanced technology and sophisticated equipment, Thailand will certainly be able to increase its foreign exchange earnings.

Thailand can also develop hopefully the new foreign markets for Thai rice, not only maintaining good relation with her traditional customers.

19. Price of agricultural products in producing country is usually low. Thai rice is not an exception. Consequently, it is hard to induce a private enterprise to invest to the construction of its own storage

facilities for the products. Apparently there is little incentive to the private sector to develop the storage of grains in Thailand for the moment.

On account of shortage of proper storage facilities in the producing area, farmer's power in the market is obviously very small. As a result, farmer's financial status remain unimproved and quality of their products could not improve.

In view of these facts, this storage project would certainly give the socio-economic impact on the improvement of farmer's life and betterment of marketing systems.

(Conclusion)

20. The Project is justified by the feasibility study based on the careful field study and evaluation. Considering the urgent necessity, the Project should be taken place as soon as possible.

It is advisable that the Project should be implemented in accordance with the integrated approach in separated stages as aforementioned, taking account of priority for the national interest as well as the actual managerial function of PWO.

II. RECOMMENDATIONS

It is recommended that the following plan should be taken into consideration in the implementation of this project.

(1) Recruiting and Training of Personnel

The recruiting and training of capable personnel is the most important element in the set-up of the PWO's staff in order to accomplish the whole Project.

It is necessary, therefore, to begin with the construction of the Storage Technology Improvement and Training Center as soon as possible. This would effect the purposes to strengthen personnel power and improve storage control technology.

(2) Management and Control

When agricultural products are stored in humid tropical areas, it is essential to prevent their losses and wastage during storage. PWO should review and strengthen its management system so that it can operate the storage facilities efficiently and economically after they are constructed and installed.

The total construction period of the project is estimated to be 5 years, which is divided into three stages. It is safe to proceed to the next stage only after the facilities completed in the preceding stage are confirmed in full operation.

The port operations for the export of milled rice under this Project are required to be efficient enough, paying attention to the adjustment with activities of private sector. "A Corporation for Shipping Operation" should be organized independently from PWO, and is expected to manage and operate such shipping activities.

(3) Cooperation with Other Organizations

In view of the socio-economic relations with national interest, it is recommended that PWO should take necessary measures to carry out the Project in close cooperation with other governmental agencies and research institutions.

CHAPTER I INTRODUCTION

CHAPTER I INTRODUCTION

1-1 Brief History of the Project

In June, 1982, the Government of Thailand submitted to the Government of Japan a request entitled "Development of Storage Facilities and State Trading Services of Agricultural Products". The purpose of the request was to seek financial and technical assistance needed for a national expansion of warehouse facilities.

In response to this request, the Government of Japan sent a preliminary survey mission to Thailand in December, 1983, and consulted with the Public Warehouse Organization (hereafter called PWO), as a counterpart agency, regarding "the Comprehensive Storage Facilities Development Project" for a feasibility study.

A study team organized by Japan International Cooperation Agency (hereafter called JICA) undertook the Feasibility Study Phase I on the project aimed at analyzing the current status of agricultural product storage facilities in Thailand. The study team also identified an integrated plan to improve existing problems by using the role and functions of PWO. In close cooperation with PWO, the field work for the survey was conducted for 45 days between February 15 and March 31, 1984, and the team submitted "The report on the Feasibility Study Phase I on the Comprehensive Storage Facilities Development Project".

Based on the direction and concepts resulting from the Phase I study, the Government of Japan decided to conduct Phase II study on the project in accordance with the Minutes of the Meeting on the "Scope of Work" for the study, agreed upon between PWO and JICA on August 30, 1984 in Bangkok, Thailand.

The Phase II feasibility study was intended to further continue the study for plans to modernize and expand storage facilities. In addition, to specifically confirm that the project could appropriately and economically be executed.

The study was conducted by the JICA study team in close cooperation with PWO with two stages, field survey and home office work, from

October 10, 1984 to January 19, 1985. In the work, proposed construction sites in 18 locations throughout Thailand were surveyed in detail to gather and analyze the necessary data. Using the data gathered in the field work, realistic and concrete planning and design were conducted regarding functional and economical warehouses and various facilities which PWO would manage and operate throughout Thailand.

This report has been compiled as a result of this work and proposes a few recommendations to the PWO based on the study results.

1-2 Personnel Concerned

1-2-1 Members of Supervisory Group

<u>Assignment</u>	<u>Name</u>	<u>Position</u>
1. Chairman	Mr. Mitsuho MORIMOTO	Director, Purchase Division, Operation Department, Food Agency, Ministry of Agriculture, Forestry and Fisheries (MAFF)
2. Facilities	Mr. Akira AOKI	Senior Officer, Purchase Division, Operation Department, Food Agency, MAFF
3. Marketing	Mr. Kojiro SEKI	Senior Officer, Purchase Division, Operation Department, Food Agency, MAFF
4. Storage	Mr. Toshiro NONOMURA	Chief, Planning of Feed Industry Structure Section, Commercial Feed Division, Livestock Industry Bureau, MAFF
5. Economic Evaluation	Mr. Toshio FUJINUMA	Assistant Manager, 1st Division, Loan Department I, The Overseas Economic Cooperation Fund

1-2-2 Members of Study Team

	<u>Assignment</u>	<u>Name</u>	<u>Position</u>
1.	Team Leader, Expert of Marketing	Mr. Kaichiro AIDA	Counselor (Former President) Overseas Merchandise Inspection Co., Ltd. (OMIC)
2.	Sub-Leader, Expert of Storage	Mr. Makoto YAMADA	Manager, Consultants Dept., OMIC
3.	Plant Engineer	Mr. Isamu YAMAZAKI	Sub-Manager, Consultants Dept., OMIC
4.	Engineer of Machinery and Facilities	Mr. Harunobu YOSHINO	Consultants Dept., OMIC
5.	Architect	Mr. Tadahiro SUZUKI	Technical Advisor, OMIC
6.	Foundation and Civil Engineer	Mr. Haruhiko NAKAMURA	Sanyu Consultants Inc.
7.	Economic and Financial Analyst	Mr. Masami SUGIMOTO	Technical Advisor, OMIC

1-2-3 Counterparts

Dr. Savaraj Sachamarga	Managing Director, PWO
Mr. Anong Termpangun	Assistant Managing Director, PWO
Mr. Kiangsak Wongpunawat	Warehouse Administration Division Chief, PWO
Miss Rachanee Leewaroonpan	Foreign Trade Division Chief, PWO
Mr. Boonsong Kanchananut	Ambulatory Sale Unit Chief, PWO
Mr. Pinyo Panomchai	Warehouse 2 Chief, PWO
Mr. Montri Ratana -amoon	Warehouse 1 Chief, PWO
Mr. Vittaya Ratanataworn	Warehouse 3 Chief, PWO
Mr. Saran Thitanantabutr	Research & Planning Division Chief, PWO
Mr. Sajaporn Sungkaw	Computer Section Chief, PWO
Mr. Somchai Siangluecha	Regional Warehouse Division Chief, PWO
Mr. Nopadol Sithichai	Warehouse Business Chief, PWO
Mr. Vaivoot Din -udom	Economist 4, PWO

1-3 Study Itinerary, Contents

Days	Date	Day of the Week	Contents of Study	Place of Stay
1	Oct. 10	Wed.	3 man Study Team departs Tokyo arrives Bangkok. (CX501/CX703)	Bangkok
2	Oct. 11	Thu.	Courtesy call to Japanese Embassy JICA, PWO	Bangkok
3	Oct. 12	Fri.	Explanation and study of the plan of Operation to/with PWO	Bangkok
4	Oct. 13	Sat.	Study Team Discussion (Selection of planned sites)	Bangkok
5	Oct. 14	Sun.	ditto	Bangkok
6	Oct. 15	Mon.	Re-study of Phase I Survey with PWO Regional Investigation (Bukkalo, Rajburana)	Bangkok
7	Oct. 16	Tue.	Selection of planned site. Study with PWO on the scale and function of the facility	Bangkok
8	Oct. 17	Wed.	Discussion with PWO on the survey schedule and execution system. 3 men of the 2nd Study Team depart.	Bangkok
9	Oct. 18	Thu.	Study with PWO on the location of regional warehouses and storage capacity	Bangkok
10	Oct. 19	Fri.	ditto Field Investigation (Nonthaburi)	Bangkok
11	Oct. 20	Sat.	Study Team Discussion (on the work schedule)	Bangkok
12	Oct. 21	Sun.	Study Team Discussion (Plans of Central Shipping Complex)	Bangkok
13	Oct. 22	Mon.	Study with PWO on Business Operation Field Investigation (Nonthaburi)	Bangkok
14	Oct. 23	Tue.	Study of required storage amount by prefecture and by district. Study of treating processes of export rice and domestic rice. Field Investigation (Nonthaburi)	Bangkok

Days	Date	Day of the Week	Contents of Study	Place of Stay
15	Oct. 24	Wed.	Study of the Eastern Seaboard Development Program. Basic stacking experiment Depth measurement of Chao Phraya River (Nonthaburi)	Bangkok
16	Oct. 25	Thu.	Visit NESDB Head. Regional investigation plan preparation.	Bangkok
17	Oct. 26	Fri.	Visit Public Works and ask for cooperation. Basic stacking experiments.	Bangkok
18	Oct. 27	Sat.	Regional Investigation (Laem Chabang, Sattahip Map Ta Phut)	Bangkok
19	Oct. 28	Sun.	Study Team Discussion (Regional Investigation)	Bangkok
20	Oct. 29	Mon.	Study with PWO on ship loading facilities Regional Investigation (Prachin Buri)	Bangkok Nakhon Ratchasima
21	Oct. 30	Tue.	Give interim report to JICA Bangkok Office Regional Investigation (Nakhon Ratchasima)	Bangkok Nakhon Ratchasima
22	Oct. 31	Wed.	Final discussion with PWO on local warehouse installation locations and storage capacity. Team Leader returns to Japan temporarily. Regional Investigation (Surin)	Bangkok Ubon Ratchathani
23	Nov. 1	Thu.	Study of Warehouse Facilities and Incidental Facilities. Regional Investigation (Ubon Ratchathani)	Bangkok Udon Thani
24	Nov. 2	Fri.	Study of Warehouse Facilities and Incidental Facilities. Regional Investigation (Udon Thani)	Bangkok Khon Kaen
25	Nov. 3	Sat.	Data Arrangement Regional Investigation (Khon Kaen)	Bangkok Khon Kaen
26	Nov. 4	Sun.	Visiting agricultural product display. Transfer day (Khon Kaen → Phitsanlok)	Bangkok Phitsanlok

Days	Date	Day of the Week	Contents of Study	Place of Stay
27	Nov. 5	Mon.	Discussion with people at PWO concerned with grain storage technology development facilities. Regional Investigation (Phitsanulok)	Bangkok Lampang
28	Nov. 6	Tue.	Study of the facility outline for grain storage technology development facilities. Regional Investigation (Lampang)	Bangkok Chiang Rai
29	Nov. 7	Wed.	Arrangement of facility contents for grain storage technology development facilities. Regional Investigation (Chiang Rai)	Bangkok Chiang Mai
30	Nov. 8	Thu.	Study of the model warehouse of grain storage technology development facilities. Regional Investigation (Chiang Mai)	Bangkok Nakhon Sawan
31	Nov. 9	Fri.	Study of the research content of grain storage technology development facilities. Regional Investigation (Nakhon Sawan)	Bangkok
32	Nov. 10	Sat.	Study Team Discussion (Preparation of the results of the regional investigation, and preparation of a progress report)	Bangkok
33	Nov. 11	Sun.	Arrangement of data. Arrival of economic appraisal experts.	Bangkok
34	Nov. 12	Mon.	Preparation of a Progress Report Outline	Bangkok
35	Nov. 13	Tue.	Preparation of a Progress Report Outline. Discussion of the economic appraisement benefit factors	Bangkok
36	Nov. 14	Wed.	Preparation of a Progress Report Outline	Bangkok
37	Nov. 15	Thu.	Preparation of a Progress Report Outline	Bangkok
38	Nov. 16	Fri.	Preparation of a Progress Report Outline (Surathani)	Bangkok Surathani

Days	Date	Day of the Week	Contents of Study	Place of Stay
39	Nov. 17	Sat.	Fact-finding survey on River Harbors	Bangkok
40	Nov. 18	Sun.	Arrangement of data	Bangkok
41	Nov. 19	Mon.	Study Team Discussion (Preparation of English Progress Report)	Bangkok
42	Nov. 20	Tue.	Study of Facility Contents. Interim report to JICA Embassy. Regional Investigation (Suphan Buri)	Bangkok Phichit
43	Nov. 21	Wed.	Preparation of a Study List for Facility Contents Regional Investigation (Phichit, Sara Buri)	Bangkok
44	Nov. 22	Tue.	Discussion with PWO on Facility Contents. Visit CIPO. Collection of Integrated Data	Bangkok
45	Nov. 23	Fri.	Discussion with PWO on Facility Contents. Collection of Integrated Data	Bangkok
46	Nov. 24	Sat.	Study Team Discussion (Benefit factors, Schedule of Work Supervision) Collection of Integrated Data	Bangkok
47	Nov. 25	Sun.	Survey of Bangkok Harbor Conditions. Arrival of Work Supervisor and Team Leader.	Bangkok
48	Nov. 26	Mon.	Accompany Work Supervisor on visits to PWO, Embassy, JICA. Collection of Integrated Data	Bangkok
49	Nov. 27	Tue.	Explanation of work progress to Work Supervisor and study of Problem Points	Bangkok
50	Nov. 28	Wed.	Meeting of PWO, Work Supervisor, and Study Team. Preparation of Progress Report	Bangkok Nakhon Sawan
51	Nov. 29	Thu.	Study of Progress Report Compilation. Regional Investigation of the Work Supervisor (Nakhon Sawan, Chainat, Sara Buri)	Bangkok

Days	Date	Day of the Week	Contents of Study	Place of Stay
52	Nov. 30	Fri.	Meeting of PWO, Work Supervisor, and Study Team. Preparation of Progress Report	Bangkok
53	Dec. 1	Sat.	Progress Report Preparation	Bangkok
54	Dec. 2	Sun.	Progress Report Preparation	Bangkok
55	Dec. 3	Mon.	Final Study and Discussion with PWO on Preparation of the Progress Report. Progress Report Preparation	Bangkok
56	Dec. 4	Tue.	Present at discussions of NESDB, CIPC, PWO. Progress Report Preparation	Bangkok
57	Dec. 5	Wed.	Progress Report Preparation	Bangkok
58	Dec. 6	Thu.	Listen to conditions regarding Paddy Bank execution from BAAC Progress Report Preparation.	Bangkok
59	Dec. 7	Fri.	Submission of Progress Report. Reporting of Study Results to Embassy and JICA	Bangkok
60	Dec. 8	Sat.	Arrangement of Study Results. Preparation for return home	Bangkok
61	Dec. 9	Sun.	Return of Study Team Bangkok → Tokyo (TG740)	

CHAPTER 11 GENERAL VIEW OF PROJECT BACKGROUND

CHAPTER II GENERAL VIEW OF PROJECT BACKGROUND

2-1 Agriculture of Thailand

Agriculture is the largest and most important sector of the Thai economy. From statistics of the Office of Agricultural Economics, Ministry of Agriculture and Co-operatives, the major food crops in 1982/83 were about 38.42 million tons with a total farm value of 71,505 million baht as detailed below:

Table 2-1

<u>Major Food Crops</u>	<u>Production</u> (millions of tons)	<u>Farm Value</u> (millions of baht)
Paddy -- Major crop	14.77	47,422
Second crop	2.10	5,315
-----	-----	-----
Subtotal	16.87	52,737
Cassava	17.79	9,071
Maize	3.00	6,035
Mungbean	0.28	1,659
Sorghum	0.23	583
Soybean	0.11	688
Ground Nuts	0.14	732
-----	-----	-----
Total	38.42	71,505

The national development programs so far have concentrated mainly on the agricultural sector. Agriculture is a primary source of the national income, accounting for about 26 percent of total income. In addition, employment in agriculture involves 15.6 million people or approximately 70 percent of the total labor population. Agricultural exports accounted for about 70 percent of the total foreign exchange earnings of the country in 1983.

During the past 20 years, agricultural output has increased at a high rate of about 5 percent per annum compared with an annual worldwide agricultural growth rate of only 2.5 to 2.8 percent. Thai agriculture has diversified extensively into many new cash crops in order to satisfy

the domestic and world demand. Thus, Thailand has become the largest country in Asia which has continuously enjoyed the position of a main net agricultural product exporter during this period.

Thailand's agricultural export increased substantially in the two decades. In 1960 total exports of all agricultural products from Bangkok port was about 2.6 million tons and in 1980 the export of these products reached about 14.5 million tons including over 4 million tons of milled rice.

The income of Thai farmers, however, has been limited and their living standard is still low. Most farmers move their crops to market immediately after harvest due to lack of storage facilities and to obtain cash for living expenses. In the Fifth Five-Year National Economic and Social Development Plan (1982 - 1986), special emphasis has been placed on encouraging farmers to develop their social and economic status.

Thailand has become a major agricultural product exporting country in the world. However, presently, the country faces keen competition in the quality oriented international market.

It is generally recognized that unskilled post-harvest practices and distribution shortcomings, particularly lack of storage facilities and low export product quality are factors in suppressing farmers' income and national export earnings. Under the Sixth Five-Year National Economic and Social Development Plan (1987 to 1991), we have been told that the Government of Thailand will shift its main emphasis of agricultural product development from quantity to quality.

2-2 Rice Production

In Thailand's economic history, rice has been the principal crop, leading export and mainstay of the economy. Its role in farm production remains prominent, although new crops have been developed at an astonishing rate.

Rice now provides roughly one-fifth of the value of Thailand's total exports as well as accounting for two-fifths of the total value of farm production and one-tenth of the GNP. The regulation of the price of rice

has become an important task of the Government because the price of rice has a major impact on consumer prices and, indirectly, on non-agricultural goods and wages.

The Ministry of Agriculture and Co-operatives predicts that paddy production during 1983/84 (November 83 - October 84) will be 19.2 million tons of which 16.5 million tons will come from the major crop and 2.7 million tons from the second crop.

In the calendar year of 1984, rice export is expected to amount to 4.5 million tons; from January until November 18, export volume had already reached 4.016 million tons, up from 3.273 million tons in the same period of 1983. Also predicted is that of the 4.48 million tons of exportable rice, about 27% will be high quality rice, 13% medium quality, 17% low quality, 16% broken rice, 21% par-boiled rice, 4% glutinous rice and 2% other grades.

In the crop year of 1983/84, though there was a record production of 19.2 million tons, and the stable export volume of rice had pushed up the paddy price to 3,000 baht per ton at ex-rice mills.

The attached illustration of Fig. 2-1 shows "Rice Production and its Marketable Surplus by Province" on the basis of 3 years average statistical data from 1979 to 1981.

2-3 Distribution Structure of Rice

The channel of trade for agricultural products flowing to domestic consumers or to export markets can be summarized by the activities of traders at three market levels; local farmer's market, assembly wholesale market, and terminal or Bangkok markets. An illustration of "Rice Marketing Flow" Fig. 2-2 is attached as reference.

1) Local Farmer's Market

This is where the exchange or the transaction of agricultural products occurs in producing areas. It is the closest to the farmers. The size of trade is not in large quantities. The dealers here are mostly middlemen who buy the products from farmers directly.

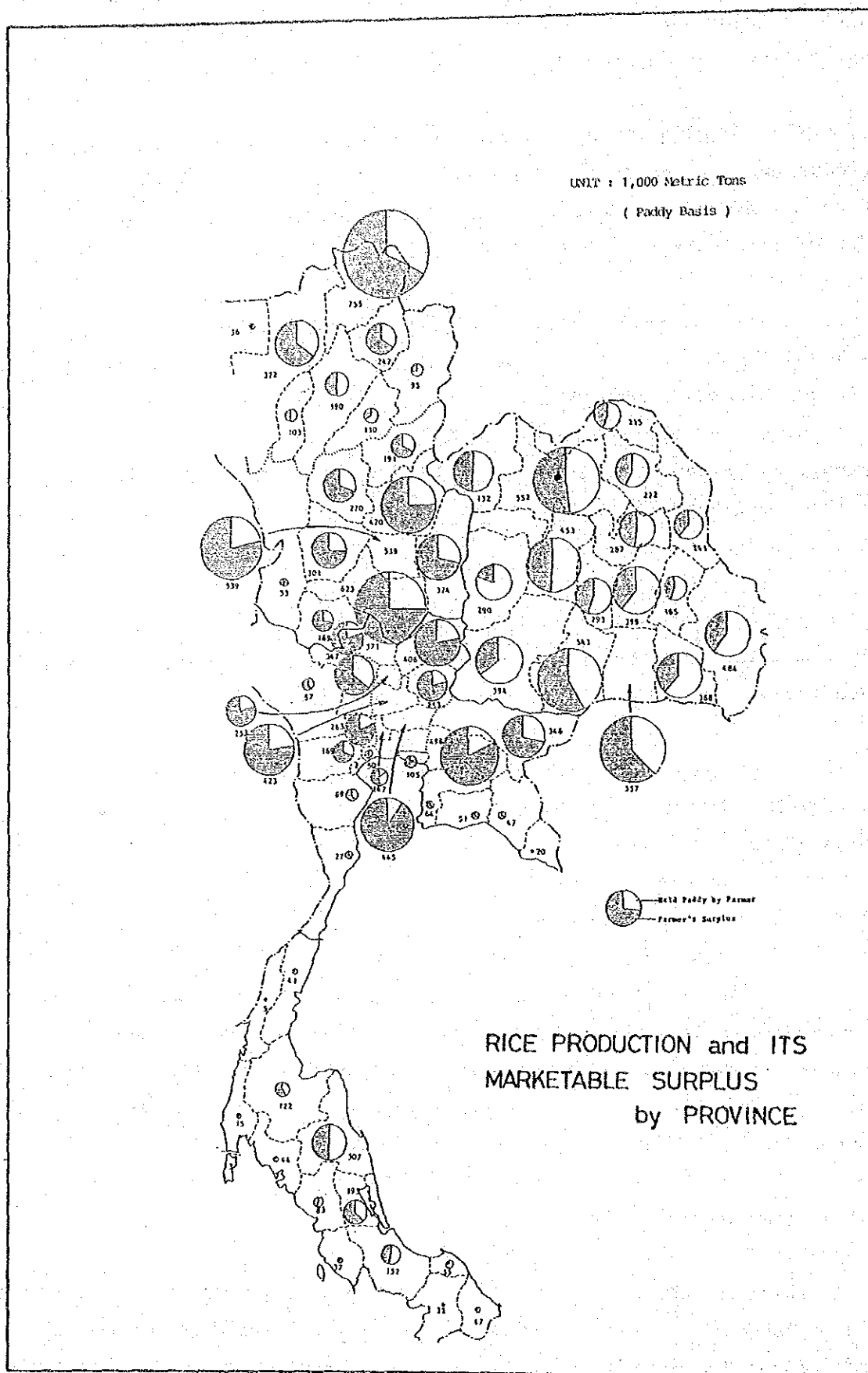


Fig. 2-1

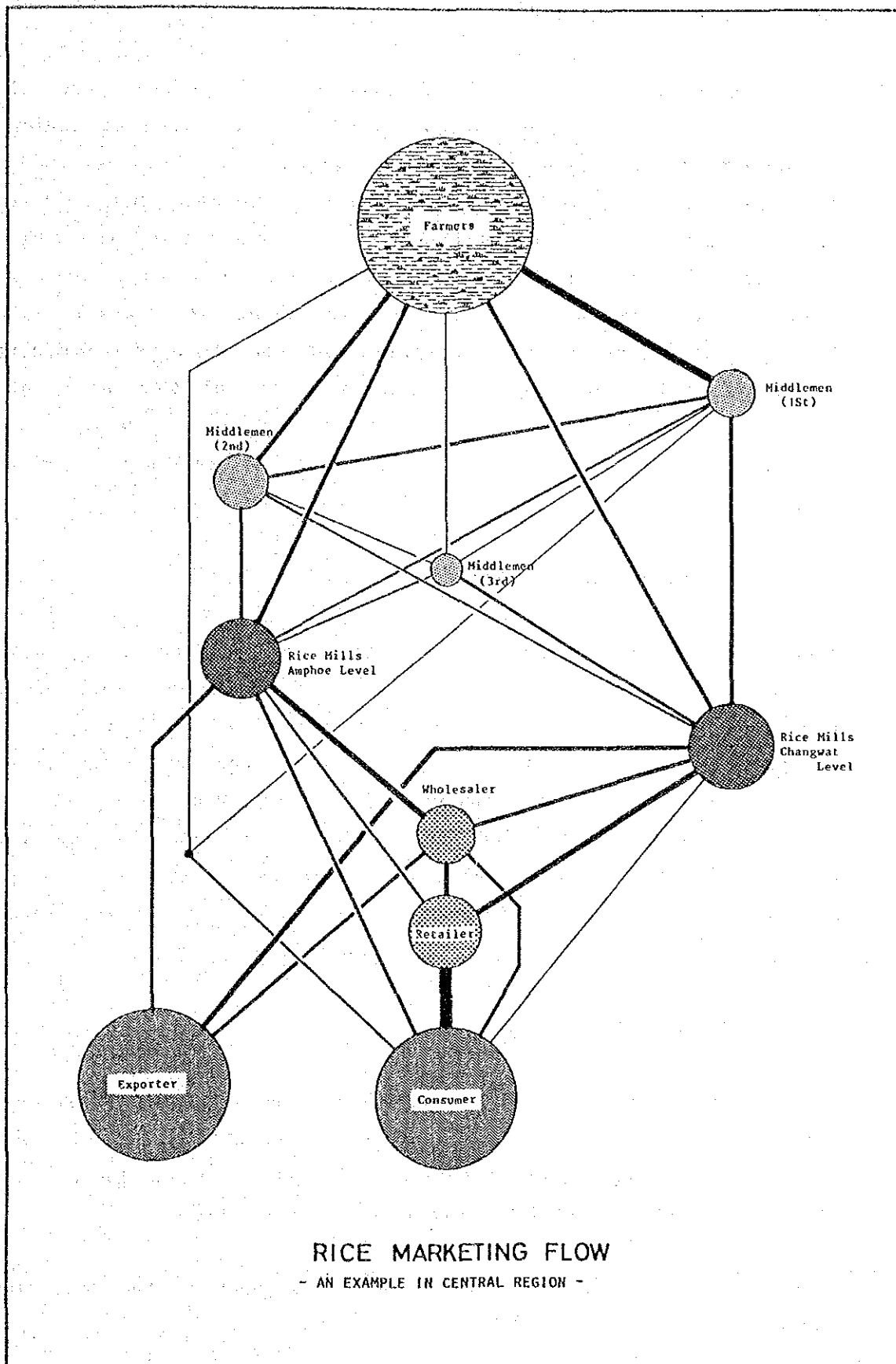


Fig. 2-2

2) Assembly Wholesale Market

This market is sometimes the Changwat Central Market, generally located at a main transportation center of a province or region. The dealers in this type of market are merchants who buy the produce from the local farmer's markets through middlemen and sell to terminal markets. These merchants usually operate large scale operations in that they have adequate capital resources and also trade various other agricultural products in large quantities. The transactions are mostly based on grades and quality of the products as specified by trade market standards. Most of them also have their own godowns or warehouses for storage with cemented open spaces. However, those facilities and practices are substandard and simple.

3) Terminal Markets or Bangkok Market

These markets do business with Bangkok metropolitan markets and foreign markets. They collect products from various markets in producing areas, and conduct grading and packing in their own warehouses in the markets. They usually engage in large transactions and influence the buying and selling prices of products. The operations of these merchants directly affect the business circle and most of them have large scale facilities in Bangkok, especially in port areas for various operations such as receiving, storing, re-grading, packing, fumigation and shipping.

Farmers' Paddy Sales Pattern

Farmers generally sell their surplus either to middlemen or itinerant rice mills. Farmers sell, as a very rough average, in the case of the Central region, about two-thirds of their production and the other one-third is used for their food, seed and feed.

Farmers' paddy sales pattern, by month, is shown in the following table:

Table 2-2 Monthly Percentage Distribution of
Paddy Sale by Farmers

Month	Rainy Season Paddy	Dry Season Paddy
January	17.0	-
February	28.9	-
March	21.5	-
April	9.7	2.0
May	5.9	5.6
June	2.7	16.0
July	1.9	44.3
August	3.0	25.4
September	2.7	3.1
October	2.1	0.2
November	1.6	-
December	3.1	-

Source: Ministry of Agriculture and Co-operatives

Most farmers prefer to sell their paddy at home or directly from paddy fields just after harvest. This results in an oversupply of paddy in the peak harvesting season and causes a sharp fall in price. Seasonal price fluctuation of paddy/rice, by month, generally tends to decline slowly during November and December when the first paddy flows to market, and it continues to decline further until about April. The price then rises and continues to rise until September and October. The price trend is thus interrelated to the farmers' paddy sales volume.

2-4 Marketing Facilities of Rice

2-4-1 Transportation

Transportation of rice and paddy was generally done by cargo boats, rail trains or trucks. Shipment by cargo boats was popular in the 1960's because the main rice producing areas were predominantly located in the Central region and rice mills were situated near the main rivers. Nowadays, the road transportation system, including rural road access, has been substantially developed and transportation of rice has changed to truck services. Even though cost of trucking per unit is higher than either the waterway or railway systems, transportation by trucks has the

advantage of rapid accessibility from rice mills direct to Bangkok and port terminal warehouses. This trend of rice transportation by truck is expected to continue to prevail.

An illustration of the national transportation network Figs 2-3, 2-4 is attached for reference.

2-4-2 Rice Mills

Most rice mills are located in paddy producing areas. According to information obtained from the Ministry of Agriculture and Co-operatives, in 1982 the number of mills including rice mills in villages, totaled approximately 30,000. Of this total, rice mills having a capacity of more than 10 tons per day accounted for about 6,000. It appears that there exists a non-utilized or excess rice mill capacity. In fact, a large number of the rice mills at the village level and a proportion of small scale mills, including medium scale rice mills, are actually out-dated and employ old-fashion machinery.

The milling efficiency of rice mills varies according to the size of the mills and depends on several factors such as the type of milling machine, quality of paddy, and yield of milled products. It is assumed in the Central region that milled output, including both whole and broken kernels, weighs between 662 - 692 kgs, or 673 kgs per ton of paddy, or an average milling yield of about 67 percent. The cost of rice milling in 1983 in the Central region averages about Baht 135/mt. paddy. This figure includes cost in cash and non-cash, e.g., milling expenses, equipment and machinery depreciation plus interest on capital.

2-4-3 Storage Facilities

According to a survey conducted by the Bank of Thailand in 1979, the total capacity of storage of various farm products in Thailand was about 14.4 million tons. Most of these storage facilities were substandard and simple shelters to protect the commodities from rain or theft.

Rice millers in producing areas possess the largest storage capacity of about 4 million tons in terms of paddy stockpile. Most of them are built mainly to store paddy so they are not suitable to store milled rice

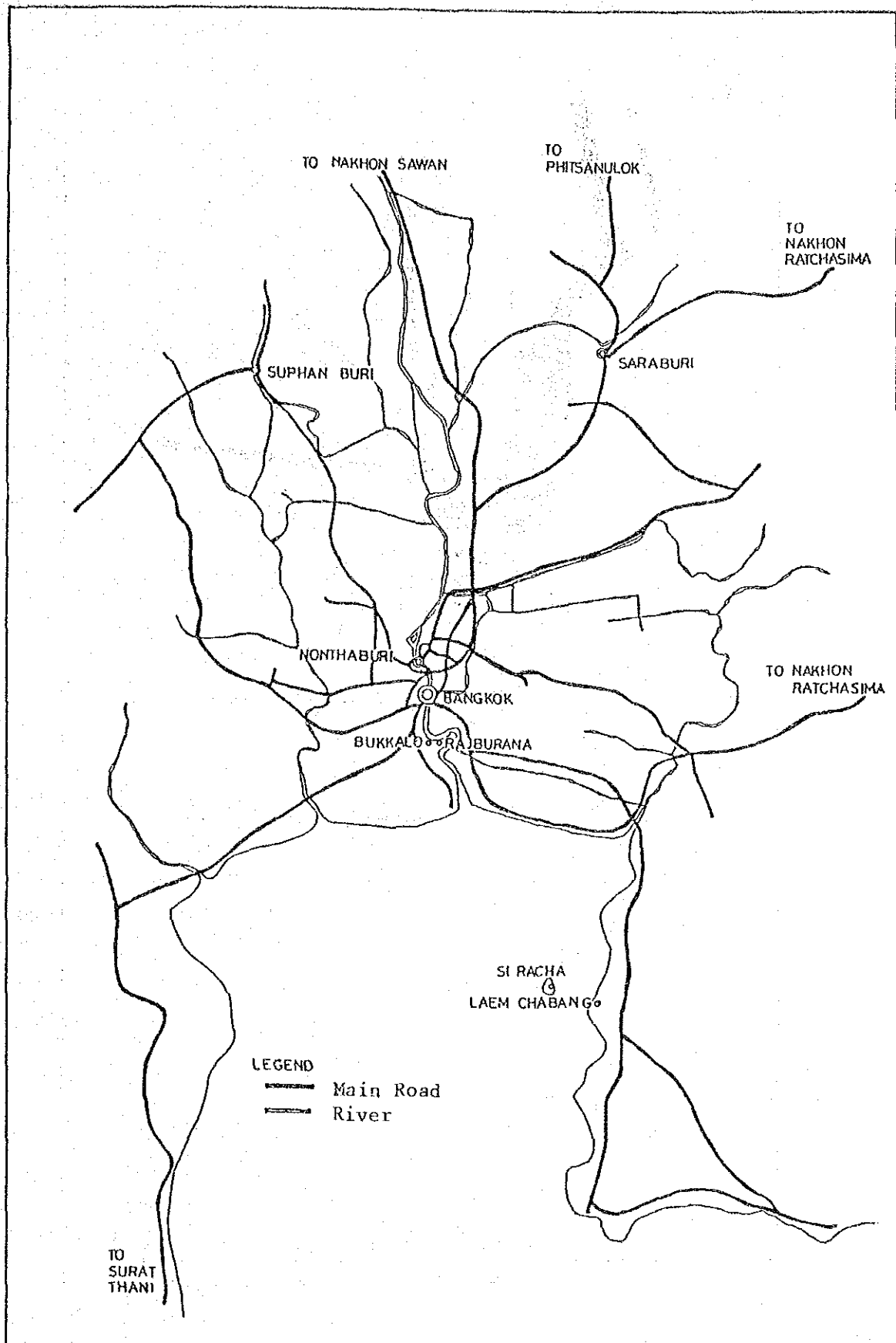


Fig. 2-3

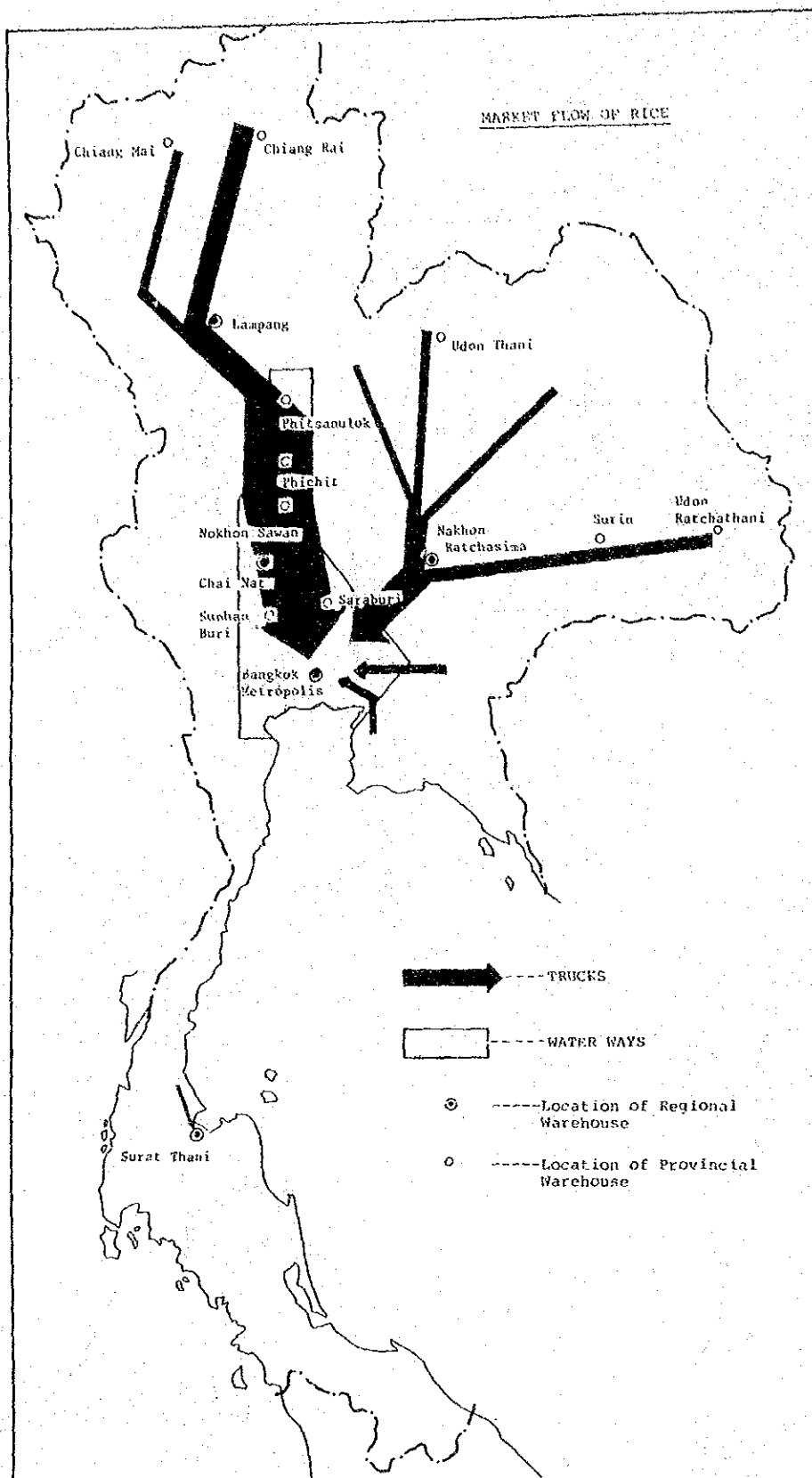


Fig. 2-4

safely under the severe climatic conditions in the tropics. Further, insufficient knowledge of storage technology causes considerable loss. Insect, fungus and rodent damage to the stored products are estimated to be enormous.

Recently, however, private sector activities in the warehousing field appear to be gradually expanding parallel with the export development of bulk agricultural products. These suppliers build warehouses to handle sugar, maize and cassava chips and pellets in both producing areas and shipping ports. However, it must be noted that most storage facilities of warehouses for other products remain generally the same.

2-4-4 Port Facilities

Most of the Bangkok metropolitan markets and port facilities remain unchanged from the way they were in the 1960s when rice handled and exported amounted to only 1.5 million tons.

Present warehouse and shipping facilities in river port of Bangkok are confirmed to be not only short of capacity but heavily congested.

According to a survey conducted by the Bank of Thailand, the total warehouse capacity for rice storage in Bangkok was 826,732 tons in 1979. Of this, space for about 600,000 tons is used for handling overseas shipments. There are two types of warehouses: old warehouses, called "godowns", located mostly in Satupradit and Rajburana and belonging to rice mills, most of which have now moved to rice producing areas. The other type are relatively large and new warehouses constructed in Prapradaeng by rice exporters to facilitate rice loading at their annexed wharf onto ships of approximately 6000 to 7000 tons. These places provide space and facilities for receiving milled rice from producing areas and for mixing according to the export contract specifications, before loading onto the vessel.

The warehousing operations are mostly done by manual labor, and since the Port of Bangkok is located along the Chao Phraya River, loading rice is limited to about 7,000 tons maximum. Vessels then have to move to Ko Sichang for additional loading of rice from barges.

As exports of agricultural products rapidly increase and shipping style and distribution modes change, new investments are directed towards facilities for modern bulk storage and loading to meet the requirement of handling, for example, automatic loading systems with silos for maize, sugar and cassava.

On the other hand, facilities for bagged commodities, especially for rice, remain the same as they were in the 1960s and have not been renovated. Most of these existing warehouses and shipping facilities are substandard and too old-fashioned to meet the actual handling requirements of large-scale and proper services that are needed today.

To overcome these problems, the Thai Government is presently making their utmost effort to build modern and efficient sea-port facilities in the areas of the eastern coast under "the Eastern Seaboard Development Program", including development of urban areas, provision of industrial estates and export processing of agricultural products.

2-5 Government Rice Policies

The role of government intervention in rice pricing and distribution can be summarised as follows:

Production Encouragement

Efforts have been made to help rice farmers receive sufficient funds and obtain necessary production facilities at cost in order to increase their yield per rai and reduce their costs of production. For instance, a sufficient supply of low cost fertilizers, irrigation investment support and improved seed are some examples.

Distribution Policy

The promotion of rice storage facilities, silos, grain dryers, rice mills, transportation and post-harvest equipment can improve the distribution operation and quality for domestic and export markets.

Price Support Policy

Support for rice prices is necessary, and the necessity for market intervention by the Government is high especially when farm paddy price is low. Thus, the Government acts as a competitor with private traders and announces and supports the fixed farm prices of paddy and other agricultural products. This measure is designed to maintain and support the price of paddy sold by farmers, so as not to fall below the level as determined by the Government.

Consumer Price Stabilization Policy

Stabilizing the rice price for consumers within the country is also an important policy for the Government. Due partly to the price support for paddy, the price of white rice does rise for consumers in rice shortage areas and in the Bangkok metropolitan area. In view of this fact the Government must implement a relief policy to lessen the burden on the low-income population.

Rice Export Control Policy

The control of rice export, export taxes and premiums are all used as measures of the Government to adjust export quantity. One such measure is to collect a premium when foreign market demand is high, or to increase the premium rate gradually. Another way is that when the foreign market price declines, the premium is reduced in order to encourage an increase in rice export. Thus Government manipulation of the rice premium has helped to minimize the fluctuation of the rice price.

Government Export Policy

The Government directly intervenes in rice export, especially in government to government contracts, in order to maintain a steady rice flow to foreign countries when foreign demand is low. This direct government intervention is also made when the international market price of rice is low and supply of export rice from traders is not sufficient.

The distribution system of agricultural products and price determination is generally disadvantageous to farmers since prices of most products are determined by central markets in Bangkok and by middlemen who have better information on market trends than farmers.

These factors always result in a relatively weak bargaining power for farmers. Trade through cooperatives or farmers' organizations has been underdeveloped and therefore the majority of farmers still trade through local middlemen.

Therefore, the Government has to increase its role and activities in the market and improve the pricing system and distribution facilities at all levels of farmers, retailers, wholesalers and exporters.

2-6 Recent Activities of PWO

The activity objectives of PWO are described in the Royal Decree as: "the objectives of the organization shall be to ensure that quantity, quality and prices of rice, and other agricultural products are appropriate and that the supply is sufficient to meet the demand of the State and the Public".

The main current activities of PWO are as follows:

- 1) Participation in a rice price support and stabilization program in which PWO procured milled rice to create a demand for paddy and help raise ex-farm paddy prices. Also, release of this rice on the local markets when consumer prices showed signs of excessive increase.
- 2) Export of rice either under government to government contracts or under directly negotiated contracts.
- 3) Supply of rice for local consumption under normal commercial terms.
- 4) Storage and distribution of rice under the low rice price program.

- 5) Temporary storage of paddy and other agricultural commodities for farmers until prices rise; and in the interim provide farmers with credit.
- 6) Procurement of consumer goods essential for public welfare and selling at face value in order to stabilize market prices to reasonable levels.

A recent significant activity of PWO is a joint venture with the Bank for Agriculture and Agricultural Co-operatives (hereafter called BAAC). This scheme enables farmers to pledge their paddy to warehouses provided by PWO.

When farmers deliver paddy to the warehouse they can use the warehouse receipt to obtain short-term loans amounting to 80% of the paddy value. They can sell their paddy when prices of paddy are favorable.

BAAC first launched this program with the cooperation of PWO to provide its services in Nakhon Ratchasima and Khon Kaen Provinces in the 1983/1984 harvest season. In 1984/1985, the project was expanded, and was named "Paddy Bank". It spread into the following 20 provinces:

Nakhon Ratchasima, Khon Kaen, Udon Thani, Ubon Ratchathani,
Surin, Phitsanulok, Sukhothai, Phichit, Nakhon Sawan,
Kamphaeng Phet, Uthai Thani, Uttaradit, Chiang Mai,
Chiang Rai, Payao, Ayutthaya, Anthon, Prachin Buri,
Nakhon Nayok, Suphan Buri.

Due to the lack of warehouse facilities, PWO picked only 13 provinces to provide warehouses out of the above 20 provinces. Most warehouses in the 13 provinces used in this scheme were rented from the private sector.

For the coming crop season, 1984/85 year, BAAC decided to make HM, the King's birthday (December 5, 1984), as a starting day to begin this year's "Paddy Bank Project," and is prepared to provide 1,000 million baht or more if farmers prove to be interested in the project.

CHAPTER III ACTUAL CONDITION OF RICE STORAGE AND IMPROVEMENT MEASURES

CHAPTER III ACTUAL CONDITION OF RICE STORAGE AND IMPROVEMENT MEASURES

This chapter describes the actual condition of milled rice storage based on the survey made by the study team in various parts of Thailand and its observations of actual warehouse conditions. The chapter also makes suggestions regarding warehouse facilities to be modernized and expanded by PWO.

3-1 Rice Storage Mode

Generally, rice is stored in the form of paddy. It is far safer to store rice in the form of paddy than to store in the form of milled rice. This can be readily understood when one thinks that milled rice is a processed starchy product to be sold as food; compared with paddy grains which is in the natural form of living matter protected by a rice bran layer and husk.

In Thailand and in most other countries of Southeast Asia which produce rice, paddy sold by farmers is usually collected and stored in warehouses owned by rice mills and then, rice millers process paddy according to their sales schedules. They usually ship milled rice without storing it further. Milled rice from various places of Thailand is generally collected in warehouses in Bangkok, which are mostly owned by rice traders (mainly exporters), and is mixed and graded for sale. It is then shipped to consumers in Bangkok or to export.

As long as rice moves smoothly through these marketing channels, it does not have to be stored in warehouses for a long period of time. However, on account of the following reasons, milled rice is sometimes stored in warehouses for a longer period.

(a) Seasonal Milling Operation

Generally, rice mills commence milling rice around December when rice harvest starts and usually ends in May of the following year. This is the usual pattern in one-crop harvesting area. In Thailand, unless the rice mills have a very large rice collecting capacity or the mills are located in two-crop areas, milling operation is actually suspended when paddy supply is ceased. Under these circumstances, it is estimated that about two million tons of milled

rice is stored at many keypoints of production, marketing and export, throughout Thailand.

(b) Export

Through exporter's warehouses located in Bangkok area, approximately 300,000 tons of rice, on average, is exported per month regularly. Sometimes, export of rice in a month reaches more than 500,000 tons. Exporters normally collect rice systematically from rice mills affiliated with them for shipment according to their plans. However, stocks of milled rice in port warehouses, increases when the export market becomes weak.

(c) Milled Rice Storage for Speculation

Many merchants store milled rice for a long time in rice producing towns and in Bangkok during the process of marketing for speculation. They do not have proper space of storage, but utilize living spaces, etc. Individual storage amounts are small; however, the number of these merchants is large, and the volume of stored milled rice is not negligible.

(d) Transportation

As many as five million tons or more of rice is brought into Bangkok from rice producing areas per year, and the bulk of this mostly depends on large trucks for transportation. These trucks are also used to carry other agricultural products including maize and cassava pellets exceeding ten million tons from various producing areas to Bangkok. If no proper transportation arrangements are made during the peak transportation period, a considerably large volume of milled rice is stored in warehouses in producing areas for fairly long period of time.

3-2 Actual Condition of Warehouses

For the most part, milled rice is stored by rice mills in producing areas, and exporter warehouses in port. (Refer to Phase I for details.)

Warehouses Owned by Rice Mills

The warehouses owned by rice mills were originally built to store paddy and have no facilities for storing milled rice safely for a

long time in the tropics where both temperature and humidity are high.

Port Warehouses Owned by Exporters

The transferred milled rice is re-graded in the port warehouses in accordance with contract standards and load rice onto vessels. Even though new warehouses have recently been built with structural improvements, basically, the bulk of these port warehouses are not suitable for long term storage of milled rice. The common points of these warehouses are as follows:

- a. Lack of function of temperature and humidity control.
- b. Space in warehouses are also used for mixing, grading, packing, and other work in addition to storage.
- c. Hardly any preventive work is performed to eliminate insects in storage, and insect extermination is usually conducted after damage is seriously found.
- d. Hardly any consideration is given to insulate heat in the areas of roofs, walls, etc., and construction materials are generally simple.
- e. No proper processing facilities, such as cleaning and grading, exist for farm products and mostly performed by using manual labors.

These situations apply not only to warehouses owned by rice mills and exporters, but also to warehouses owned by PWO.

3-3 Milled Rice Storage Conditions

Requirement of the storage conditions of milled rice are as follows:

- a. Milled rice should be sufficiently dried in order to prevent deterioration.
- b. Rice should be well milled, and rice bran should be thoroughly removed. Quality deteriorates quickly if milling is not adequate and rice bran is attached to the grain.

- c. Rice should be bagged securely. Bag breakage should not occur easily.
- d. Rice is divided into lots according to its kind and grade, and lots are well separated.
- e. Thorough prevention control in storage on insects.
- f. There should be control of the internal environment of the warehouses to keep the temperature and humidity as low as possible and to minimize their difference in one day.

The actual storage condition in Thailand is described below in the sequence of the foregoing conditions.

- a. The moisture content of milled rice is 12.0 to 13.0%. Most of the major rice crop is dried to 12.2%. However, the second rice crop harvested during the rainy season tends to have a moisture content 0.5 to 1.0% higher on average.
- b. Milled rice has a large variety in grades. The more white the rice, the higher the milled rice grade.
- c. Packaging was generally satisfactory.
- d. Lot storage was also satisfactory.
- e. Insect extermination was conducted (fumigation by methyl-bromide) after insects were seriously found.
- f. Mechanical control of the environment inside warehouses is extremely rare. Where warehouses have facilities, such facilities are simple with very little effect.

3-4 Losses During Storage

The loss of milled rice during its storage differs quantitatively and qualitatively by various factors; such as moisture content and milling degree of stored rice, internal condition of warehouse, storage period, and control measure against insects etc.

Loss of milled rice during storage is divided into quantitative losses, which can be measured directly, and qualitative losses, which are determined as economic depreciation. Quantitative losses are mainly a reduction in weight of ecological substances by respiration or stored crops and damage from storage insects. Qualitative losses are a depreciation in quantity caused by quality deterioration during the storage period. In any event, these quantitative and qualitative losses are interrelated and cannot be evaluated independently.

The following is the main loss phenomena that occurs during storage:

a. Reduction in weight by energy consumption due to respiration

The respiration amount of milled rice is relatively small, and the loss quantity from it is not much excessive.

b. Reduction in weight due to damage by insect

Quantitative losses from this damage by insect during storage are relatively large. Qualitative depreciation is also large. For milled rice, multiplication of warehouse insects two or three months after milling is small. However, after this period, insects increase geometrically and losses increase proportionately.

These factors are common with other farm products. Damage is particularly large with maize because insects quickly multiply.

The volume of loss which PWO has suffered during the storage of milled rice in warehouses is stated in the Project Request submitted to the Japanese government by the Thailand government in June of 1982. According to the Project Request, 3% of milled rice stored for over 6 months in PWO warehouses under management conditions at that time was lost due to biological factors. These factors include insects, rats, birds, mold and microorganisms. 20% of the milled rice depreciates in value due to quality deterioration.

There is little reliable data on the loss of the volume of milled rice during storage in the tropical regions of the world. Although it is

a very important problem, no consensus has been reached for the loss assessment. In fact, the extent of loss may vary considerably depending upon the type of milled rice, properties (water contents, extent of rice bran attached), season of storage (dry season, rainy season, etc.), conditions of storage (warehouse conditions) and control measures (control of insects, heat, humidity and others).

The survey team conducted an extensive survey of the local areas, mainly in order to identify the various ways in which the volume of loss was suffered by PWO.

The main causes of the loss which PWO suffers during the storage of milled rice are as follows:

- 1) The warehouses leased by PWO for the storage of milled rice are mostly built to store paddy and, therefore, are not functionally suitable for the long-term storage of milled rice. For example, most of the warehouses have zinc-ion plated roofs exposed to the sun, and their floors are directly adjacent to the ground and only the husks of paddy are usually placed to prevent humidity.
- 2) Warehouses are poorly managed. For example, the principle of "first-in - first-out" is loosely observed in the operation of a warehouse. The rice may in turn incur substantial damage from insects and deterioration of quality.
- 3) Measures for protecting milled rice such as insect control, heat and humidity are rarely applied.

In short, the considerable loss of milled rice has been caused by the poor design and loose management of warehouses.

The findings of the survey on the loss of milled rice in the warehouses leased by PWO are as follows:

	Loss of weight by respiration (%)	Damage by insects, birds, microorganisms and other biological factors (%)	Depreciation of assets (%)
3 months	0.1	0.5	-
6 months	0.3	2.7	15
9 months	0.4	5.0	20
12 months	0.5	10.0	25

- 1) The percentage of weight loss during storage is higher in a warehouse with fluctuating temperatures.
- 2) The highest percentage of loss is caused by insects. This tends to increase geometrically unless protective measures for controlling insects are effectively taken.
- 3) The depreciation of assets is attributed to the deterioration of quality, including additional expenses for remilling and other processes.

These survey data figures were obtained by a site survey conducted at warehouses leased by PWO, including an interview with a number of godown keepers. The increase of loss after 6 months in storage is possibly attributed to the poor conditions of warehouses in the rainy season, in particular the increase of insects. Most of the entire volume of loss was found in those warehouses leased by PWO which were poorly operated and managed. By contrast, the volume of loss in better structured and controlled private warehouses is estimated to be less than half of the figures indicated above.

Ideally, the volume of loss should be reduced to zero. It is, however, difficult to anticipate a complete improvement in warehouses in the tropical climate of Thailand unless they are equipped with modern air-conditioned facilities.

The warehouse for this project would be designed to regulate the heat of the sun by insulating materials, and to control temperature and humidity by opening doors and windows as much as possible. It will be possible to anticipate considerable improvements in storage efficiency by utilizing this design and the possible reduction in loss of volume is conservatively estimated to be 50%.

3-5 Suggestions and Recommendations on Modernization and Expansion of PWO Warehouse Facilities and on Warehouse Operation

Farmers sell paddy immediately after harvest. This is due to economic reasons as well as because farms do not have suitable storage sheds. A large amount of paddy is sold in the market in a short period of time after harvest, causing the price of paddy to tumble, thus decreasing the earning power of farmers. The most important goal of PWO is to own warehouses in producing areas in order to secure and improve income for farmers. This can be implemented by the following:

- 1) Price control by artificially creating demand in the market by buying milled rice.
- 2) Cooperation between PWO and BAAC by purchasing paddy, etc., and by offering warehouse spaces and services.

The concept of warehouse operation by PWO basically differs from that of private warehouse operators as follows:

1. Operation by private operators is the short-term operation of inventory aimed at an efficient turnover, whereas PWO aims for long-term storage of inventory in order to stabilize the rice price.
2. Private operators always pursue their business in purchasing and selling advantages. However, PWO should perform its business affairs fairly and equally under its political roles and functions. In this sense, the private sector operates as economically as possible, and aims at achieving enterprise profits; whereas PWO operates in the interests of the public, as an implementing organization of government policies.

With such a background, PWO is required to manage rice storage in a larger quantity and for a longer period of time compared with the private sector. It is also expected to actively and extensively intervene in the market throughout Thailand, particularly when the paddy price lowers or when exports weaken.

Nevertheless, the loss quantity will be large if milled rice is stored for a long time as mentioned above, and PWO will be burdened with a large business handicap. This project aims at permitting PWO to build and expand modern warehouses and auxiliary facilities, and to conduct its business safely and economically in rice operation as a policy implementation organization.

The following concept is recommended in the modernization and expansion of warehouse facilities by PWO.

- a. Considering the character of the business operation of PWO, warehouses should be built at the province level of the main rice producing areas in order to engage in activities closest to the farm level and to contribute to improving the income of farmers.
- b. Warehouses at the regional level should be built with appropriate accommodation capacities. This would stabilize the rice price and allow PWO, as an enterprise under the administration of the Ministry of Commerce, to control rice distribution and to manipulate the rice price.
- c. Warehouses at export ports should be further modernized and expanded. This would ensure smooth shipment of exporting rice.
- d. These warehouses should have functional mechanical facilities for warehouse operations, as well as processing equipment to prepare paddy and other agricultural products for sale in the domestic market. In addition, warehouses in ports should have re-grading equipment to process a high quality of export rice which would enhance Thailand's reputation in foreign countries.
- e. In addition to modernizing and expanding related facilities, PWO is urgently required to improve and develop agricultural product storage technology, and to undertake training of those concerned. Management modernization is to be achieved through various experimentations in model warehouses.

CHAPTER IV BASIC DESIGN OF THE PROJECT

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4-1 Objective

The objective of this project is to promote the efficiency of PWO's operation of rice and other agricultural products. This will be achieved by an overall improvement and expansion of warehouses and related facilities in major key stations of production, marketing and exports of agricultural products, mainly rice. This will contribute to the achievement of various national goals of PWO, a government organization; such as, the improvement of farmers' income and the expansion of exports.

4-2 Basic Considerations for Providing Warehouses

4-2-1 Agricultural Products Handled

In view of the important role of rice in the economy and society of Thailand, the principal product of this project handled by PWO is rice.

The warehouses may also be used for other agricultural products handled by PWO whenever storage space for rice becomes seasonally available. However, the planned warehouses are designed to accommodate agricultural products packed in a bag.

The warehouses are principally used for the procurement, storage and marketing of milled rice which is conducted by PWO in order to ensure the stability of the price of rice. In addition the warehouses are partly used for the purchase of paddy at supportive prices in order to protect farmers' interests, and for the operation of paddy and other agricultural products by BAAC and other government agencies.

Thus the project would start with the handling of rice and other agricultural products in a bag. As the number and skill of PWO's officers and clerks improve and their experience in operation accumulates, the warehouses and facilities would be further expanded by PWO so that other agricultural products in various forms might be handled. In the long run, PWO intends to fully perform its social and economic functions as a government agency.

4-2-2 Volume of Products Handled

The target volume of rice to be handled by PWO under this project is 450,000 tons milled rice; about 10% of the total volume of rice marketed in Thailand both for domestic consumption and exports, as described in Phase 1 of the Study Report.

However, the target volume of paddy and other agricultural products in a bag is not specifically determined because they are handled secondarily when storage space for rice in the warehouse becomes seasonally empty.

4-2-3 Type of Warehouse

Under this project the following type of warehouse would be built so that PWO might perform its public operations efficiently and economically in each stage of production, marketing and exporting of rice.

1) Warehouses at the Provincial Level

A middle-size warehouse (5,000 tons) would be built in each of the major producing provinces in Thailand. This would enable PWO's activities to be closer to farmers and would contribute substantially to an increase in farmers' income.

Several of these warehouses are to be built in local cities, where PWO would also sell rice at a fair price for local consumers.

2) Warehouses at the Regional Level

A large warehouse (20,000 to 30,000 tons) is to be built at the marketing center of each of the five regions of Thailand, i.e., the Central Region, the Lower Northern Region, the Upper Northern Region, the Northeastern Region and the Southern Region. They will play the role of the regional center for PWO's activities. The only exception is the warehouse to be built in the Southern Region will be a middle-size one (5,000 tons) in view of the small volume of rice production and the principal function of the warehouse would be a regional distribution center for local residents.

3) Warehouses at the Port Terminal Level

PWO must efficiently ship the rice collected from the producing areas. Under this project, PWO's existing warehouses in Bangkok are initially expanded to have facilities to ensure smooth activities, including domestic sales in the market of Bangkok, exports, as well as to prepare and ship quality products. In view of the possible congestion and obsolescence of the Bangkok port currently functioning as a river port, this project foresees the completion of large export facilities including a large warehouse at a seaport. This would result in an increase of exports of agricultural products from Thailand in the near future.

4-2-4 Facilities for Storage Technology Improvement and Training

The facilities for the development of technology in the storage of agricultural products are not deemed as an academic research organ, but are designed to explore practical solutions of various urgent problems. Solutions are required for the improvement of storage control of agricultural products in each stage of harvesting, marketing and exports of agricultural products in Thailand. PWO is to promote basic and applied study, and training.

4-3 Functions of Each Warehouse

4-3-1 Provincial Warehouse

PWO's activities directly affecting the improvement of farmers income are principally conducted at provincial warehouses.

For example, a large volume of paddy is at the same time released in the market during the harvesting season, resulting in the reduction of price and the decrease of farmers income. Considering the socio-economic status of farmers, the current aspects of activities by agricultural cooperatives, the interests of the parties concerned in the marketing of rice, and other factors; PWO should preferably arrange warehouses in rice producing areas and conduct activities in order to stabilize the price of rice. The functions of a provincial warehouse include;

- 1) to store milled rice procured by PWO from rice mills in the neighborhood to maintain the rice price by artificially elevating the demand for rice.
- 2) to store paddy for various operation by PWO, BAAC or other government agencies, purchase or mortgage paddy from farmers.
- 3) to store other agricultural products; collected and distributed by PWO whenever the space for rice becomes seasonally available.

4-3-2 Regional Warehouse

A regional warehouse plays a central role in conducting PWO's activities in each region. It also conducts activities as a provincial warehouse in a province where the warehouse is located, or its neighboring provinces.

- 1) For PWO to hold a buffer stock of rice in hand for export or domestic sale,
- 2) to carry out PWO's daily operations in the regions such as procurement, storage, local sales and shipping to Bangkok or other port terminals, and
- 3) to consolidate PWO's regional operations such as a stock control, quality control, pest control and maintenance of buildings and associated machinery.

4-3-3 Port Warehouse

A port warehouse has the roles and functions of a "terminal warehouse" where rice is collected, and is processed for shipping to domestic and foreign markets. Specific functions of the port warehouse include;

- 1) to receive rice from both provincial and regional warehouses as well as directly from rice mills in regions,
- 2) to store rice temporary either for export or for domestic sale,
- 3) to re-grade rice according to required specifications for export and domestic sale contracts, and
- 4) to ship off rice for export and to deliver rice for domestic markets after re-packing and fumigation

Rice procured by PWO need not always be received and stored at local warehouses in province and region as a reasonable proportion can be dispatched directly to regional and terminal warehouses to save operational cost and to avoid storage losses as follows:

		Provincial Warehouse → Terminal Warehouse
Rice Mills	→	Regional Warehouse → Terminal Warehouse
	×	Terminal Warehouse (direct shipment)

4-4 Proposed Plan

The detailed descriptions of the warehouses, facilities and machineries to be built or installed under this project are as follows:

4-4-1 Warehouse Facilities

<u>Type of Warehouse</u>	<u>Region</u>	<u>Location</u>	<u>Storage Capacity</u> (Unit: tons)
Provincial warehouse	Central	Suphan Buri	5,000
		Chai Nat	5,000
		Saraburi	5,000
	Upper North	Chiang Mai	5,000
		Chiang Rai	5,000
	Lower North	Phitsanulok	5,000
		Phichit	5,000
	Northeast	Udon Thani	5,000
		Surin	5,000
		Ubon Ratchathani	5,000
		Total 10 areas	50,000 tons
Regional warehouse	Central	Nonthaburi*	20,000
	Upper North	Lampang	20,000
	Lower North	Nakhon Sawan	30,000
	Northeast	Nakhon Ratchasima	20,000
	South	Surat Thani	5,000
		Total 5 areas	95,000 tons
Port warehouse		Laem Chabang**	70,000 tons
Total storage capacity			215,000 tons

* Nonthaburi has the function of shipping as well as the function of collecting rice in the central region.

** Laem Chabang has the function of shipping as well as functioning as a provincial warehouse and a regional warehouse.

4-4-2 Facilities for Export Rice

<u>Type of Port</u>	<u>Location</u>	<u>Function of Facilities</u>
River port	<u>Nonthaburi</u>	a) Processing rice for export
	(Regional ware-	(Annual handling volume:
	house with a	40,000 tons)
	capacity of	
	20,000 tons)	b) Small quay for loading cargo
		into barges
	<u>Rajburana</u>	
	(Existing ware-	a) Processing rice for
	house with a	export
	capacity of	(Annual handling volume:
	50,000 tons)	110,000 tons)
Seaport	<u>Laem Chabang</u>	a) Preparing rice for
	(Port warehouse	export
	with a capacity	(annual handling volume:
	of 70,000 tons)	200,000 tons)

4-4-3 Facilities for Processing of Domestic Agricultural Products

<u>Type</u>	<u>Location</u>	<u>Function of Facilities</u>
<u>Packing Unit</u> for domestic sale of rice	<u>Bukkalo</u>	Cleaning, mixing, grading and
	(Existing ware-	packing (Annual handling volume:
	house has a	90,000 tons)
	capacity of	
	45,000 tons)	
	<u>Regional</u>	
	<u>Warehouses</u>	
	Nonthaburi	Grading and packing for local
	Nakhon Sawan	sales rice by PWO
	Lampan	
	Nakhon Ratchasima	
	Surat Thani	

<u>Type</u>	<u>Place</u>	<u>Function of Facilities</u>
Grain Processing Unit for paddy and other agricultural products	Nakhon Ratchasima (Regional warehouse with a capacity of 20,000 tons)	Drying, cleaning, grading and packing
	Nakhon Sawan (Regional warehouse with a capacity of 30,000 tons)	Ditto
Grading Unit for beans and other commercial products	Lampang (Regional warehouse with a capacity of 5,000 tons)	Cleaning, grading and packing
	Nakhon Ratchasima (Regional warehouse with a capacity of 20,000 tons)	Ditto

4-4-4 Storage Technology Improvement and Training Center

<u>Type</u>	<u>Area</u>	<u>Function of Facilities</u>
Main building, facilities	Nonthaburi	Headquarters for technological development and training
Auxiliary building	Nonthaburi	Dormitory of trainees
Warehouse	Nonthaburi	A model warehouse for experimenting and training
Facilities for handling paddy in bulk	Chai Nat	Model facilities for drying, cleaning and storing paddy in bulk Model facilities: Flat type: 1,500 tons Silo type: 1,500 tons

4-5 Management and Organization

4-5-1 Management and Action Policy

PWO's management of business activities under this study should be made efficiently and economically. Major points are summarized as follows:

1) Basic Management Method for a Provincial Warehouse and a Regional Warehouse

i) Systematic Programs of Purchase, Storage and Shipping Operations

- Establishing orderly schedule of procurement storage and shipping operation.

ii) Operation with an Emphasis on Economy of Warehouse Operation

- Duplication, such as the storage in a regional warehouse following the storage of them in a provincial warehouse shall be avoided.

iii) Management of the Warehouse with an Special Emphasis on Loss and Wastage of Storage Cargoes

- The management of a warehouse should avoid storing rice for over 6 months by adopting the stock control method based on the principle of first-in, first-out.

iv) Measures for Controlling Insects

- Insects may cause considerable damage and loss to rice stored in a warehouse. Therefore it is necessary to adopt appropriate measures for controlling insects including observation for the appearance of insects. Under this project a team of insect controllers is organized in each region for developing activities to economically control insects.

v) Inspection of the quality of rice

- The quality and quantity of rice is inspected at the time of purchase to see if they are conformed to contract terms.

vi) Management Method by Type of Warehouse

- For example milled rice should be stored temporary in a provincial warehouse so that empty spaces might be utilized for the storage of paddy and other agricultural products.

2) Basic Management Method in Terminal Warehouses Including Port Warehouses

i) Efficient Operation for Taking Products into or out of a Warehouse

- Shipping schedules should be based on information obtained through close contact with the Foreign Trade Bureau, Ministry of Commerce.

ii) Storage of Lots by Type and Grading

- The rice delivered from local areas is stored by type and by grading. This is essential for preparing rice for export.

iii) Processing Rice for Export and Domestic Consumption

- The processing of rice for export used to rely on the intuition of a superintendent or godown keeper. Under this project the processing would be mechanized to save labor and to grade rice into lots of uniform quality in accordance with each contract. This would raise the quality evaluation, in the eyes of foreigners, of rice exported from Thailand. It should be made to impress private exporters as a model effort.

iv) Promotion of Exports by Various Packages

- Competition is currently fierce in the export market of rice, especially where diversified packages are required, as well as the improvement of quality. Technology for packages should be developed in such a manner as to contribute to the increase of exports of rice produced in Thailand. The various methods of packages of rice for domestic sales should also be develop for further sales.

v) Improvement of Shipping Capability

- The shipping of rice produced in Thailand has conventionally been conducted in Bangkok, which is a river port, to the extent that the draft of a vessel permits. This is an unpopular method among foreign owners and operators of vessels. Under the planned project a full set of shipping facilities are built in the seaport so that all the cargo work might be conducted directly from the quays where large vessels set. This removes the cause of cargo work delay by the conventional method, which relied on the river port. Naturally PWO's management practices should be improved to cope with the change of functions.

4-5-2 Organization and Personnel

The organization for implementing this project will become an arm of PWO, which is an administration under the Ministry of Commerce. However, it will initially be managed by a "Planning Commission", a body reporting directly to Director General of PWO. The Commissioners on the "Planning Commission" consist of PWO's officers selected from Administration Department, General Warehouse Department, Agricultural and Consumer Products Department, Export-Import Department, Internal Audit and Control Department, Office of the Managing Director and Business Policy and Planning Division.

The operational organization for handling milled rice will consist mainly of a Warehouse Operation Division and a Shipping Operation Division. The former is augmented by PWO's existing departments, and the latter is managed by "A Corporation for Shipping Operation" (temporary

name) presided over by the Director General of PWO. The part of this project concerning shipping operations is undertaken by another body on behalf of PWO.

The reasons for separating the functions of shipping operations from the duties of PWO are as follows;

- 1) Heavy export operations in the port could not be handled effectively under the roles and functions of PWO.
- 2) The understanding of, and cooperation from the Board of Foreign Trade, the Department of Commerce, are absolutely necessary for the continuous implementation of export duties.
- 3) Close contacts with the Port Authority, the Express Transport Authority and other Public Corporations are indispensable for smooth implementation of tasks at the port.
- 4) Experienced people should be recruited from private sectors to conduct export businesses efficiently and economically.

The duties of the Warehouse Operation Division, controlled directly by PWO, are undertaken mostly by the existing General Warehouse Department, which is supported by Business Policy and Planning Division, Agricultural and Consumer Products Department, and Export-Import Department.