

GOVERNMENT OF MALAYSIA

**FEASIBILITY STUDY
ON
RATIONALIZATION AND
CROP DIVERSIFICATION
IN
NON-GRANARY IRRIGATED AREAS
IN MALAYSIA**

Volume 1

Main Report

October 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA
Vol. 1
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*Feasibility Study on Rationalization and Crop Diversification
in Non-granary Irrigated Areas in Malaysia*

LIST OF REPORTS

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PREFACE

In response to a request from the Government of Malaysia, the Japanese Government decided to conduct a feasibility study on the Rationalization and Crop Diversification Project in Non-granary Irrigated Areas in Malaysia and entrusted the study to the Japan International Cooperation Agency (JICA).

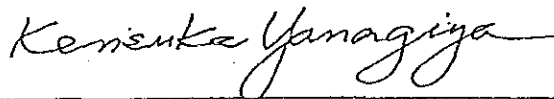
JICA sent to Malaysia a survey team headed by Dr. Yasuhiko Kunihiro, Nippon Koei Co., Ltd., and composed of members from Nippon Koei Co., Ltd. and Hokkaido Engineering Consultants Co., Ltd., three times between March 1989 and September 1990.

The team held discussions with the officials concerned of the Government of Malaysia, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincerest appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the team.

October 1990

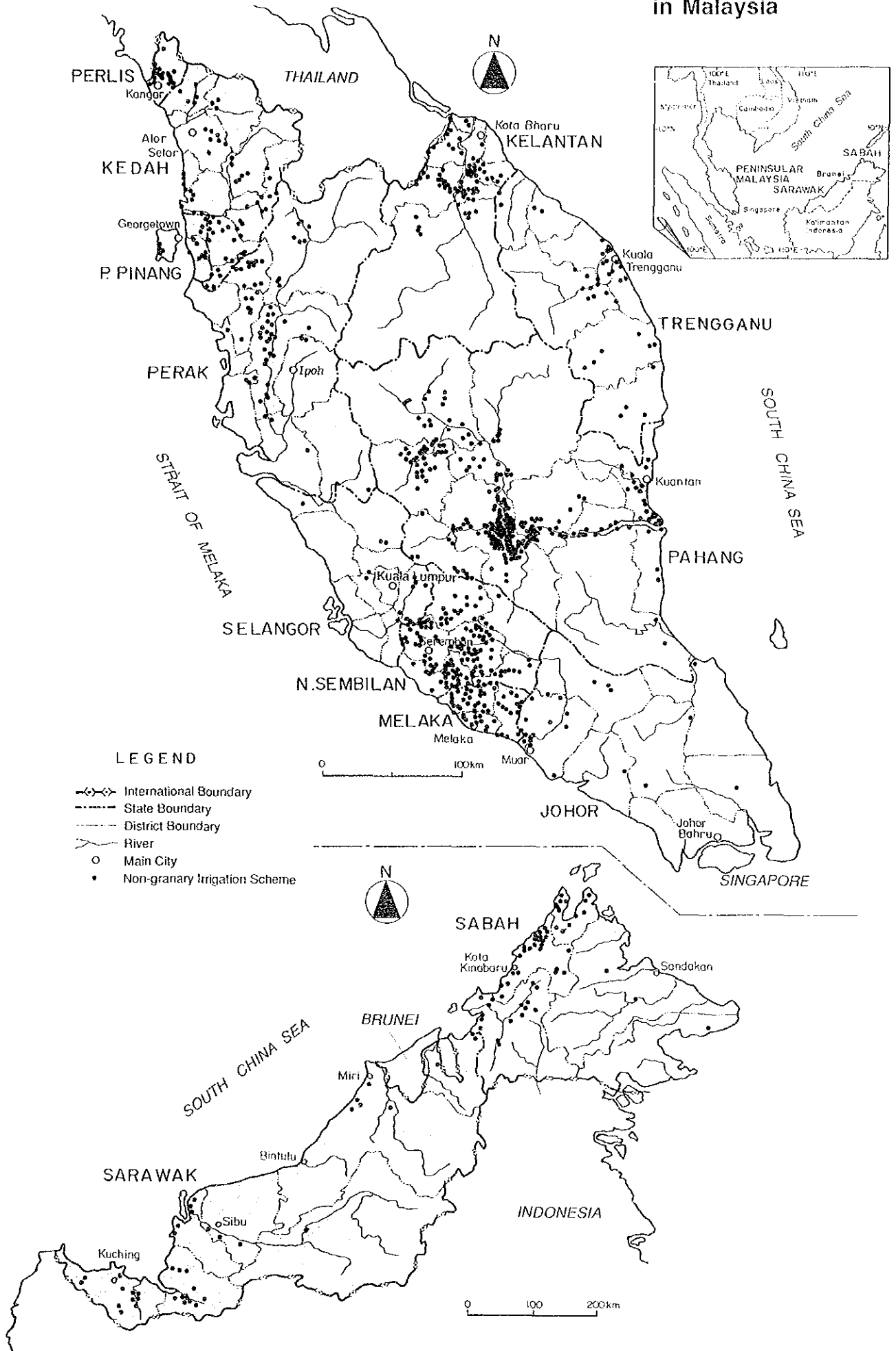


Kensuke Yanagiya

President

Japan International Cooperation Agency

Location of Non-granary Irrigation Schemes in Malaysia



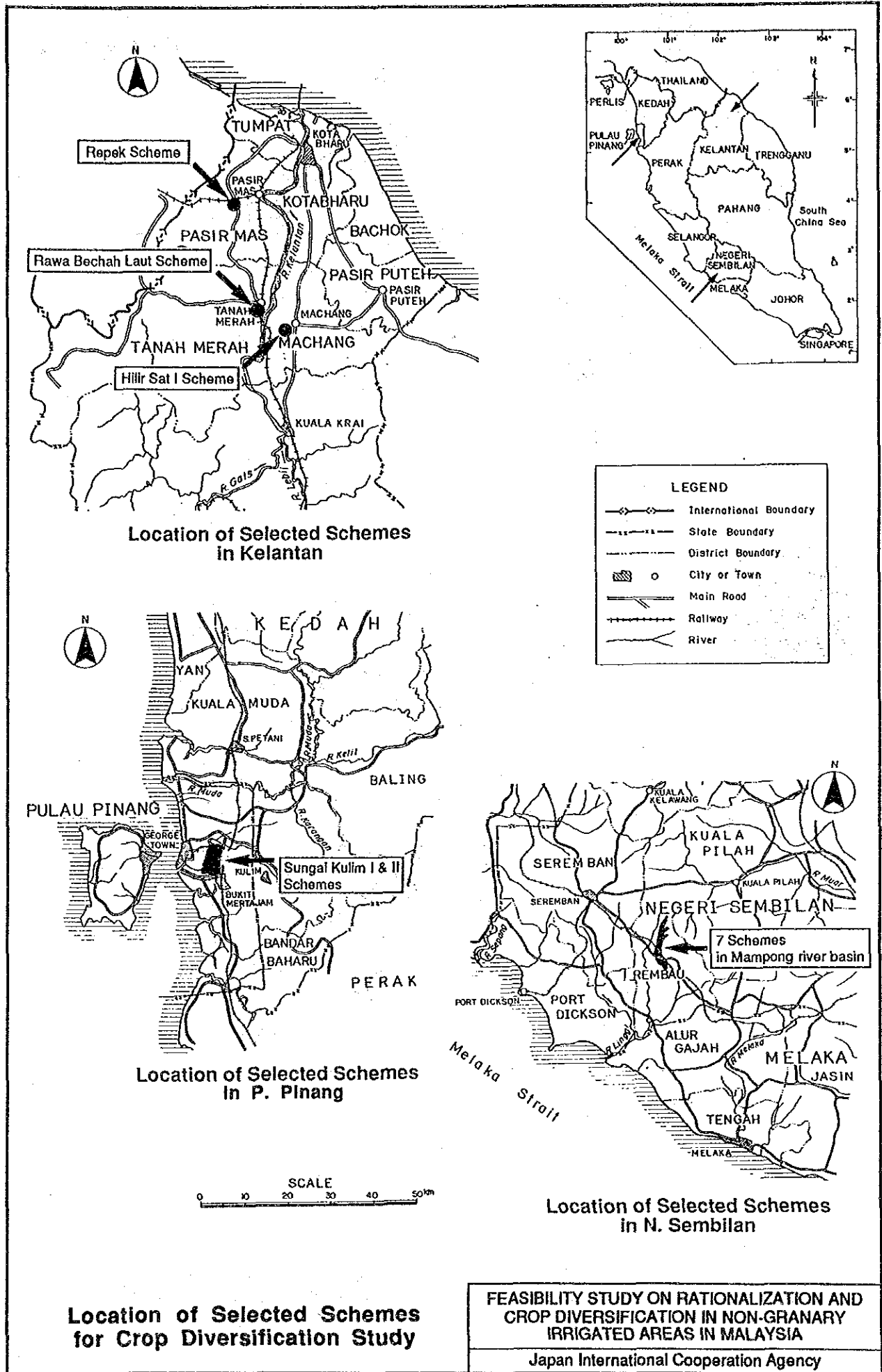
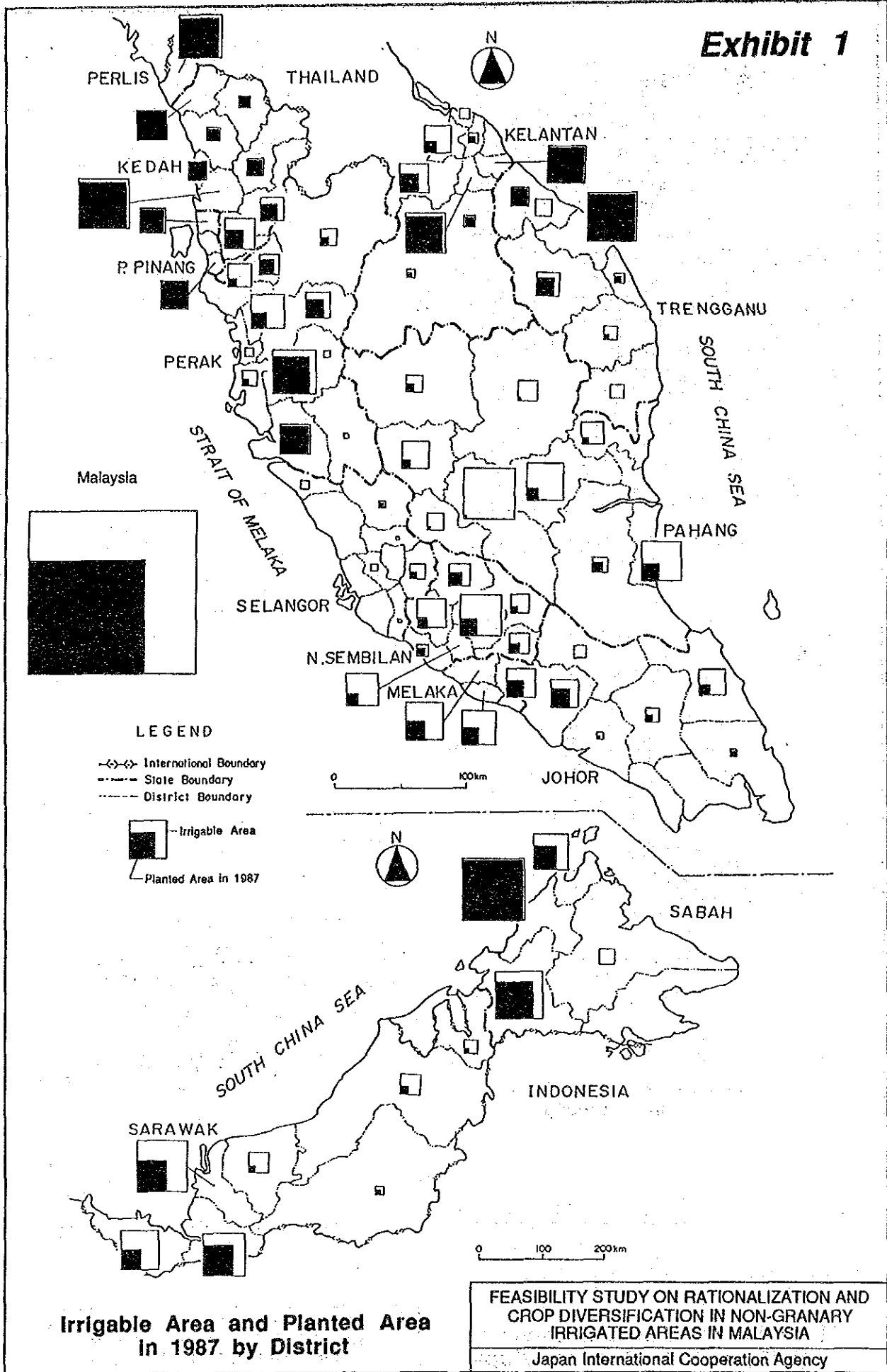


Exhibit 1



**Irrigable Area and Planted Area
In 1987. by District**

**FEASIBILITY STUDY ON RATIONALIZATION AND
CROP DIVERSIFICATION IN NON-GRANARY
IRRIGATED AREAS IN MALAYSIA**

Japan International Cooperation Agency

Exhibit 2

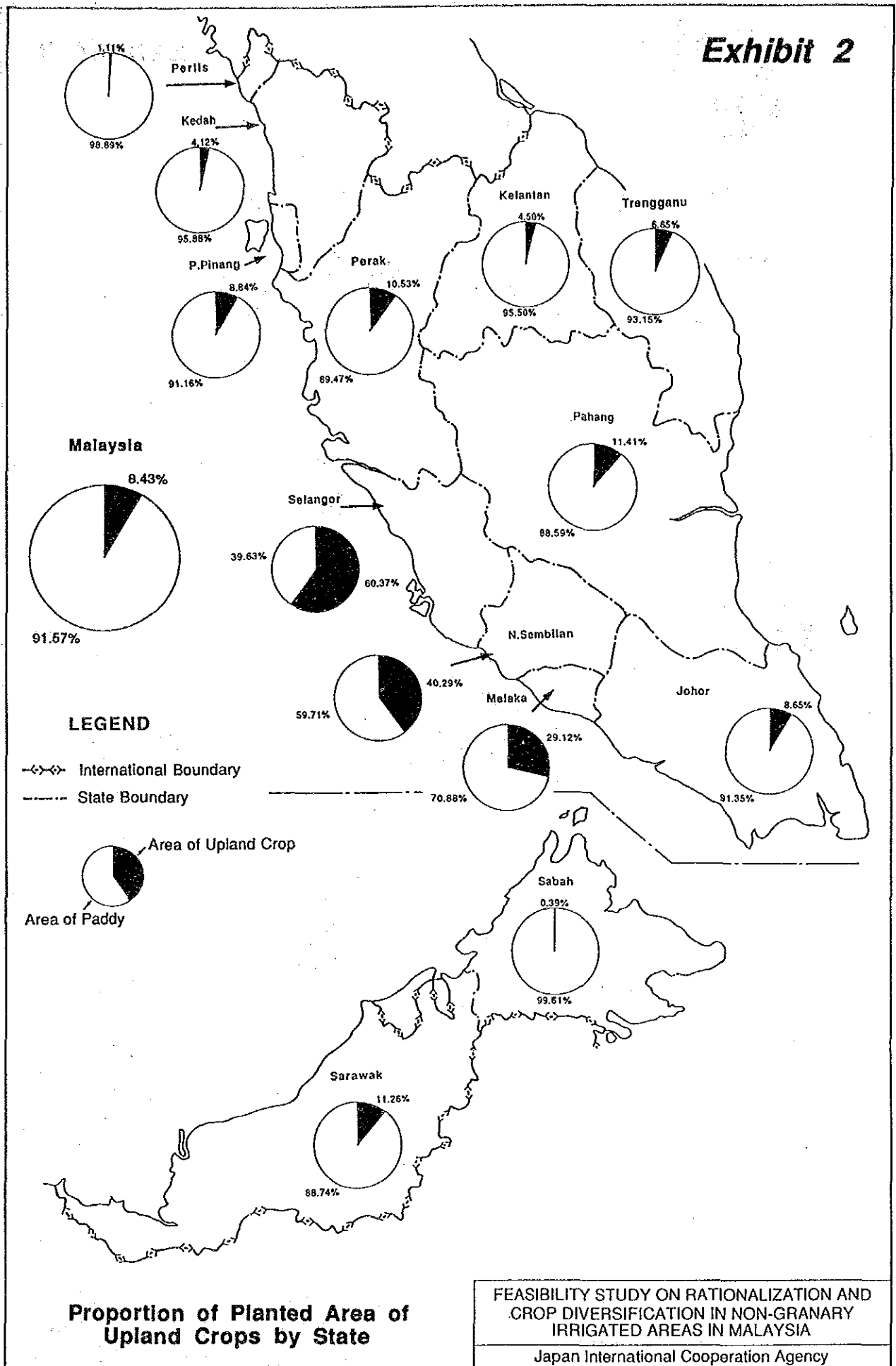
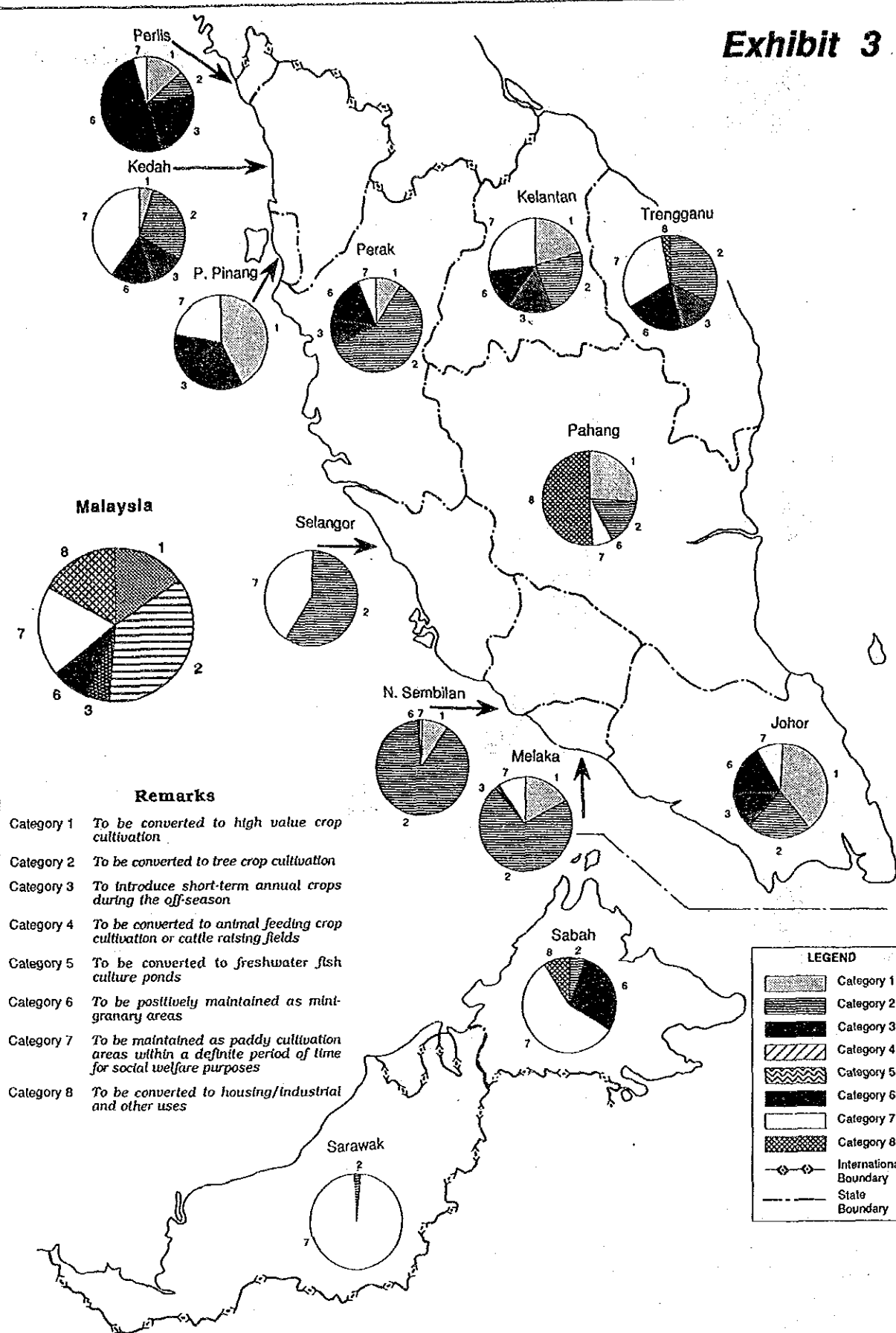
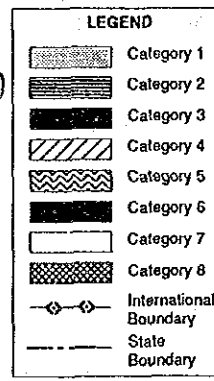


Exhibit 3



Remarks

- Category 1 To be converted to high value crop cultivation
- Category 2 To be converted to tree crop cultivation
- Category 3 To introduce short-term annual crops during the off-season
- Category 4 To be converted to animal feeding crop cultivation or cattle raising fields
- Category 5 To be converted to freshwater fish culture ponds
- Category 6 To be postively maintained as mini-granary areas
- Category 7 To be maintained as paddy cultivation areas within a definite period of time for social welfare purposes
- Category 8 To be converted to housing/industrial and other uses

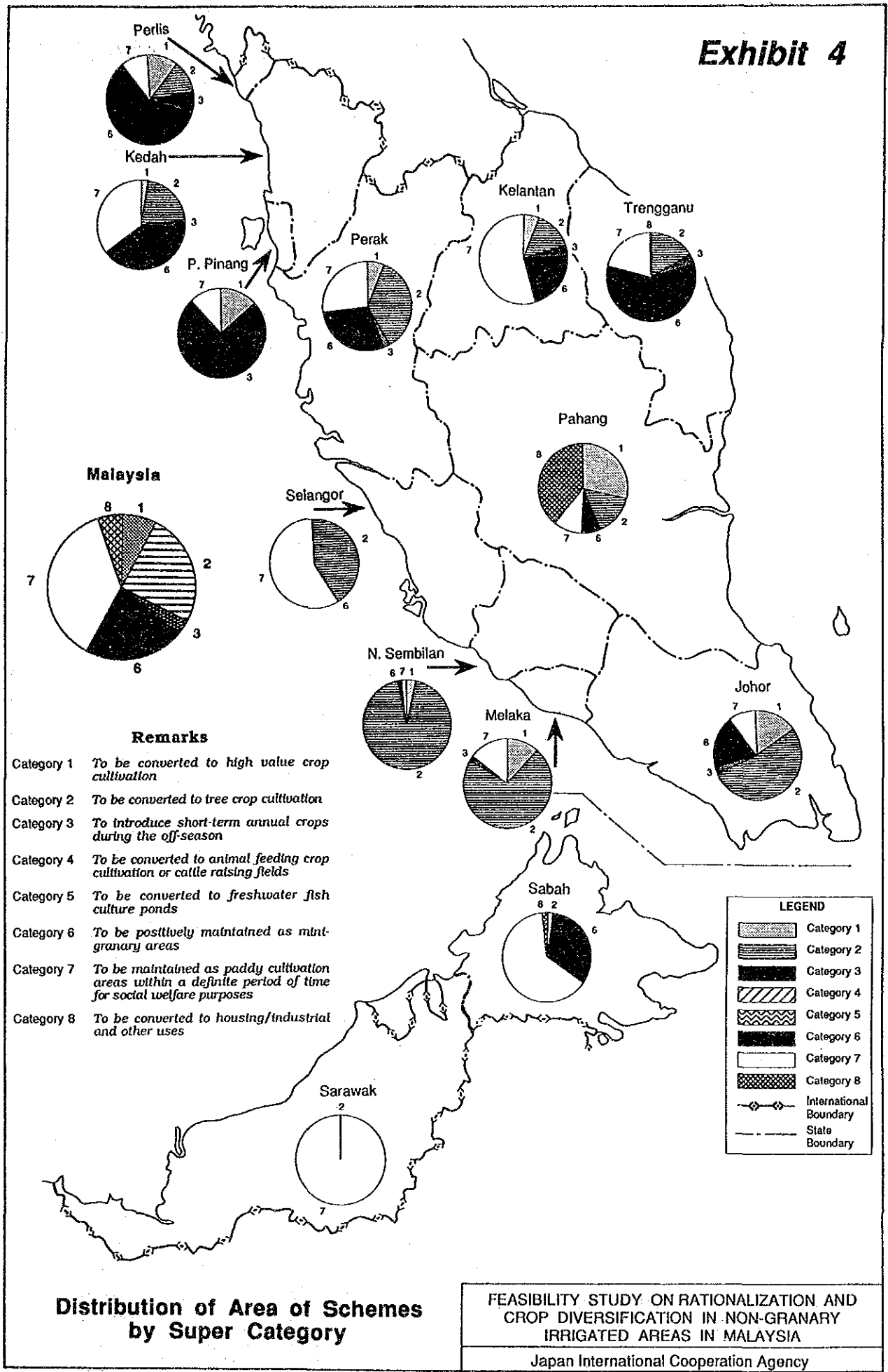


Distribution of Number of Schemes by Super Category

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Japan International Cooperation Agency

Exhibit 4



SUMMARY

1. The Study

In response to a request from the Government of Malaysia, the Japanese Government agreed to conduct the *Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas in Malaysia* (the Study) through the Japan International Cooperation Agency (JICA) and agreed on the Scope of Work with the Economic Planning Unit, Prime Minister's Department, the Government of Malaysia. The Study was carried out over a period of 20 months from March, 1989 in collaboration with the Department of Irrigation and Drainage (DID) as the counterpart agency.

The aim of the Study is to evaluate the potential for crop diversification in non-granary irrigated areas and to provide the officials concerned with basic planning and decision making information and references. For this purpose, a nationwide scheme-by-scheme inventory survey was carried out to grasp the present situation and prevailing constraints in the 924 non-granary irrigation schemes. The evaluation of the crop diversification potential was made by processing and analyzing the information collected. Following this, a feasibility study was carried out with regard to improvement of infrastructures and strengthening of non-structural measures which will both be required for promoting crop diversification in the selected non-granary irrigated areas of three States: Pulau Pinang, Negeri Sembilan and Kelantan.

This report presents the results of the Study in 17 volumes as follows:

Volume 1	Main Report
Volume 2	Crop Diversification Evaluation Methodology
Volume 3	Crop Diversification Study on Selected Schemes
Volume 4	Manual for Information Management System
Volume 5	State Reports (13 volumes in total)

2. Paddy Cultivation in Malaysia

Malaysia at present has about 600,000 ha of paddy fields. Wet paddy fields constitute about 85% and dry/hill paddy fields comprise the rest. Irrigation and drainage facilities are provided to 340,600 ha of wet paddy fields which are situated in eight large scale irrigated granary areas covering 210,500 ha and 924 medium to small size non-granary irrigation schemes totalling 130,100 ha. Annual paddy production in 1988 was 1.29 million tons from the total harvested area of 546,000 ha, meeting 84% of the domestic demand.

In 1987 there were 659,000 'poor' households of which 85% lived in rural areas. These households comprised rubber smallholders, paddy farmers, coconut smallholders, fishermen and estate workers, the greatest number being paddy farmers with 26%.

The incidence of idle paddy fields was very widespread where at the end of the 1970s, the total area was about 160,900 ha. Of these, 71,900 ha of paddy fields had been continuously idle for three years, the main causes being insufficient irrigation facilities in rainfed paddy fields and uneconomic holding size coupled with aging farmers in irrigated paddy schemes.

Under the on-going Fifth Malaysia Plan, and in line with the National Agricultural Policy large scale paddy cultivation is to be concentrated in the granary areas. All other paddy fields, particularly those that are left idle, are to be gradually phased out and used for production of more remunerative crops other than paddy.

3. Inventory Survey

The nationwide Inventory Survey on 924 non-granary irrigation schemes was carried out to evaluate the present situation and prevailing constraints, and to obtain the various information required for preparing the crop diversification plan. It comprised a Scheme Inventory Survey and a Socio-economic Sample Survey.

Under the Scheme Inventory Survey, attention was given to collection of information from State DIDs regarding the present condition of irrigation and drainage facilities as well as on utilization of irrigated paddy fields. The Socio-economic Sample Survey, provided an insight into farmers' intentions towards continuation of paddy cultivation, and towards introduction of diversified cropping, from 4,728 paddy farmers and 1,309 local community leaders.

For effective use of the information collected through the Inventory Survey, a management information system was established and a database has been set up to provide users with updated information to facilitate planning and decision making on crop diversification programs.

4. Present Condition of Non-granary Irrigation Schemes

In Malaysia, non-granary irrigation schemes depend mainly on run-of-river type intakes of many different kinds which may be summarized as follows:

Gravity	494	Pump	153
Gravity/Pump	21	Control drainage	49
Gravity/Control drainage	1	Inundation	187
Pump/Inundation	2	Others	3
No record	5	Converted	9

Irrigation water availability in the respective non-granary irrigation schemes also varies greatly. It was evaluated by examination of the balance between water requirements for full double cropping of paddy and possible intake discharge at the diversion points. As a result irrigation water availability and the number of irrigation schemes may be summarized as follows:

Sufficient of water supply throughout the year	436
Insufficient of water supply for the off season puddling	164
Sufficient of water supply only for the main season	217
Insufficient of water supply even for the main season	13
Controlled drainage and others	94

In non-granary irrigated areas, idle paddy fields are commonly observed throughout the country. The average overall cropping intensity for the main season is now only 49%, and the main season land use conditions over the last three years may be summarized as follows (see Exhibits 1 and 2):

Fully planted schemes	79
More than 50% of schemes planted	281
Less than 50% of schemes planted	250
Fully idle schemes	305
Schemes fully converted to tree crops	9

The results of the Socio-economic Sample Survey reveal that the respondent paddy farmers sampled from non-granary irrigation schemes, expect an increased income level, stable revenue, raising of living standards and creation of employment opportunities as beneficial effects of growing other crops in their paddy fields. Under present circumstance, however, 45% of them are reluctant to convert to other crops because of frequent occurrence of pests, diseases and poor facilities. For venturing into crop diversification, their major concerns are upgrading of drainage and farm access facilities and improvement of extension, credit and marketing services.

5. Evaluation of Potential for Crop Diversification

From the Inventory Survey, the following seven factors were selected for evaluation of the diversification potential in the non-granary irrigated areas:

- (a) Water resources availability,
- (b) Farmers' intentions towards continuation of paddy cultivation and introduction of crop diversification,
- (c) Land suitability for performing direct seeding and mechanized plowing and harvesting for growing paddy,
- (d) Soil suitability and limitations for the cultivation of specific crops,
- (e) Crop profitability,
- (f) Crop marketability, and
- (g) Investment performance with regard to crop diversification.

Based on these seven factors, the crop diversification potential of each non-granary irrigation scheme was evaluated by category selecting super, 2nd, 3rd and 4th priority for each scheme as follows:

- Category 1 : Schemes to be converted to high value crop cultivation under irrigated condition.
- Category 2 : Schemes to be converted to tree crop cultivation.
- Category 3 : Schemes with two-cropping system planting paddy during the main season and short-term annual crops during the off-season.
- Category 4 : Schemes to be converted to animal feed crop cultivation or cattle raising fields.
- Category 5 : Schemes to be converted to freshwater fish culture ponds.
- Category 6 : Schemes to be maintained as Paddy Cultivation (mini-granary) areas.
- Category 7 : Schemes to be maintained as paddy cultivation areas for a definite period of time due to social consideration and thereafter to be further categorized, and
- Category 8 : Schemes to be converted to housing/industrial and other uses.

The distribution of non-granary irrigation schemes in super categories by state is shown below (see Exhibits 3 and 4):

(no. of schemes)

State	Super Categories								Total No. of Schemes
	1	2	3	4	5	6	7	8	
Perlis	3	2	5	-	-	11	1	-	22
Kedah	4	21	9	-	-	11	30	-	75
P. Pinang	6	-	5	-	-	-	3	-	14
Perak	6	37	6	-	-	10	4	-	63
Selangor	-	10	-	-	-	-	7	-	17
N. Sembilan	14	140	-	-	-	1	1	-	156
Melaka	9	39	1	-	-	-	5	-	54
Johor	9	5	3	-	-	4	2	-	23
Pahang	77	45	-	-	-	2	18	148	290
Trengganu	-	13	5	-	-	8	12	1	39
Kelantan	16	18	12	-	-	11	20	-	77
Sabah	-	3	-	-	-	16	32	5	56
Sarawak	-	1	-	-	-	-	37	-	38
Total	144	334	46	-	-	74	172	154	924

6. Crop Diversification Plan

A feasibility study was carried out on 12 selected non-granary irrigation schemes (Categories 1 to 3) in Pulau Pinang, Negeri Sembilan and Kelantan with a total area of 3,209 ha.

For promotion of crop diversification, particularly irrigated upland crop cultivation, it is prerequisite to improve on-farm facilities including drainage, irrigation and road networks. Drainage systems must be designed to drain out a 1-in-5 year design rainfall within 24 hours, and the density of on-farm facilities should be 50 m/ha for tertiary canals and field drains and 110 m/ha for farm road networks.

On average, it was found that on-farm development works needed an initial investment of M\$8,700/ha in Pulau Pinang and M\$9,300/ha in Kelantan for growing upland crops. For converting to tree crop fields, the initial investment cost will be M\$940/ha in Negeri Sembilan.

In Pulau Pinang, in the case of Kulim Irrigation scheme, the initial cropping pattern may comprise main season paddy and some cash crop during the off season period. Full crop conversion can take place at a later stage when farmers' experience and capability in carrying out upland crop cultivation have been further developed. The required cost for the full development including enhancement of water resources is estimated to be M\$23 million. Investment efficiency in terms of financial internal rate of return is estimated to be 27%.

In Negeri Sembilan, the proposed crop diversification plan is to grow permanent industrial tree crops such as oil palms and cocoa with the provision of drainage and farm access facilities. The required cost for improvement of on-farm service facilities is estimated to be M\$ 430,000 for converting an area of 459 ha in Mampong area to perennial tree crop area. Investment efficiency in terms of financial internal rate of return is estimated to be 12.5% for oil palm and 23.0% for cocoa.

In Kelantan, it is proposed to promote crop diversification through encouraging paddy farmers to grow off-season upland crops in irrigated paddy fields by gravity and pump systems. On-farm service facilities are proposed to be upgraded to an appropriate canal density of 50 m/ha. The cost for three selected schemes covering 873 ha is estimated to be M\$10.4 million. Investment efficiency in terms of financial internal rate of return is estimated to be 23%.

7. Conclusions and Recommendations

The potential for crop diversification has been evaluated for each of the 924 non-granary irrigation schemes by Inventory Survey. The crop diversification potential evaluation through this nationwide overall survey contains results based on a series of assumptions and simplified criteria. The Study concluded that promotion of crop diversification matching the specific features of a particular non-granary irrigation scheme can be achieved with provision of necessary actions.

An information management system for the non-granary irrigated areas was established not only for the use of the Study results but also for the monitoring of future scheme performance.

It is recommended that the following four issues be taken up:

- (a) Formulation of crop diversification plans for the other five States with different physical and socio-economic circumstances. These are the States of Perlis, Kedah, Perak, Pahang and Trengganu. Due to insufficient basic data being available in Sabah and Sarawak, undertaking of a resource oriented study is recommended followed by preparation of a crop diversification plan.
- (b) Continuous updating of data in the information management system and strengthening of the nationwide network system.

- (c) Implementation of pilot projects to demonstrate the success of diversified cropping with a view to encouraging farmers' participation in crop diversification. Two initial sites should be selected one in Pulau Pinang (the Sungai Kulim non-granary irrigation scheme) and another in Kelantan (the Repek scheme).

- (d) Collection of data and information to establish a comprehensive database on the 280,000 ha of rainfed paddy fields which are distributed outside the granary and non-granary irrigated areas covered in this Study, as the first step towards a future plan of crop diversification.

*Feasibility Study on Rationalization and Crop Diversification
in Non-granary Irrigated Areas in Malaysia*

(Volume 1)

Main Report

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ABBREVIATIONS

Plans

NEP	:	New Economic Policy
NAP	:	National Agricultural Policy
IMP	:	Industrial Master Plan
5MP	:	Fifth Malaysia Plan, 1986-1990

Organizations

BPM	:	Agricultural Bank of Malaysia (Bank Pertanian Malaysia)
DID	:	Department of Irrigation and Drainage
DOA	:	Department of Agriculture
EPU	:	Economic Planning Unit
FAMA	:	Federal Agricultural Marketing Authority
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FO	:	Farmer's Organization
FOA	:	Farmer's Organization Authority
JICA	:	Japan International Cooperation Agency
KADA	:	Kembu Agricultural Development Authority
LPN	:	National Paddy and Rice Board
MADA	:	Muda Agricultural Development Authority
MARDI	:	Malaysian Agricultural Research and Development Institute
MOA	:	Ministry of Agriculture

Others

CS	:	Cropping System
FIRR	:	Financial Internal Rate of Return
GDP	:	Gross Domestic Product
IADP	:	Integrated Agricultural Development Project
O&M	:	Operation and Maintenance
Sg.	:	Sungai (river)

CONVERSION FACTORS

	<u>Metric to Imperial</u>	<u>Imperial to Metric</u>
<u>Length</u>	1 cm = 0.394 inch	1 inch = 2.54 cm
	1 m = 3.48 feet	1 feet = 30.48 cm
	1 km = 0.621 mile	1 mile = 1,609 km
<u>Area</u>	1 m ² = 10.76 sq.ft	1 sq.ft = 0.0929 m ²
	1 ha = 2,471 acres	1 acre = 0.4047 ha
	1 km ² = 0.386 sq.mile	1 sq.mile = 2.59 km ²
<u>Volume</u>	1 lit = 0.22 gal (imp)	1 cu.ft = 28.33 lit
	1 m ³ = 35.3 cu.ft	1 gal (imp) = 4.55 lit
	1 MCM = 811 acre-ft	1 acre-ft = 1,233.5 m ³
<u>Weight</u>	1 kg = 2.20 lb	1 lb = 0.4536 kg
	1 ton = 0.984 long ton	1 long ton = 1.016 ton
<u>Derived Measures</u>	1 m ³ /sec = 35.3 cusec	1 cusec = 0.0283 m ³ /sec
	1 ton/ha = 891 lb/acre	1 lb/acre = 1.12 kg/ha
	1 m ³ /sec = 19.0 mgd	1 mgd = 0.0529 m ³ /sec
<u>Temperature</u>	°C = (°F - 32) x 5/9	°F = 1.8 x °C + 32
<u>Local Measures</u>	1 lit = 0.22 gantang	1 gantang = 4.55 lit
	1 kg = 1.65 kati	1 kati = 0.606 kg
	1 ton = 16.5 pikul	1 pikul = 60.6 kg

CURRENCY EQUIVALENT

(as of mid 1990)

US\$ 1.0 = M\$ 2.54

1. INTRODUCTION

1.1 General

This Final Report for the Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas in Malaysia (the Study) has been prepared in accordance with the Scope of Work (S/W) agreed on July 20, 1988 between the Japan International Cooperation Agency (JICA) and the Economic Planning Unit (EPU), Prime Minister's Department, the Government of Malaysia. The S/W is attached at the end of this Report.

The Report describes the present situation, prevailing constraints and directions for future utilization of 924 non-granary irrigation schemes distributed throughout the country. Further, it presents the results of feasibility studies for schemes selected in the three States: Pulau Pinang, Negeri Sembilan and Kelantan.

The Final Report consists of 17 volumes as follows:

Volume 1	Main Report
Volume 2	Crop Diversification Evaluation Methodology
Volume 3	Crop Diversification Study on Selected Schemes
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1.2 Background of the Study

The Malaysian Government has set up various agricultural policies to attain self-sufficiency of rice as the nation's staple food during the 20 years since Independence. Numerous irrigation projects have been implemented as a part of these policies and in 1985 irrigated areas totalled 340,000 ha throughout the country. During the 1970's, the agricultural sector grew well as a result of successful performance of export-oriented crop productions such as oil palm, rubber and cocoa.

The economic growth of other sectors was however superior to the growth of the agricultural sector in those decades. This triggered off migration by the young to urban areas and other industries. Problem of aging paddy farmers assumed an acute phase in rural societies. Further, productivity of the paddy sub-sector became stagnant due mainly to uneconomical farm sizes created by traditional land inheritance in irrigated areas. Consequently, many paddy farmers gave up paddy cultivation and have left their paddy fields idle. Such extent of idle paddy fields increased year by year and reached 160,000 ha in Peninsular Malaysia in 1980.

Under the Fourth Malaysia Plan, the Government implemented programs revitalize the idle paddy fields. The National Agricultural Policy introduced in 1984 and under the Fifth Malaysia Plan starting in 1986, the rice self-sufficiency target has reduced to a floating target. Also, it was decided that the extent of public involvement and investment in paddy production should be concentrated in eight granary areas with a total area of 210,000 ha and with upgraded large-scale irrigation system. In line with this policy other paddy fields should be gradually phased out and used for the production of more remunerative crops than paddy.

Accordingly, the Malaysian Government decided to conduct a study with the view of collecting the information required for evaluation crop diversification potential in 924 non-granary irrigation schemes.

1.3 Study Objectives and Area

(1) Study objectives

The objectives of the Study are as follows:

- (i) To determine the prevailing site conditions and to identify the existing problems through an inventory resource survey of all the non-granary irrigated schemes;
- (ii) To categorize the schemes according to potential for revitalization including the selection of suitable crops for cultivation as well as proposing appropriate cropping patterns; and
- (iii) To carry out feasibility studies on selected schemes including evaluation of their technical feasibility, financial viability and social acceptability of farmers towards crop diversification.

(2) Study area

The Inventory Survey covered all of the 924 non-granary irrigation schemes throughout the country with a total irrigable area of about 130,000 ha. The Feasibility Study was conducted for 12 schemes selected in the States of Pulau Pinang, Negeri Sembilan and Kelantan with a total area of 3,209 ha.

1.4 Study Performance

The Study covering for a total period of 20 months commenced in March 1989. For the execution of the Study, JICA sent a Study Team comprising 10 experts. A total of 13 Malaysian counterparts were assigned to the Study. Table 1 shows the list of members of the JICA Study Team and Malaysian counterparts.

The Study was undertaken in two phases i.e. Phase I and Phase II. The flow chart of the Study is illustrated in Fig. 1. The Phase I comprised field work up to September 1989 and home office work by the end of 1989. Major activities in Malaysia were to undertake the Inventory Survey on all the 924 non-granary irrigation schemes and to carry out supplemental investigations and analysis of the Inventory Survey's results. Focal points in the home office work were to process various materials obtained through the Inventory Survey, to categorize all the non-granary irrigation schemes and to select schemes for the Feasibility Study during the Phase II. During this phase, two reports, i.e. Progress Report (I) and Interim Report, were submitted to the Government of Malaysia.

During the Phase II, the Study comprised field work from January to March 1990 and home office work from April to mid August 1990. Detailed field investigations were performed for the 12 non-granary irrigation scheme areas of the three States selected through discussion on the Interim Report with the Government of Malaysia. Special attention was paid to clarify the actual conditions of irrigation and drainage facilities, farming activities, agricultural supporting services and farmers' intention towards promotion of crop diversification. During the home office work period, crop diversification plans were formulated for the selected schemes. In this phase, two reports, Progress Report (II) and Draft Final Report, were submitted to the Malaysian Government.

Discussions were made between the Malaysian Government and the Study Team on the findings of the Study as presented in the Draft Final Report in August, 1990. All the comments received from the Malaysian side are incorporated into the Final Report.

1.5 Transfer of Technology

In accordance with the agreed Scope of Works of the Study, training sessions for the purpose of technology transfer related to crop diversification were held as follows:

- A training workshop in Melaka; February 12th to 17th, 1990.
- National seminar on Crop Diversification in Melaka;
August 27th to 29th, 1990
- Lecture and discussion with State Co-ordinators
in Pangkor island.

The workshop was held to conduct training on the proper use of the computerized information management system to 31 participants from EPU, MOA, DID, Department of Agriculture (DOA), Farmers' Organization Authority (FOA), Federal Agricultural Marketing Authority (FAMA) and Malaysian Agricultural Research and Development Institute (MARDI).

The national seminar on Crop Diversification was held for the two purposes: one is to increase awareness among policy makers, planners and project implementors on the potential of crop diversification in non-granary irrigated areas; and the other is to disseminate the results of the Study. A total of 16 papers were presented in this seminar. The topics covered crop diversification status in Malaysia, policy issues, regional perspective, options for crop diversification, marketing, case studies and technological considerations in support of crop diversification. The essence of these Topics are fully incorporated in this Final Report. Participation of the seminar comprised senior officers from relevant Government departments such as EPU, Agencies under MOA and other Ministries including Federal Land Consolidation and Rehabilitation Authority (FELCRA), and representatives from the relevant private sector. A total of 170 participants attended the seminar.

A lecture and discussion meeting was held with a view to inform the results of the Study to the 18 State coordinators and staff of State DID who were involved in the Inventory Survey.

1.6 Undertaking by the Government of Malaysia

For smooth operation of the Study, the Government of Malaysia has established a Steering Committee chaired by Dr. Abdul Aziz bin Yaacob, Director of Agriculture, EPU and a Technical Committee chaired by Ir. Quah Tek Hoe, Assistant Director General, DID. The Steering Committee consisted of seven members EPU, MOA, DID, DOA, MARDI, FOA and FELCRA. It functioned to provide policy guidelines and strategies for the Study. A Technical Committee was responsible for all technical matters related to the Study. Its members were representative from the MOA, DID, DOA, MARDI, FOA, FAMA and Project Directors of Kedah and Melaka Integrated Agricultural Development Projects (IADP). To facilitate the Inventory Survey, one coordinator was appointed from each of the 13 State DIDs and under his direction, staff of DID District Offices in every State were also involved to ensure the smooth operation of the Inventory Survey. Members who have been directly involved in the Study area listed in Table 2.

1.7 Acknowledgements

In undertaking the Study, the Study Team has attached great importance of the views of Departments and Agencies of the Malaysian Government relating to the various aspects covered by the Study. The contribution to the Study of officials of both the Federal and State Governments and individuals who have provided information and data, participated in discussions, given valuable advice and provided other forms of assistance to the Study Team are greatly acknowledged. Heartful gratitude is extended to officials of the Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fisheries, and Embassy to Malaysia of the Government of Japan, the JICA Malaysia Office and Japanese Colombo Plan Experts who have given advice, directly participated in the Study and provided various support towards the Study. In reality, the Study can be regarded as a joint effort by the Malaysian and Japanese officials and individuals concerned and the Study Team. The Study Team sincerely hopes that this joint effort will

contribute to the future promotion of crop diversification and to raising of living standards of farmers in the non-granary irrigated areas.

2. BACKGROUND

2.1 Policy Background

(1) New Economic Policy (NEP)

The New Economic Policy, launched in 1971, was drawn up to eradicate poverty, irrespective of race, and to eliminate the disparity of economic function between the races. Under the framework of NEP, action-oriented policies, programs and projects have been implemented for the past 20 years.

Although the fundamental objectives remain unchanged, the strategies and policies have been adjusted accordingly to the circumstances prevailing in the latter half of the 1980s. Instead of playing a leadership role in promoting economic growth, the public sector has been making efforts to create a more suitable environment and climate for the private sector. The private sector has been identified to provide the leading role and dynamism in the economy.

The growth of agricultural sector has declined since early 1980s. Agricultural productivity, particularly in the paddy and rubber smallholder sub-sectors, has been constrained by uneconomic holding sized low-yielding crops, traditional methods of production, increase in idle land and inadequate access to supporting services. The migration of the younger labor force from rural to urban areas has caused a shortage of agricultural labor and the aging of the rural labor force.

(2) National Agricultural Policy (NAP)

The NAP was introduced in 1984. Its objective is to maximize income from agriculture through efficient utilization of the country's resources and revitalization of the sector's contribution to the overall economic development of the country. Under the NAP, the process of

maximizing farm income is achieved through the expanded production of traditional export crops, the development and promotion of potential export crops, and the development and expanded production of food and industrial crops. The production of all agricultural commodities, except rice, is to be evaluated from the technical, agro-climatic and economical considerations. Production of rice, the country's staple food, is to be considered from the national food security viewpoint.

As there are wide disparities between crop yields in the estate or estate-type sub-sector and non-organized smallholder sub-sector, the NAP emphasized the necessity for increasing production and income through productivity improvement. It is necessary to intensify agricultural support services to selected crops so as to avoid waste of limited financial and manpower resources and furthermore to ensure timely delivery and adequate provision of the services.

(3) Paddy and rice policy

The paddy and rice policy as a part of the NAP aims to achieve increase in farm income and low rice prices for consumers. To achieve these targets, the Government has implemented a range of policies including a Guaranteed Minimum Price, fertilizer and price subsidies, provision of drainage and irrigation facilities as well as research and development.

As compared to oil palm and rubber which are discriminated by means of an imposition of export tax and other duties, the paddy and rice industry is heavily protected. The resultant impact of these differential policies is to render paddy growing profitable vis-a-vis oil palm and rubber. There is therefore a strong tendency and inclination for paddy farmers to remain where they are, rather than diversifying into other activities.

The economic implications of the paddy and rice policy are: welfare losses to consumers since they have to pay for higher domestic

rice prices; a severe burden on Government budget allocation; and a heavy net societal cost. Under such circumstances, a re-look at the prevailing paddy and rice policy is taken in the direction of inducing the relocation of resources particularly in paddy farms into other alternative production activities. In this connection, the Government has revised its policy to confine paddy production to the granary areas and to reduce the rise self-sufficiency level from the previous target between 80% and 90% to the new floating target obtainable from the granary areas.

(4) Agricultural diversification policy

In Malaysia, agricultural diversification is defined as a widening of the range of agricultural activities with the objective of reducing a farm's dependence on one or extremely few commodities. Agricultural diversification can be classified into two types; horizontal and vertical. Horizontal diversification refers to commodity-oriented diversification and involves increasing the range of products within the agricultural farm. Vertical diversification includes the opportunities for generating added value from a given product by further processing, handling and marketing.

Agricultural diversification has been an objective of Malaysian development policy for a long time. The success in agricultural diversification program on tree crop commodities for the last three decades is the result of comparative advantages in particular the historical development of related institutions, favorable economic factors and significant progress in technological package. Among tree crop commodities, oil palm has significantly contributed to the very high agricultural growth in Malaysia. Despite the Government's promotion with large direct and indirect interventions in both production and marketing, however, endeavours in agricultural diversification outside tree crop sub-sector has limited success.

The future agricultural diversification policy for the traditional export commodities in the 1990's is to consolidate those contribution

to the national economy through improved productivity and economic efficiency by way of vertical diversification. As for food crops for domestic consumption and export, further horizontal diversification is more relevant to the pressing need, considering limited success in sustaining agricultural diversification programs.

(5) Fifth Malaysia Plan (5MP)

The directions for agricultural development as mentioned in the NAP were reflected in the 5MP. Major points are:

- To modernize and commercialize the smallholder sub-sector through continuing new land development, in-situ development, provision of support services, and social and institutional development;
- To rationalize the extent of government involvement by the changeover from subsidies to credit schemes, the reduction of primary level marketing activities and others; and
- To adopt and put a more balanced commodity and human development approach in operation through improved sector-wide planning and policy analysis.

Through embodiment of these strategies, the 5MP aims to improve living standard of farm households so as to reduce the economic imbalance between the urban and rural areas. Further, it aims to increase agricultural productivity of smallholders by encouraging agricultural diversification with introduction of private sector's involvement and promotion of profit-oriented farm management. The major thrust in the agricultural sector is to improve productivity and economic efficiency of oil palm and cocoa production, while to sustain those of rubber and timber. Prospects for agricultural diversification is limited to fruits, vegetables and some minor crops which show near competitiveness with imports.

With regard to paddy, the rice policy, the large scale cultivation of paddy is to be confined in the eight granary areas in Peninsular Malaysia using modern techniques and well trained professional management teams. All other paddy fields are to be gradually phased out and used for the production of other more remunerative crops.

(6) Industrial Master Plan (IMP)

The Industrial Master Plan was launched by the Government in 1986 providing main objectives for manufacturing development as follows:

- To accelerate the growth of the manufacturing sector to ensure a continued rapid expansion of the economy and to provide basis for meeting the social objectives consistent with the NEP
- To promote opportunities for the maximum and efficient utilization of the nation's natural resources; and
- To build up the foundation for leap-frogging towards an advanced industrial country in the formation age by increasing indigenous technological capability and competitiveness.

The IMP covers such four areas related to the agriculture sector i.e. rubber, palm oil, food processing and wood-based industries. Of these, the food processing has been primarily chosen to cater for the domestic market. The food processing industry contributes largely to the economy in terms of generating employment, expanding, savings in foreign exchange, creating value-added and increasing rural income. Potentially, it has wide backward and forward linkages to several other supporting industries such as crop production, packaging, refrigeration, processing equipment and machinery industries.

The potential areas for investment in food processing, based on local resources, are fruits and vegetables processing, cocoa processing,

animal feeds, meat processing as well as utilization of agricultural waste/by-products. Fruits such as passion fruit, guava, starfruit, mangosteen, jackfruit, watermelon and papaya can be made into exotic tropical fruit juices/concentrates.

2.2 Sociological Background

(1) Population

The total population of Malaysia was estimated to be 17.1 million in 1988. It increased by 3.2 million from 13.9 million in 1980 with the annual average population growth rate of 2.6%. According to the long-term population projection made by the Department of Statistics and the National Population and Family Development Board, the total population is estimated to be 17.9 million in 1990, 22.4 million in 2000 and 35.1 million in 2025.

As for the population structure, the share of children below the age of 15 declined from 39.9% in 1980 to 37.0% in 1990. It will further go down to 34.4% in 2000 and 28.8% in 2025. While those aged 65 and above shared 3.5% of the total population in 1980. It is projected to increase to 3.7% in 1990, 4.5% in 2000 and 7.7% in 2025.

The urbanization rate in Malaysia was 34.2% in 1980 and will rise to 40.7% in 1990. The urban population is expected to increase from 5.9 million in 1985 to 7.3 million in 1990 with an average rate of 4.2% per annum during the 5MP period. In Peninsular Malaysia, it is expected that the population of Malays and other Bumiputera in the urban areas will continue to record the highest growing rate of 6.0% per annum with their increasing migration from the rural areas.

(2) Labor force and employment

The working-age population is defined as those aged between 15 and 64, while the labor force is estimated by multiplying the working-age population by overall labor force participation rates. The size of the labor force was 5.1 million in 1980 and 6.6 million in 1988. It is forecasted to be 7.0 million in 1990.

Of this labor force, unemployment rates were 5.7% in 1980 and 8.1% in 1988. It will decline to 7.6% in 1990. The contribution of agricultural sector to the employment went down from 39.7% in 1980 to 31.3% in 1988, and further to 30.3% in 1990.

(3) Poverty eradication

In Malaysia, the number of poor households and the incidence of poverty have been measured on the basis of a poverty line income. The definition of poverty line income is an income sufficient to purchase a minimum food basket for maintaining a household in good nutritional health and the conventional needs for keeping the standard of living prevailing in Malaysia.

According to the Post Enumeration Survey in 1970, Agricultural Census in 1977 and Household Income Surveys in 1984 and 1987, the overall incidence of poverty declined quite substantially for the period between 1970 and 1984 from 49.3% in 1970 to 39.6% in 1977 and further to 20.7% in 1984 and 19.3% in 1987.

Of 649,400 poor households in 1984, 14% or 93,000 households were in the urban areas. In 1987, the poor households amounted to 649,100 of which 14.7% or 95,200 households lived in the urban areas. Among the main target groups such as rubber smallholders, paddy farmers, coconut smallholders, fishermen and estate workers, the maximum group is paddy farmers. Its proportion to the total poor households was 28% in 1984 and 26% in 1987.

2.3 Economic Background

(1) Gross Domestic Product (GDP)

The Gross Domestic Product of the Malaysian economy, as measured in 1978 constant market prices, increased M\$44,702 million in 1980 to M\$57,150 million in 1985. The average annual growth rate was 5.8% for the 4MP period. The per capita GDP rose by 4.4% per annum from M\$3,719 in 1980 to M\$4,609 in 1985.

With export volumes stagnating and commodity prices on a downward trend for two years in 1985 and 1986, overall output declined for the first time since Independence. By the middle of 1986, the economy began to recover. Since then, the expansion of Malaysian economy has been stimulated by favourable external demand, particularly for exports of Malaysian manufactures, coupled with strong domestic investment and consumption demand. In 1988, the real GDP amounted to M\$66,258 million at 1978 constant market prices. It is estimated to be M\$71,294 million in 1989. The per capita GDP is M\$5,360 in 1988 and M\$5,793 in 1989.

Since Independence, the agricultural sector has been the mainstay of Malaysia's economy. Although the manufacturing sector has made high contributions to the GDP in the 1980s, the agricultural sector has also been the leading contributors to growth. In 1988, the agricultural sector contributed to 21.2% of GDP and 35.0% of the total export earnings.

(2) Agricultural production

In Malaysia, the total land area is 32.96 million ha. Of these, around 5 million ha are under crop cultivation. Agriculture in the country is featured by the existence of an efficient and well-organized estate sector as well as the traditional and non-organized smallholder sector. Malaysian estates cover an estimated area of 1.3 million ha and smallholders, though less developed, occupy 3.7 million ha.

Malaysian agriculture is still geared towards the production of export commodities. The country is now the primary exporter of natural rubber and palm oil in the world. Further, cocoa, pepper, pineapple and tobacco are dominant commodities with high growth of export earnings. Of these crops, cocoa has risen fast to become a major foreign exchange earner and the third major plantation crop in the 1980s. As the prospect of a turnaround and good profits has continued to remain bright investments in new plantings, cocoa is playing a key role in providing the principal basis for further diversification of the agricultural sector.

Gross export in 1988 amounted to M\$55,334 million. The main agricultural commodity is palm oil. The export earnings of palm oil were M\$4,528 million or 8.2% of the total export earnings.

In 1988, Malaysia spent M\$3,839 million for importing food and live animals, while exported ones earned M\$2,851 million. Of this value, M\$1,059 million or 28% was derived from import of maize, rice and wheat, and M\$583 million from vegetables and fruits, M\$1,263 million from dairy products and animal feeding stuff, and M\$457 million from sugar and sugar preparations. Gross food imports accounted for 8.8% of the total imports and 6.9% of export earnings (see Table 3).

Rubber cultivation still occupies the biggest area accounting for 1.89 million ha or 45% of the total area under the major crops in 1988 and engaged over half-million workers on full-time and part-time basis. Oil palm was second to rubber in terms of planting area covering 1.75 million ha, about one-third of the total cultivated area in the country for 1988. The total area under cocoa increased from 0.12 million ha in 1980 to 0.40 million ha in 1988. As for paddy, its planted area declined from 0.72 million ha in 1980 to 0.65 million ha in 1988 (See Table 4).

The trend of major agricultural production between 1980 and 1988 is featured by drastic increase in palm oil and cocoa outputs. During this period crude palm oil rose from 2.58 million tons in 1980

to 5.03 million tons in 1988 and cocoa production increased from 36,500 tons in 1980 to 230,000 tons in 1988. Rubber production also slightly increased from 1.53 million tons in 1980 to 1.67 tons in 1988. On the other hand, paddy output reduced from 2.17 million tons in 1980 to 1.79 million tons in 1988 (See Table 5).

3 OVERVIEW ON PADDY CULTIVATION IN MALAYSIA

3.1 Historical Changes in Paddy Production Policy

(1) Paddy production policy in the 1960s

The paddy production policy for the 1960's was aimed to increase rice self-sufficiency level through expansion of irrigated areas and increase in paddy yield. In line with the guideline in the Final Report of the Rice Committee, short and long term policies were implemented to improve farm management and living standard of paddy farmers. These were achieved through distribution of high-yielding rice variety seeds, introduction of fertilizer subsidy system, realization of double cropping of paddy by constructing irrigation systems, establishment of FAMA, setting up of farmers organization, and revision of Padi Cultivators Act.

In 1970, the annual paddy planted area in Peninsular Malaysia amounted to 533,200 ha with a total paddy production of 1.43 million tons meeting 78% of the domestic demand. This attainment of output was due to the development of new high yielding rice varieties. \$434 million or 22% of the expenditures for agriculture development during the 1970s were allocated for upgrading and the construction of new irrigation and drainage facilities. As a result, the share of double cropping area increase from 5% in 1963 to 25% in 1970. Production targets were amended to 90% by 1970 rather than full sufficiency in view of the high costs of production.

The economic growth of other sectors was however superior to the paddy production sub-sector during the above period. It brought further expansion of income differential on paddy farmers in comparison with urban sectors and other agricultural sub-sectors. In this connection, the farm earnings of 88% paddy farmers in Peninsular Malaysia in 1970 was below the poverty line income which is defined as an income sufficient to purchase a minimum food basket for

maintaining a household in good nutritional health and the conventional needs for keeping the standard of living prevailing in Malaysia. This ratio far exceeded the average figure of 59% in rural areas and 49% in the whole country.

(2) Paddy production policy in the 1970s

The NEP, started in 1971, aims to eradicate poverty and to achieve the national unity through restructuring of the society. To rectify economic imbalance by means of restructuring the society, it is hoped to eliminate the identification of race with economic function. To do so, special efforts were made to promote economic activities of Malay people and more equitable participation of them in secondary and tertiary industries. The paddy production policy for the 1970s or the first half of the NEP mainly followed the previous policy in the 1960s which focussed upon eradication of poor paddy farm households by increasing annual gross income and also maintaining of rice self-sufficiency level at 80% to 90%.

The average rice self-sufficiency level for the 1970s reached 89%, resulting from further increase in double cropping area and improvement of farming practices. As a reaction to the world food crisis occurred during this period, a further spurt in expenditures on irrigation facilities was seen in allocation of the Government budget with a gross amount of M\$1,036 million accounting for 12% of the total allocated for agricultural development. In 1974 for Peninsular Malaysia, the annual paddy planted area and production reached 598,000 ha and 1.82 million tons, respectively. After 1974 paddy production shows a downward trend. In 1980, the annual paddy planted area was 530,000 ha in Peninsular Malaysia and 717,000 ha for the whole country, while the annual paddy production was 1.77 million tons in Peninsular Malaysia and 2.17 million tons throughout the country (See Table 6).

The proportion of poor paddy farm households was reduced to 53% in 1980. However, it was 37% of a farm households and 29% of

all households in rural and urban areas. This slow progress in eradicating poverty in the paddy smallholder sector was caused by insufficient improvement of farm household income due to structural reasons such as uneconomical holding size, traditional land tenure situation, increase in production cost and low yield. Furthermore, the farm labor shortage problem was acute in traditional paddy cultivation areas where young generation labor force moved out to other sectors.

(3) Paddy production policy in the first half of the 1980s

Constant farm labor shortage in rural areas resulted in paddy cultivation being operated with less manpower requirements. Paddy farmers made practical use of direct sowing method and also mechanized plowing and harvesting on a contract service basis in areas where irrigation canal facilities were available. The incidence of idle paddy fields was observed in areas under rainfed or with irrigation system. In 1985, the annual paddy planted area declined to 465,000 ha in Peninsular Malaysia and 662,000 ha in the country, while the annual paddy production was 1.68 million tons in Peninsular Malaysia and 1.90 million tons in the country. Continuous efforts were made to the improvement and intensification of irrigation and drainage facilities in granary areas with an expenditure M\$1,451 million or 18% of the allocation for agricultural development during this period. This increased the ratio of double cropping area to 42%.

(4) Paddy production policy in the second half of the 1980s

In line with the rice policy in the framework of the NAP, the extent of Government involvement and investment in paddy production was to be concentrated in the granary areas. Accordingly, the irrigation program also focused on intensification of irrigation facilities in these areas. During the 5MP period, the allocation for drainage and irrigation sub-sector was curtailed to M\$337 million or less than 3% of the total amount allocated to agricultural development. At the Mid-

term Review of the 5MP, the amount allocated was revised and increased to M\$478 million.

3.2 Current Rice Production

(1) Irrigated condition

At present Malaysia has 600,545 ha of paddy fields (irrigated and rainfed) of which 406,545 ha are located in Peninsular Malaysia and the remaining in Sabah and Sarawak as shown in Table 7. Wet paddy fields constitute about 85% of the total paddy fields in the nation and dry/hill paddy comprise the rest. In Peninsular Malaysia, 308,320 ha have been provided with irrigation or drainage facilities, while the balance consists of rainfed wet paddy fields of 92,225 ha and dry/hill paddy fields of about 6,000 ha. In Sabah and Sarawak, 32,299 ha have been provided with irrigation facilities. Thus, the irrigated paddy fields amount to 340,619 ha throughout the country. Out of these irrigated paddy fields, 210,497 ha are designated as granary areas, while the remaining 130,122 ha are called non-granary irrigated areas.

(2) Granary areas

In Malaysia, the granary areas comprise eight large-scale irrigation schemes as shown below:

<u>Granary Area</u>	<u>State</u>	<u>Paddy Area (ha)</u>
Muda (MADA)	Perlis	19,500
	Kedah	75,500
Balik Pulau/Seberang Perai	P. Pinang	13,000
Krian/Sungai Manik	Perak	30,058
Seberang Perak	Perak	9,510
Barat Laut Selangor	Selangor	19,022
Besut	Trengganu	5,100
Kemasin Semarak	Kelantan	7,330
Kembu (KADA)	Kelantan	31,477
	<u>Total</u>	<u>210,497</u>

(3) Integrated Agricultural Development Project (IADP)

The concept of the Integrated Agricultural Development Project is to bring together in a well coordinated manner the components necessary for developing the existing agricultural areas and realization of increasing agricultural production of the farming community.

This concept would be achieved by way of:

- Provision of improved agricultural infrastructures including drainage and irrigation systems, and farm access facilities;
- Provision of improved agricultural supporting services such as research, extension services, marketing and credit; and
- Direct involvement of farmers in credit and marketing.

There are 21 IADPs currently under the various stages of implementation in the country. Starting with the Muda Agricultural Development Project (Muda I) in 1965, three IADPs have been completed up to date. These are Muda I, Besut and Kembu Agricultural Development Projects. 14 IADPs are on-going as listed up in Table 8 including three new IADPs started during the 5MP period, namely, Kemasin Semarak, Samarahan and Kalaka Saribas. Another three IADPs, Sungai Golok, Sungai Nal/Sungai Sokor and Tumboh Block, will be implemented when financial allocations are made available.

In Muda, Kembu and Barat Laut Selangor areas, the average paddy yield increased from 2.0 to 3.5 ton/ha per one crop season and farm income went up to M\$4,200 annually. In Perlis, Lembah Kedah and Melaka IADP areas, crop diversification programs have been promoted and to date 38% of the target paddy fields of 7,000 ha in total have been converted to fruit and vegetable cultivation areas. Under the Barat Laut Selangor and Johor Barat IADPs, cocoa planting has been encouraged in coastal areas and an average yield of dry cocoa beans reached 1.6 ton/ha, being twice compared with that before the project. Also an average yield of oil palm reached to a level of 10 ton/ha. In the Johor Barat IADP area, some farmers earn M\$24,000 every year

through oil palm and cocoa planting and sheep raising on an experimental basis.

(4) Planted area and production

Paddy statistics of MOA for the period 1985 to 1988 shows that paddy production in the country has stagnated. (See figures below)

	<u>1984/85</u>	<u>1985/86</u>	<u>1986/87</u>	<u>1987/88</u>
Paddy Planted area (1,000 ha)				
Peninsular	465.5	431.0	452.0	474.1
Malaysia	664.7	630.4	644.8	665.8
Paddy Yield (ton/ha)				
Peninsular	2.95	3.26	3.35	3.15
Malaysia	2.87	3.09	3.13	2.98
Paddy Production (1,000 ton)				
Peninsular	1,557.3	1,453.5	1,423.5	1,496.2
Malaysia	1,848.1	1,747.3	1,700.4	1,782.9
Milled Rice Production (1,000 ton)				
Peninsular	1,012.3	944.8	925.3	972.5
Malaysia	1,189.1	1,123.4	1,094.4	1,147.8

With regard to self-sufficiency of rice, Malaysia has imported milled rice mainly from Thailand to cover the balance of rice requirements as shown in Table 9 and is summarized below.

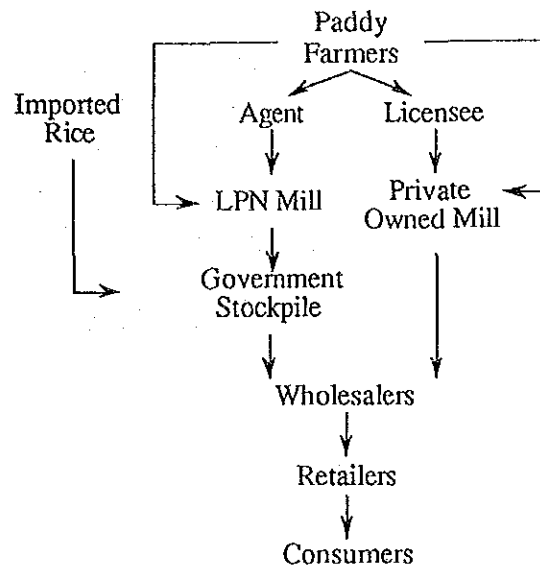
	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1988</u>
Total consumption (1,000 ton)	1,459	1,485	1,673	1,501
Total import (1,000 ton)	144	203	421	290
Per capita annual consumption (kg)	143	108	108	88
Self-sufficient rate (%)	90	89	75	77

(5) Processing and marketing

Paddy processing is undertaken both by commercial mills and the National Paddy Board (LPN). There are 297 commercial mills and

33 LPN complexes. Commercial mills account for 84% of the total rice milling capacity in Peninsular Malaysia.

The marketing of rice in the country has two components, namely local and imported rice as illustrated below:



Paddy is sold to private mills or LPN either directly or through licensed agents. Milled rice is sold to the consumers through wholesaler and retailers.

Imported rice is initially kept as Government stockpile. When required, rice from the stockpile is released and sold to consumers through the same downstream marketing channel. The sole agent for importing rice is LPN in Malaysia.

The domestic prices of rice is controlled by LPN under the Price Control Act. The controlled prices are derived at after taking into account the income of paddy farmers, retailers' milling costs and the welfare of consumers.

(6) Governmental involvement

Various activities of the rice industry are closely monitored and in some cases controlled by the Government as summarized below:

<u>Agencies</u>	<u>Activities</u>
LPN	Pricing, import and storage, and paddy price subsidy scheme
FOA	Paddy farmers cooperative, and fertilizer subsidy scheme
DOA	Agriculture extension
MARDI	Agriculture research
DID	Irrigation and drainage
Agricultural Bank of Malaysia (BPM)	Extension of credit facilities

3.3 Constraints to the Rice Industry

(1) General

Despite the continuous efforts by the Government to increase paddy production and to raise incomes of paddy farmers through the various price support, input subsidy schemes as well as through the massive public investments in irrigation infrastructure, the production of paddy in the country still shows declining trend.

The falling planted areas and productivity in the last decade could also be attributed to the persistent labor shortage as rural youths migrate in large numbers to the urban sector or prefer to take up the higher paid jobs in the oil palm or rubber estate. Among the rural youths, interest in paddy farming has declined over the years due largely to the rapid expansion in employment opportunities and the better incomes and social amenities in the urban sector or even the plantation sector.

Apart from the labor shortage problem, the paddy sub-sector faced problems associated with land market systems which, over the

years, has aggravated the problem of small farm sizes and fragmentation of paddy land resulting from inheritance practices. The small farm sizes are a major constraint to increases in yields and productivity. The reason is that modern planting technology can only be applied to large farms and mechanization cannot be extensively implemented in the paddy sub-sector.

(2) Technical constraints to paddy production

The low remuneration of the paddy industry is a direct result of several critical factors such as small holdings, high production cost and often unstable yield. Major issues on the structure of paddy industry, socio-economic parameters and technical aspects are given as below:

Shortage of farm labor and high cost of labor:

Of the 2.4 million active labor/force in the country, 38% are engaged in agriculture, of which 52% are in the estate sub-sector. The balance is shared among the other sectors. Out of the 336,000 paddy farming families, about 116,000 households are full time paddy growers earning their incomes from paddy production. The labor-intensive system of paddy production needs 60 to 80 man-day/ha but as the wage rate is less than M\$10/day, willing labor is scarce. Due to the availability of higher incomes in the other sectors and a marked preference for jobs in the urban areas, there is a shortage of able-bodied labor in the paddy sub-sector resulting in the age structure becoming progressively older.

Environmental adversity leading to low and unstable paddy output:

Adverse weather conditions such as seasonal floods, flash floods, deep water and drought often restrict normal crop growth and yield. Yield instability and crop failure are frequently experienced. Unproductive and marginal soils also result in low output. Though water resource development projects through the provision of irrigation and drainage systems are extensively undertaken, control over the water regime is often not satisfactory to guarantee a sustained high output.

Low productivity:

Contributory factors are: small holding land size of between 0.9 and 1.2 ha, low or moderate farm yield of less than 4 ton/ha, high cost of production ranging from M\$900/ha to M\$1,400/ha, inefficient production practices, inadequate or absence of institutional assistance and non-optimum utilization of available farm resources.

Inability to adopt advanced labor-saving technology:

The widespread adoption of mechanization and other productive labor-saving production practices are difficult due to the absence or inadequacy of infrastructural facilities, unsystematic lot paralleling and orientation, lack of suitable machinery and absence of an appropriate management system.

Technology transfer-related problems:

When superior alternatives are available, the improper usage of inputs and the failure or inability to adopt superior methods of production give rise to substantial gaps between target yields and practical yields, being 28% to 72% at present.

Plateauing of unit yield potential:

Experimental yield potential derived from the development of new varieties since 1970 up to the present time is only able to yield less than 7.0 ton/ha and this is good only for the replacement of deteriorating varieties.

(3) Problems in financial support for paddy farmers

Paddy sub-sector remains a small contributor to national economy, contributing only 1% to GDP and 4.7% of agricultural value added in 1988. Due to the insufficiency of domestic production, rice importation fills up the balance of domestic demand. In 1988, the rice import bill amounted to M\$207 million and accounted for 5.4% of the total food import bill, 0.5% of the total imports and 0.4% of the export earnings as shown in Table 3.

In spite of the minimal contribution of rice production to GDP and relatively low import cost of rice as shown in Table 10, the

traditional attachment to rice by a substantial portion of the rural households has led the Government to provide direct support to the paddy sub-sector. As shown in Table 11, the estimated cost of direct assistance to the paddy and rice industry amounted to M\$449.6 million in 1988. The average cost of direct subsidy is M\$244/ton for paddy and M\$396/ton for rice. Apart from this direct cost, the Government allocates its expenditure to cover costs for construction and maintenance of irrigation works, subsidies for pesticides and seeds, and assistance to cooperatives in the form of input subsidy. The profits from sales of imported rice at a premium paid by consumers are also not included, which help to finance or subsidize part of LPN's paddy operation.

Nevertheless, the paddy and rice industry has been left behind the success of the oil palm in agriculture and the industrialization programs resulting in increasingly unattractive returns from paddy production. Furthermore, the Government's pricing interventions have not achieved the income and the output goals intended to promote the welfare of the poor paddy smallholders, because the current distribution system of price subsidies to paddy farmers is operated on the quantity base as shown in Table 12. Consequently, paddy production less declined and idle paddy fields has increased, while quality of paddy delivered has deteriorated in terms of moisture and impurity standards.

3.4 Idle Paddy Fields

Since early 1980s, idle paddy fields within irrigation schemes maintained by DID have been increasing year by year. The present situations of idle paddy fields in Malaysia are clarified hereunder based on the inventory surveys undertaken by this Study.

(1) Definition of idle paddy fields

The definition of idle paddy fields according to MOA is as given below.

- Paddy fields which have been alienated permanently in accordance with the National Land Code or given temporarily to individuals or group of people to be cultivated satisfactorily according to the conditions stipulated, but not being cultivated for a period of three years consecutively, have been classified as long term idle paddy fields.
- Paddy fields which have been alienated, whether given full infrastructural facilities or not, but with potential resources for double-cropping, but cultivated for one season only, have been classified as the off-season idle paddy fields.

(2) Statistics on idle paddy fields

According to sources from the MOA, the total area of idle paddy fields in Peninsular Malaysia was 125,255 ha in 1986 as shown in Table 13. This comprise long-term idle paddy fields of 91,203 ha and the off season idle paddy fields of 34,052 ha. Under the 5MP, some rehabilitation works for idle paddy fields have been implemented. The target area of rehabilitation is about 30,000 ha distributing in most states in Peninsular Malaysia as shown in Table 14.

(3) Causes of idle paddy fields

When some problems and constraints against continuing paddy production arise, farmers will leave the paddy fields unused. Various factors either individually or in combination play important roles in causing farmers to abandon their paddy fields. These can be broadly classified into physical, technological, social and economic, and competitive factors. The incidence mechanism of idle land is illustrated in Fig. 2.

The main physical factors that affect the increase in idle paddy fields comprise the following:

Reduction of water resources and increase of floods:

Land development in the upper catchment of schemes causes reduction of available water resources for irrigation during the dry season and increase of flood discharges during the wet season;

Steep and narrow topography:

The topographical conditions of the land make it difficult to introduce intensified paddy cultivation,

Poor soil conditions:

Soil conditions such as peat, acid sulphate and bris soil cause low productivity of paddy; and

Inadequate infrastructure:

Inadequate irrigation and drainage facilities result in low yields. Lack of transportation facilities, or inadequate road network, results in a higher cost of transportation for harvested paddy and farm inputs and increases production costs.

The social and economic factors that affect on the increase of idle paddy fields are as follows:

Shortage of manpower:

Migration of youths to towns causes a shortage of labor to cultivate paddy. The available manpower existed in the rural areas becomes aged and less efficient farmers;

Increased production cost:

The income derived from paddy production is not attractive as compared with the costs of inputs. Paddy farmers are reluctant to use more agriculture inputs or high costs of farm machinery services; and

Land tenure:

Those farmers wishing to continue paddy cultivation often meet with problems of land ownership and lack of cooperation by absentee land owners.

The competitive factors are the expansion on the industrial sector in towns and cities and the provision of better and steady income opportunities. Both these factors cause out-migration of youths from the agricultural sector.

(4) Rehabilitation of idle paddy fields

To improve the wastage of the country's resources by idling of farm lands, the Government embarked on a nation-wide program to rehabilitate idle land since 1986. The task of rehabilitating idle paddy fields was then rested on MOA, which subsequently appointed FOA as a 'lead agency' to spearhead the implementation of the program.

Basically, the idle paddy field rehabilitation program comprises numerous small integrated land development projects. From the early stages of the planning and during the course of implementation, many parties are involved. Each project may be subdivided into various components based on the work requirements. The most important item is the development of infrastructure facilities which will be financed by the Government on subsidy. The infrastructure items include drainage and irrigation facilities, farm roads and bridges.

The tasks of rehabilitating the idle areas involve many agencies. With the guidance of the National Task Force Committee headed by FOA and with members comprising MOA, DOA, MARDI, DID, FAMA, Bank Pertanian Malaysia, FELCRA, MADA and KADA, the rehabilitation programs have been coordinated and implemented smoothly. State Agricultural Committees as well as District Offices have cooperated not only to identify potential areas to be rehabilitated but have also helped to persuade land owners to re-cultivate their land. Idle paddy field rehabilitation program provides the opportunities for land owners to diversify their cultivation. They are allowed to continue cultivating paddy on the rehabilitated land, but are nevertheless encouraged to plant other crops which are marketable at higher prices and providing profitable returns.

3.5 Crop Diversification in Non-granary Areas

(1) Form of crop diversification

The process of agricultural diversification at the farm level is expected to take the following forms:

- Changes in the cropping pattern; year-to-year crop rotation,
- Moving to multiple cropping, which is a sequence of different crops grown on the same piece of land during a given time period, generally a year, and
- Shift from the present type of cropping or farming pattern. This again takes the form of substituting one crop for another or moving to mixed farming involving crop, livestock and fish production.

From the above, the choice of multiple cropping is considered an important form of agricultural diversification, as more intensive use of land is made in a given period of time. This form of agricultural diversification in Malaysia is the least developed and practiced. However, the relative importance of multiple-cropping in Malaysia may increase in the future with reduced availability for arable land, population increase and the need to enhance land utilization. Under the Study, crop diversification is defined as one form of agricultural diversification centering to more intensive use of the existing paddy fields in order to generate remunerative farm income sources.

(2) Need for crop diversification

Given the prevailing problems faced by the paddy farmers, the present strategy is to diversify paddy production in these areas to more lucrative crops in order to increase income. The present rice policy is to encourage planting paddy in those regions with competitive advantage and through production cooperatives using mechanization

and professional management in the large scale irrigation scheme areas. With minimum upgrading in support facilities within the granary areas, the current target of rice self-sufficiency could be achieved. This could also release considerably the other non-granary irrigated areas for the cultivation of other more viable crops such as oil palm, vegetables, and fruits and other economic crops.

Development of irrigation for upland crops has been comparatively slow and the existing irrigation systems have been mostly undertaken by private concerns. High incidences of pests and diseases lower the yield and quality and hence the farmers' income. Marketing is another area of concern as crops such as vegetables are highly perishable and any marketing problem such as lack of transport or ready buyers can result in substantial loss of farm incomes. Extension services to the vegetable farmers are rather inadequate. Only about one-quarter of the vegetable farmers in Peninsular Malaysia received some sort of services from the agencies concerned.

In Malaysia, it is normal practice for alienated agricultural lands to have certain restrictions regarding the crops that can be grown. In all gazetted paddy irrigation schemes, the land titles have stipulations which prohibit the cultivation of crops other than paddy. This is basically to ensure that the large investments in the construction of irrigation facilities are put to effective use through the cultivation of paddy only. In the event that crops other than paddy are to be planted on paddy lands, prior approval has to be obtained from relevant Land Offices. While this restrictive condition has been of benefit in the past, it may now hinder efforts towards diversifications of irrigated rice based systems. Consequently this has made it necessary that such restrictions be reviewed and modified in line with changing situations.

For the future, it is necessary to diversify crops in the non-granary areas as a hedge against market risk and to provide marginal growers with alternatives. The most obvious goal for diversification is through import substitution of food. Malaysia imports some M\$2,800 million of food products annually.

(3) Advanced cases of crop diversification in Melaka

In Melaka, crop diversification programs are undertaken 23 non-granary irrigation schemes as a result of the promotion efforts by the Melaka IADP. Of these, 13 schemes are grown with oil palm, cocoa and banana, while 10 other schemes are partly converted to irrigated high-value upland cropping areas. The major upland crops cultivated are asparagus, melon, chilli, vegetables, guava and star fruits with a total area of 40 ha for the main season and 250 ha for the off season.

Many upland crop farmers prefer private dealers to market their products. In this way, the farmers can concentrate on their farming operation and to increase yield. But, it is necessary to organize growers of a specific crop within the vicinity to control market prices at a profitable level attractive to them.

At present, growers of asparagus and honey melon are able to maintain high selling prices in the market because they provide high quality produce without strong competitors. On the other hand, growers of guava are facing difficulties due to sharp drop of market price in major cities such as Singapore.

Lessons from the Melaka case reveal that the key factor for successful operation of crop diversification depends largely on quality improvement in addition to quantity increase competitiveness and to strengthen price leadership in major markets.

(4) FOA's cases

Under the FOA's idle paddy land rehabilitation program, land owners are allowed to continue cultivating paddy, on rehabilitated land, but they are encouraged to grow other crops which are marketable at higher prices. In addition landowners have willingly agreed to cultivate their land with long-term crops such as oil palm and cocoa.

During the period from 1986 to 1989, oil palm is grown in nine rehabilitated areas of 258 ha, cocoa in 30 areas covering 718 ha, cash crops and vegetables in 12 areas of 187 ha, fish ponds in three areas with a coverage of 133 ha, and other crops in three areas of 214 ha.

To convert idle paddy fields to tree crop areas, the most important factor is water management because of topographic condition. Flooding during the wet months and over drying during the dry months have detrimental effects on the plants, especially during early stage of tree crop growth. Soil improvement work is required prior to planting to reduce the effect of hardened soil and hard pan on good rooting and steady plant growth. Landowners need to be assured of good management if long-term projects such as cocoa and oil palm are to be planted on their idle paddy areas. Financing of infrastructure and loan components are necessary to create further incentives to landowners to diversify their cultivation.

The experiences of the FOs in Negeri Sembilan and Perak show that the non-granary irrigated areas can be turned into viable cocoa and oil palm smallholding plantations. With the agreement of the landowners to cooperate with the FOs to manage their land as mini-estates/estates, more areas can be developed under the package deal of the idle paddy land rehabilitation program.

(5) FELCRA's case in Negeri Sembilan

Throughout Peninsular Malaysia, FELCRA has carried out many rehabilitation of idle land (See Tables 15 and 16). All projects extend over ex-paddy fields with physical problems caused by flooding and unsuitable soils. The target crops are oil palm and cocoa both of which can be expected to give farmers favourable incomes, but short-term crops are taken into consideration.

In Negeri Sembilan, FELCRA has successfully developed 180 projects. Among them, are Gugusan Sendayan in the Port Dickson District (882 ha where oil palm and mixed crops have been planted),

and Gugusan Durian Daun in the Rembau District (602 ha where oil palm and rubber have been planted).

The model used by FELCRA to develop idle land schemes seems to be the most appropriate as it has met the following criteria.

- Optimum land utilization and reasonable economic returns for the farmers: In FELCRA projects farmers surrender their land to FELCRA to decide on the type of crop to be planted for the development of the land for a certain period of time. In return for the use of the farmers' land, farmers are given a number of shares in the proposed project in proportion to the size of their land. In addition farmers are entitled to receive dividends from FELCRA derived from profits of the project.
- Farmer participation and employment opportunity: Farmers are employed in the projects to provide the labor force and they are paid normal wages for their labor.
- Apart from turning the unutilized land into productive sources of income, the FELCRA projects also provide labor employment opportunities for the farmers. Therefore, farmers participating in the projects have two sources of income. Firstly they receive wages for their labor and secondly they also received dividends from the profits derived from the project.
- Although FELCRA can be considered an appropriate agency to handle the problem of idle land, it is unlikely that it will be able to rehabilitate all the idle land in the non-granary irrigation schemes because of many factors such as manpower shortage and dispersion of schemes.

4. PRESENT CONDITION OF NON-GRANARY IRRIGATION SCHEMES

4.1 General

The information and data on irrigation schemes maintained by DID have been collected based on a certain format since 1960s. These information are available in DID's annual report, DID's files and databases established in 1988. For the Study, however, it is necessary to conduct the Inventory Survey as a resource survey in order to reveal the present conditions of each scheme, problems to be solved, farmers' socio-economic status and their opinions towards crop diversification, and specific issues.

The Inventory Survey under the Study can broadly be classified into two types as follows:

- a) Scheme Inventory Survey on all non-granary irrigation schemes involving data collection on irrigation and drainage infrastructural facilities, crop growing conditions and agricultural supporting services; and
- b) Socio-economic Sample Survey comprising collection of information on paddy farm households such as socio-economic status, farm operation, farm economy, farmers' opinions on operation and maintenance of the irrigation facilities as well as crop diversification.

The number of non-granary irrigation schemes in Malaysia is currently 924 in total. Its distribution according to site is shown below.

<u>State</u>	<u>Nos. of Scheme</u>	<u>State</u>	<u>Nos. of Scheme</u>
Perlis	22	Johor	23
Kedah	75	Pahang	290
P. Pinang	14	Trengganu	39
Perak	63	Kelantan	77
Selangor	17	Sabah	56
N. Sembilan	156	Sarawak	38
Melaka	54	<u>Total</u>	<u>924</u>

4.2 Scheme Inventory Survey

4.2.1 Survey method

This is a scheme-by-scheme data collection program directed towards scheme information that is readily available and that could be collected by the government staff. For this purpose, a questionnaire form was designed by the Study Team and subsequently distributed to all DID State Offices for their actions. Since the information requested in the questionnaire cover a variety of issues and involving many agricultural agencies concerned, a State Coordinator was appointed amongst the staff of each State DID to coordinate and to oversee collection and to verify data.

The main items listed in the questionnaire are as follows:

- Location / Water resources, hydrology and climate, / Soils and land use / Land tenure systems / Irrigation and drainage facilities, / Access roads / Investment costs / Post-harvest and marketing facilities / Farm operation, crops grown, farming practices and beneficiaries / Agricultural support services / Crop production costs and farm management conditions / On-going rural and agricultural development projects / Socio-economic background.

4.2.2 Data arrangement

All the information collected through the Scheme Inventory Survey are arranged and compiled into a database of micro-computer according to the following 10 parameters.

Quantity and quality of land resources / Land tenure / Land utilization ratio / Land productivity / Irrigation area and water resources availability / Function of irrigation and drainage facilities / Operation and maintenance of irrigation and drainage facilities / Farmers' association and group farming / Production and marketing support services / Labor productivity.

4.2.3 Results of Scheme Inventory Survey

All the results of the Scheme Inventory Survey are presented in detail in Volume 2, Appendix A. The following paragraphs give an overview of the non-granary irrigation schemes.

(1) Number and irrigable area

The number of non-granary irrigation schemes under the maintenance of DID is 924. The distribution of non-granary irrigation schemes by State is as follows (see Fig. 3):

State	Nos. of Scheme	Irrigable Area (ha)	Scheme Size in State (ha)		
			Average	Maximum	Minimum
Perlis	22	4,215	192	490	25
Kedah	75	17,133	228	2,149	23
P. Pinang	14	3,541	253	1,328	18
Perak	63	12,722	202	2,309	10
Selangor	17	939	55	160	11
N. Sembilan	156	10,934	70	601	10
Melaka	54	7,149	132	814	12
Johor	23	4,010	174	1,474	22
Pahang	290	17,430	60	1,038	3
Trengganu	39	9,083	233	2,024	17
Kelantan	77	10,667	139	1,487	9
Sabah	56	17,163	306	2,079	15
Sarawak	38	15,136	398	3,052	71
<u>Total</u>	<u>924</u>	<u>130,122</u>	<u>141</u>		

(2) Irrigation water intake facilities

Generally the non-granary irrigation schemes in Malaysia are characterized by simple irrigation and drainage facilities, consisting mainly of run-of-river type intakes, main and secondary canals, and a system of gravity drainage. The distribution of schemes by type of water intake structure is summarized below (see Table 17 and Fig. 4).

Gravity	494	Pump	153
Gravity/Pump	21	Control drainage	49
Gravity/Control drainage	1	Inundation	187
Pump/Inundation	2	Others	3
No record	5	Converted	9

Generally irrigation water intake facilities were constructed on the basis of DID's design criteria. The design capacities of these intake facilities are usually enough to divert water required downstream. In some river basins, however, the clearance of natural forest in catchment areas causes water shortage problems through reduction of available base flows during dry months.

(3) Water availability

Based on the data collected by the Scheme Inventory Survey and by the information supplemented by previous records and reports, the availability of water resources by scheme is evaluated. As shown in Table 18 and Fig. 4, 436 schemes have sufficient irrigation water for double cropping of paddy, 164 schemes faced water shortage during the presaturation period for the off-season paddy, 217 schemes limited to single cropping of paddy in the main season, and 13 schemes with insufficient irrigation water even for the main season paddy cultivation.

(4) Land utilization

In the States of Perlis, Kedah, Kelantan and Sabah, most farmers of non-granary irrigation schemes still rely their main income sources on paddy cultivation, and the main season cropping intensity is maintained at a level of 80% for 230 non-granary irrigation schemes. Trend of planted area of paddy and upland crops by state from 1983 to 1987 is shown in Fig. 5 and 6, respectively.

In the States of Pulau Pinang, Perak, Selangor, Negeri Sembilan, Melaka and Johor, the main season cropping intensity has been reduced to 47% on an average. In the States of Pahang, Trengganu and Sarawak, the main season cropping intensity is as low as 32%.

A total of nine schemes covering 295 ha have been completely converted to permanent tree crop cultivation through FOA's idle paddy land rehabilitation program and involving of FELCRA. The State-by-State comparison of the present land utilization in the non-granary irrigated areas is shown below.

State	No. of Schemes	Main Season			Fully Converted	Fully Idle
		Planted 100%	Planted over 50%	Planted below 50%		
Perlis	22	7	15	0	0	0
Kedah	75	21	39	3	0	12
P. Pinang	14	3	6	5	0	0
Perak	63	7	26	15	0	15
Selangor	17	0	6	5	0	6
N. Sembilan	156	2	22	83	6	43
Melaka	54	4	17	23	2	8
Johor	23	1	9	8	0	5
Pahang	290	1	28	65	1	195
Trengganu	39	7	21	6	0	5
Kelantan	77	7	57	8	0	5
Sabah	56	11	29	8	0	8
Sarawak	38	0	14	21	0	3
<u>Total</u>	<u>924</u>	<u>79</u>	<u>281</u>	<u>250</u>	<u>9</u>	<u>305</u>

Generally, the extent of idle paddy fields in the non-granary irrigated areas is more severe in schemes which depend their water sources on minor rivers and from small catchments as well as in

inundation and controlled drainage schemes. Long duration idle land for more than three years occurs in 305 schemes covering an area of 18,000 ha. In addition, 250 schemes of 40,000 ha have land utilization in the main season of less than 50%.

(5) Scheme management

Implementation and management works of the engineering component in the granary areas are handled by DID, under the Project Director of IADP and under the overall policy direction of MOA. In case of the non-granary irrigation schemes, operation and maintenance works are carried out by DID and budgets are provided by the Government.

4.2.4 Information storage and retrieval system

Data collection and information retrieval are an essential component of this Study. All the information collected through the Inventory Survey are checked and verified. To facilitate processing and quick retrieval of data, an IBM compatible micro-computer is used. The information is stored using a standard database management software. Two database files namely "S-Info" and "S-Area" were created.

The database "S-Info" file contains 102 different types of information mainly related to physical background and details of schemes while the "S-Area" file consists of data which require frequent updating and editing, and contains 97 items of information on factors such as annual land use and crop production.

To facilitate ease of operation of database as well as retrieval of relevant information for decision making, 52 programs have been prepared by the Study Team. These programs currently in operation are user-friendly, easy to use, and allow quick retrieval of frequently used information. In addition, information can also be retrieved according to predetermined combinations.

This information storage and retrieval system are vital to the Study considering the vast amount of data involved and the cross analysis of information that are required in the evaluation process of potential for crop diversification. Apart from the use for the Study itself, the system when updated periodically can be used in monitoring the performance of all irrigated schemes. The list of information that can be readily retrieved through the prepared customised programs is shown in Volume 4, Manual for Information Management System.

4.3 Socio-economic Sample Survey

4.3.1 Survey method

Face-to-face interview method was adopted aiming at collection of data on socio-cultural and agro-economic situation of paddy farm households in non-granary irrigated areas. Special attention was paid to clarify the behavior of paddy farmers and to grasp views of local community opinion leaders in relation to idle paddy fields. To do so, questionnaires were designed by the Study Team through a series of discussions with MOA and a trial operation at the field level with the local Consultant's staff that has been appointed to carry out the survey.

Sample paddy farmers were selected in 674 non-granary irrigation schemes. While, local community opinion leaders were sampled in all non-granary irrigation schemes including the 250 completely idle schemes. In the non-granary irrigation schemes surveyed, two to 28 respondent paddy farmers and one to two opinion leaders were selected according to a size of each scheme. They were interviewed by Malay speaking enumerators of the local Consultant using the questionnaires. The number of sample paddy farmers and opinion leaders by State are shown below:

<u>State</u>	<u>Paddy Farmers</u>	<u>Opinion Leaders</u>	<u>Total (nos)</u>
Perlis	242	40	282
Kedah	654	115	769
P. Pinang	100	31	131
Perak	373	91	464
Selangor	40	20	60
N. Sembilan	504	200	704
Melaka	311	116	427
Johor	152	33	185
Pahang	631	321	952
Trengganu	305	65	370
Kelantan	597	125	722
Sabah	499	79	578
Sarawak	320	73	393
<u>Total</u>	<u>4,728</u>	<u>1,309</u>	<u>6,037</u>

The main items of information collected from paddy farmers and opinion leaders are shown below.

- Personal particulars
- Living conditions
- Background of household members
- Intention towards future farming practices
- Land situation
- Irrigation and drainage condition
- Crop cultivation
- Mechanization
- Farmers' organization
- Idle land and crop conversion
- Required conditions for crop diversification
- Farmers' needs and expectation

4.3.2 Data arrangement

Information on individual paddy farm households obtained through the Socio-economic Sample Survey is arranged according to the following 56 parameters.

- General profile:
civil status / age distribution / number of household members including head of household / education level / religion / ethnic origin / language in daily life;
- Living circumstances:
major farm income sources / annual income from major crops / side incomes from other sources than major crops / reasons for engaging in side jobs / annual side income from other sources / total annual revenue of farm households / lighting condition / condition of domestic water / household items / participation in farmers' organization / participation in rural community / names of mutual aid system / works activities in which mutual aid system still remain;
- Farming conditions:
land tenure status / size of total farm land / total cultivated area / total planted paddy area / total cultivated area for double cropping of paddy / total cultivated area for two cropping / number of farm lots / number of paddy cultivation per year / existence of irrigation facility for paddy fields / irrigation water supply quantity / inundation period after normal flooding / inundation period after heavy rainfall / irrigation facility condition / drainage control facility condition / use of farm machinery / types of owned farm machinery / ownership status of tractor / kind of draft animal used for farming / full utilization of paddy fields / reasons of existence of idle paddy fields / present condition of converted paddy fields / problems and difficulties encountered in farming practices; and
- Farmers' requirements and intentions:
hope for succession of farm operation / number of candidate successors / status of candidate successors / future mode of farm operation / intention of continuing farm operation / utilization plan of idle lands / intentions to convert or further utilize paddy fields / activities expected to participate or expand in future / requirements for irrigation / requirements for drainage requirements or farm road / requirements for other facilities / expected beneficial effects by growing other crops in paddy fields / major concerns about introducing other crops in paddy fields / suggestions and opinions on rationalization and crop diversification.

Information obtained from opinion leaders in rural community is arranged according to the following 28 parameters.

- Profile of opinion leaders:

income sources / age distribution / educational level / land tenure status / size of total farm land / size of total paddy fields / hope for succession of farm operation by household members / number of candidate successors / future mode of farm operation / influence to change behaviour of paddy farmers; and

- Opinion leaders' views:

opinion leaders perception about DID works / condition of irrigation facilities / condition of drainage control facilities / rating of DID's operation and management works of irrigation and drainage facilities / understanding about how farmers utilize irrigated paddy fields / occurrence of idle paddy fields / intentions to increase idle paddy fields / reasons of existence of idle paddy fields / present condition of converted paddy fields / utilization plan of idle paddy fields / initiative taken for preparation of conversion plan / farmers' intentions towards irrigated paddy cultivation / intentions to convert or further utilize paddy fields / expectations for drainage facilities / expectations for farm roads / expectations for other related facilities / expected beneficial effects by growing other crops than paddy / concerns about introducing other crops than paddy / suggestions and opinions on rationalization and crop diversification.

4.3.3 Results of socio-economic sample survey

The results of the Socio-economic Sample Survey are described in detail in Volume 2, Appendix B. The highlights are presented hereunder.

(1) Overview of sample farmers

More than 75% of 4,728 of respondent farmers are over 46 years old. Young farmers aged 18 to 25 years and 26 to 35 years account for only 1% and 9% of the total, respectively. The majority of young

people dislike farming. Hence, the age of farmers may well explain the reason of the idle land phenomenon. Out of the respondent farmers, 73% are own-operators, while 19% are pure tenants and only 6% are classified as owner-tenants. As regards the present land use, farmers who carry out double-cropping of paddy account for 31%, while 28% of the respondents answer that they will not plant paddy anymore.

In Malaysia, land is used to be bequeathed in smaller parcel according to Islamic custom of inheritance. The results in general show the preponderance of small uneconomic farm holdings, with 24% of the active farmers cultivating less than 0.8 ha. Without other sources of income than paddy, it is hard to survive with less than 0.8 ha of paddy land. Generally, the income of farm household consists of earnings from farming as the main occupation, part-time occupation and other sources, especially contributions from working children. Taking M\$4,800 a year as the nation's poverty income line, the results of the Socio-economic Sample Survey show that over half of the households are below the poverty income level.

(2) Notable requirements and intentions of sample farmers

Paddy farmers' responses are summarized below in respect to the present condition of irrigation and drainage facilities.

<u>Item</u>	<u>No. of Responses (%)</u>
a. Irrigation facilities	
- Well maintained	2,300 (66)
- Structures damaged	447 (13)
- Canal broken	348 (10)
- Canal silting	247 (7)
- Others	163 (4)
<u>Total</u> (No. of respondents: 3,309)	<u>3,505</u>
b. Drainage control facilities	
- Well maintained	2,055 (69)
- Canal silting	487 (16)
- Stop log/gate broken	266 (9)
- Others	170 (6)
<u>Total</u> (No. of respondents: 2,954)	<u>2,978</u>

The type of problems or difficulties in farming practices is reported by 4,728 respondent farmers as below.

<u>Problems & Difficulties</u>	<u>No. of Responses(%)</u>	
a. Inefficient irrigation facility	565	(5)
b. Insufficient water supply	2,060	(18)
c. Poor drainage	768	(7)
d. Lack of funds	1,182	(10)
e. Lack of labor force	1,181	(10)
f. Difficult marketing	305	(3)
g. Natural disaster	1,245	(11)
h. Frequent pest and diseases	3,530	(31)
i. Others	293	(3)
j. None	229	(2)
<u>Total (No. of Respondents: 4,728)</u>	<u>11,358</u>	

Among 4,728 respondent farmers, 72% have currently fully utilized their paddy fields. While 28% answered "not fully used" giving the following reasons.

<u>Reasons</u>	<u>No. of Responses(%)</u>	
a. Shortage of manpower	723	(34)
b. Low profitability of paddy cultivation	129	(6)
c. Lack of drainage facilities	199	(9)
d. Insufficient water supply	547	(27)
e. Damage of rats, birds and/or insects	157	(7)
f. Others	364	(17)
<u>Total (No. of Respondents: 1,217)</u>	<u>2,119</u>	

A total of 143 sample farmers among 4,728 respondents have already converted their paddy fields to other crops. Among 152 responses to the question regarding the present condition of converted paddy fields, 60% indicate "no problems" and the rest show such constraints as low level of farming technique, insufficient irrigation water supply, poor drainage condition and poor access to farm lots.

To the question whether or not they have intention to convert paddy cultivation to other crops, 45% answer in the negative. Only

15% are willing to introduce other crops to their paddy fields. Those who give replies either "willing" or "no intention" point out the following problems and difficulties:

<u>Problem and Difficulty</u>	<u>No. of Responses (%)</u>		
	<u>Reply "No Intention"</u>	<u>Reply "Expected"</u>	<u>Reply "No Plan"</u>
Poor facilities	1,063 (26)	367 (27)	957 (27)
Lack of fund/machinery	589 (14)	149 (11)	489 (14)
Labor shortage	482 (12)	229 (17)	430 (12)
Marketing difficulty	104 (3)	33 (2)	161 (4)
Pest/disease/disaster	1,733 (41)	489 (38)	1,378 (39)
Others	74 (2)	29 (2)	64 (2)
None	94 (2)	39 (3)	89 (2)
<u>Total</u>	<u>4,144</u>	<u>1,335</u>	<u>3,568</u>

As a background of the above conservative attitude, it seems that the farmers are feeling too old to work and to be trained for learning new technology, or they have other jobs.

For those who agree with crop diversification, the crops in order of preference are: cocoa, banana, maize, durian, rambutan, vegetables, oil palm and other miscellaneous crops. It appears that farmers prefer the crops which require relatively of less manpower and low perishability.

The following gives an indication of farmers' expectation on beneficial effects by growing other crops.

<u>Expected Effects</u>	<u>No. of Responses (%)</u>
a. Income increase	3,076 (48)
b. Stable revenue	823 (13)
c. Creation of employment opportunity	404 (6)
d. Leveling up of living standard	876 (14)
e. Nothing special	1,180 (19)
f. Others	37 (0)
<u>Total (No. of Respondents: 4,728)</u>	<u>6,396</u>

On the question of constraints to introduce other crops in paddy fields, 55% of the respondents indicate that "finance" is a leading

problem in the farm operations. Secondly, 33% perceive undeveloped marketing system to be a problem, followed by labor shortage of 30% and low level of technique of 24%. Table 19 shows major concerns of respondent farmers by State.

Farmers' opinions on crop diversification indicate the following trend. The details by State are shown in Table 20.

<u>Opinions</u>	<u>No. of Responses (%)</u>	
a. Increase Government help for more crop harvest	713	(10)
b. Supply agricultural input	584	(8)
c. Conduct survey to identify suitable crop	552	(8)
d. Good irrigation water supply	471	(7)
e. Paddy field not suitable for other crop cultivation	407	(6)
f. Others	3,312	(47)
g. No opinion	1,002	(14)
<u>Total (No. of Respondents: 4,728)</u>	<u>7,041</u>	

(3) Views of local opinion leaders

With regards to promotion of crop diversification towards paddy farmers, the influence of opinion leaders in the rural communities is summarized below.

<u>Influence</u>	<u>No. of Responses (%)</u>	
a. Possible	755	(58)
b. Limitedly possible	226	(17)
c. Impossible	306	(23)
d. No comment	22	(2)
<u>Total</u>	<u>1,309</u>	<u>(100)</u>

To the question whether opinion leaders know that DID has constructed the irrigation and drainage facilities and is maintaining these in their areas, 66% of them say "yes and well known", followed by 27% for "yes but not in detail" and 7% for "no". With regard to the conditions of irrigation and drainage facilities, the percentages of those who answer "well maintained" are 48% for irrigation and 43% for drainage. Compared with the answers of paddy farmers for the same

questions both accounting for 70%, opinion leaders' understandings are generally more severe.

As regards to the understanding of opinion leaders on how paddy farmers utilize irrigated paddy fields, 67% of the opinion leaders say that paddy farmers are fully or partly engaged in paddy cultivation, while 33% answered "stopped paddy cultivation and already converted to other crop" or "abandoned and left as idle land".

With regard to paddy farmers' intentions towards irrigated paddy cultivation in the future, 55% of opinion leaders consider that paddy farmers will continue their paddy cultivation, while 17% and 21% reply that they will stop it sooner or later and diversify it, respectively.

Opinion leaders expect beneficial effects by growing other crops in paddy fields as follows.

<u>Effects</u>	<u>Proportion (%)</u>
a. Income increase	44
b. Stable revenue	19
c. Leveling up of living standard	17
d. Creation of employment opportunity	12
e. Nothing special	8
<u>Total</u>	<u>100</u>

To the question regarding problems to introduce crop diversification in the paddy fields, 27% of the total responses mention "finance" followed by labor of 21%, marketing of 20% and technique of 15%.

Regarding the occurrence of idle paddy fields, 70% of opinion leaders answer "yes, knowing it". 88% consider that it is wrong to increase the idle paddy fields in their areas. As reasons for existence of the idle paddy fields, 566 opinion leaders give their replies. The whole point out shortage of manpower as the main reason. Further, half of them indicate insufficient water supply or lack of irrigation facilities. Other major reasons are lack of drainage facilities/flood, low

profitability of paddy cultivation, land not suitable for growing paddy, and rat, pest, bird, insect and disease problems.

To the question whether opinion leaders have any plan to utilize idle land, the majority of the responses is for the conversion to tree crop as summarized below.

<u>Plan</u>	<u>No. of Responses (%)</u>	
a. Conversion to tree crop	318	(34)
b. Conversion to non-farm land	26	(3)
c. Conversion to upland crop	45	(5)
d. Conversion to fish culture pond	61	(6)
e. Others	199	(21)
f. No plan	291	(31)
<u>Total (No. of Respondents: 917)</u>	<u>940</u>	

5. EVALUATION OF CROP DIVERSIFICATION POTENTIAL FOR NON-GRANARY IRRIGATION SCHEMES

5.1 Basic Concept

(1) Need for crop diversification potential evaluation

The problems confronting paddy cultivation are the declining number of paddy farm households, increase of aged farmers, uneconomical holding size and low income levels. As a counter-measure to overcome such problems paddy cultivation sub-sector should be attractive to paddy farmers in addition to having independent farm management with less Government subsidiary inputs.

To prepare crop diversification options for the revitalization of the non-granary irrigation schemes, the potential for crop diversification in each scheme area has to be evaluated and then indicated as options for diversification. Such procedure is called "categorization" and its outcome will provide indications on crop diversification patterns and a basis for formulating development plans and programs.

(2) Factors used in potential evaluation process

In the categorization process, each non-granary irrigation scheme is subjected to a screening process on a variety of factors. These factors are;

- Water resources availability;
- Farmers' intention towards continuation of paddy cultivation and introduction of crop diversification;
- Land suitability for carrying out direct seeding and mechanized plowing and harvesting for growing paddy;

- Soil and climatic suitability and limitations for cultivation of specific crops;
- Crop profitability;
- Crop marketability; and
- Investment performance with regard to crop diversification.

5.2 Category

Based on the results of the Inventory Survey, 924 non-granary irrigation schemes can be broadly classified into four groups: namely, paddy cultivation area, crop diversification area, idle land and non-agricultural land. In deciding options for crop diversification, it is apparent that there are various possibilities of diversifying land utilization such as double cropping of paddy, combination of paddy for the main season and short-term annual crops for the off-season, irrigated annual cash cropping, perennial tree crop cultivation, freshwater fish pond culture and cattle raising. A total of eight categories has been set up for the purpose of evaluating crop diversification potential for 924 non-granary irrigation schemes. These eight categories are as follows:

- Category 1 : Schemes to be converted to high value crop cultivation under irrigated condition;
- Category 2 : Schemes to be converted to tree crop cultivation;
- Category 3 : Schemes to introduce two-cropping system planting paddy during the main season and short-term annual crops during the off-season;
- Category 4 : Schemes to be converted to animal feeding crop cultivation or cattle raising fields;
- Category 5 : Schemes to be converted to freshwater fish culture ponds;
- Category 6 : Schemes to be positively maintained as mini-granary areas conducting double cropping of paddy;

- Category 7 : Schemes to be maintained as paddy cultivation areas within a definite period of time for social welfare purposes and thereafter to be further diversified; and
- Category 8 : Schemes to be converted to housing/industrial other non-agricultural uses.

5.3 Criteria and Procedure of Potential Evaluation

(1) General

The potential for crop diversification of each non-granary irrigation scheme is evaluated category by category based on the seven stepwise procedure as illustrated in Fig. 7.

- Step 1 Evaluation of water resources availability;
- Step 2 Evaluation of farmers' intention towards continuation of paddy cultivation and introduction of crop diversification;
- Step 3 Evaluation of land suitability for performing direct seeding and mechanized plowing and harvesting for growing paddy
- Step 4 Evaluation of soil suitability and limitations for the cultivation of specific crops;
- Step 5 Evaluation of crop profitability;
- Step 6 Evaluation of crop marketability; and
- Step 7 Evaluation of investment performance with regard to crop diversification.

Inevitably, crop diversification involves the question of which crop or crops to be recommended based on a variety of factors. In order to facilitate evaluation of the potential for crop diversification, a series of criteria is established for each of the factors. Based on these criteria, the respective non-granary irrigation schemes are examined in terms of the seven factors to identify potential crops for crop diversification. The stepwise procedure is developed in screening potential of each category as illustrated in Fig. 4.

The established criteria and procedure for evaluation of crop diversification potential is elaborated in Volume 2 of this Report. The main points are summarized below.

(2) Criteria for Categorization

Water source availability is reconfirmed in quantitative and qualitative terms by referring to the data obtained in of the Scheme Inventory Survey and supplemental investigations under the Study. Based on this reconfirmation, criteria for judging water resources availability are expressed in the following four conditions:

- Sufficient water resources for growing paddy twice a year;
- Sufficient water resources for meeting normal irrigation water demand but not enough to cover presaturation water requirement for the off-season;
- Limited water resources to supply irrigation water only for the main season; and
- Insufficient for the main season paddy cultivation.

Farmers' intention towards the continuation of paddy cultivation and introduction of crop diversification is evaluated based on information from the Socio-economic Sample Survey. Through examination of their intention towards continuation of paddy cultivation, the criteria to evaluate potential of intensive paddy cultivation are as follows:

- Possible for promoting double cropping of paddy in case when the proportion of intending farmers against the total samples in each State is over 50%. Also, possible for promoting double cropping of paddy if the scheme planted area for the last three years is more than 50% every year; and
- Impossible for promoting double cropping of paddy when the above proportions on the State and scheme-by-scheme bases are less than 50%.

Land suitability for mechanized farming practices is expressed as suitable or not suitable. Land suitability affected by the existence of soft-layer soils such as peat and organic soils. Criteria are basically applied to the Category 6. Basic data prepared by DOA is referred to.

Soil and agro-climatic conditions are very important factors to identify suitable crops for the respective non-granary irrigation schemes. Through assessment of soil-crop-suitability correlation, suitable crops are first identified and then checked for agro-climatic suitability. Data on soils and agro-climatic suitability are obtained from DOA and MARDI respectively. Criteria are set up based on limitations to crop growth as below:

- Suitable for growing a specific crop;
- Marginally suitable for crop growth with one limitation which can be upgraded by physical means;
- Very marginally suitable for crop growth with one limitation which is physically hard to be improved; and
- Not suitable.

Crop profitability is determined by comparing net farm incomes obtained from the main season paddy and other specific crops. Crop budget data collected from MOA and DOA are utilized. Criteria are expressed in the following terms;

- Suitable for diversified cropping when crop has higher profitability as compared with net income of the main season paddy; and
- Unsuitable for in diversified cropping because the net income is smaller than that derived from single cropping of paddy.

Crop marketability is another important factor when considering crop diversification programs. The criteria is based on demand and supply balance in local markets. It is expressed in two forms as follows:

- Suitable for promoting crop diversification from the marketing viewpoint if the marketable volume of a particular crop is below the demand in local markets; and
- Unsuitable for crop diversification when the marketable quantity exceeds over twice the local demand in an administrative district.

(3) Procedure

The flow chart showing the procedure of evaluation for crop diversification potential by Category is illustrated in Figs. 7 and 8. Screening of factors is made in the same manner from Step 1 to Step 7 for Categories 1 to 5 to evaluate potential for crop diversification under each Category, while different process is taken for Categories 6 to 8. The following paragraphs describes the basis and the assumptions used in evaluating potential for crop diversification.

- Category 1:

The extent of high-value upland crop cultivation is dependant on availability of water resources as in Step 1. In this connection, intensive cropping pattern for short-term upland crops for three times a year can be taken into account if water resources are available all year round. Double cropping of upland crops is possible for schemes where available water resources are limited to the main season. Even if the water resources are not enough for the main season paddy cropping, irrigated cropping of upland crops can be expected at least once a year. As upland crop is sensitive to water stress, their cultivation is not suitable for schemes where soils are featured by poorly drained condition and where flooding and submerging constraints are common. In this regard, controlled drainage and inundation schemes are not suitable for intensive cultivation of upland crops throughout the year. Through examination of profitability and marketability of crops selected in Step 4, recommendable crops are screened out for promoting crop diversification by means of high value short-term crop cultivation under irrigated condition. In Step 7, the average construction costs

are assumed to be M\$4,300/ha for schemes with moderately drainage limitation to crop growth and M\$8,600/ha for schemes having marginally to very marginally drainage problem.

- Category 2:

Suitable crops are identified through assessment of soil-crop-suitability correlation in Step 4. To evaluate profitability in Step 5 and investment performance in Step 7, annualized gross income and production cost are estimated. The cost required for upgrading drainage and farm access conditions is assumed to be the same as Category 1. Optional adjustment for further confirmation of potential fruit and tree crops is made as taking into account regional agro-climatic condition.

- Category 3:

As the schemes are irrigated areas it is assumed that water is adequate during the main season. The average paddy yield is assumed to increase from 2.25 ton/ha to 3.5 ton/ha through improvement of farming practices and on-farm level irrigation water distribution. Suitable short-term upland crops for the off-season are selected through evaluation of factors in Step 4 to 6. In Step 7, assumed investment cost is M\$4,000/ha.

- Category 4:

Irrigation water supply is not considered in Step 1. Soils with excessively drained feature are evaluated as possible for converting paddy fields to animal grazing land in Step 4. Profitability is evaluated based on the contribution of both grazing and feeding practices to beef meat production. In Step 7, additional investment cost is assumed to be M\$4,300/ha for growing animal feeding crops under improved drainage condition.

- Category 5:

In Step 1, availability of freshwater with sufficient quantity throughout the year is the most important check for identifying the potential for freshwater fish pond culture. In Step 4, important factors to be considered are heavy textured soils and flood-free

condition. For Sarawak, the possibility of introducing brackish water prawn culture can be considered in controlled drainage schemes which are located in coastal swamps. In Step 7, the required cost for excavating fish pond is assumed to be M\$15,000/ha referring to the Melaka IADP's experiences.

- Category 6:

The minimum requirement is the availability of water resources for paddy cultivation of both seasons in Step 1, and farmers' intention towards continuation of paddy cultivation and annual planted area over 50% in Step 2. The existence of problem soils such as peat and organic soils are the factor to be examined for practicing mechanized farming in Step 3. The average paddy yield is assumed to increase from 2.25 ton/ha to 3.5 ton/ha for each season. Required cost is assumed to be M\$4,300/ha to upgrade on-farm irrigation and drainage facilities. Optional adjustment is made based on scheme size of more than 100 ha.

- Category 7:

In Step 1, available water resources have to be adequate for main season paddy cultivation. Aged farmers grow paddy but have no successor and intention to improve their farming activities. This situation can be expressed by the existence of a scheme with a size of more than 100 ha and planted with paddy in less than the half of its irrigable area continuously for three years. In Step 2, special consideration is given to this evaluation.

- Category 8:

Schemes are considered for Category 8 if they have been left idle more than three years and have no sufficient water resources for the main season paddy cultivation in Step 1 and no suitable crops identified in Step 4.