5.4 Results of Potential Evaluation for Crop Diversification

The potential of crop diversification in non-granary irrigated area is evaluated category by category. As a result, one or more potential categories are identified. If a scheme has only one potential category, priority is automatically given to this category. In the case that two or more potential categories are possible, the priority category is determined by comparing the economic viability of each category. The category given the first priority is called "super category", while the categories with lower priorities are defined as "potential category".

Table 21 present the distribution of schemes based on the super category. Tables 22 to 24 give that on potential categories. The results of the categorization process are compiled in Volume 2.

A state by state report on the results of potential evaluation is as follows:

(1) Perlis

There are 22 non-granary irrigation schemes in the State with a total area of 4,215 ha. In the State of Perlis, paddy cultivation has traditionally been carried out especially in the main season. Full paddy cultivation for the main season is being undertaken for all 22 non-granary irrigation schemes. However, during the off-season, no paddy is cultivated due to water resource limitations. Generally farmers in the State derive their farm income from paddy cultivation. They are also generally in favour of continuing paddy cultivation. The results of the potential evaluation are as follows:

Category	Super category	Possible categories		
		2nd priority	3rd priority	4th priority
1	3	9	3	5
2	2	10	7	1
3	5	5	3	4
4	-	-	-	-
5	-	-	-	-
6	11	-	-	-
7	1	3	7	-
8	-	-	-	-

(2) Kedah

There are 76 irrigation schemes in the State comprising 75 non-granary irrigation schemes with a total area of 17,123 ha and one granary scheme namely MADA of 13,000 ha. For the non-granary areas the overall paddy planted intensity is about 50% for the State of Kedah. Of the 75 irrigation schemes located in the State, 44 schemes are found to have adequate water resource throughout the year. However in recent years water resource especially in the Lower Muda River Basin has become less and less available to agricultural sector to the increase in the water use for new household and industrial activities. In this respect, there is a need to examine and rationalize future irrigation water demand for the irrigation schemes in accordance to the recommendations of the crop diversification programs. The results of the potential evaluation for Kedah State are as follows:

Category	Super category	Possible categories		
		2nd priority	3rd priority	4th priority
1	4	12	-	14
2	21	37	8	1
3	9	3	-	13
4	-	-	-	-
5	-	1	9	-
6	11	-	-	-
7	30	13	9	-
8	-	-	-	-

(3) Pulau Pinang

There are 15 irrigation schemes in the State comprising 14 non-granary schemes with a total area of 3,541 ha and one granary scheme namely Balik Pulau/Seberang Perai of 13,000 ha. To ensure successful implementation of the crop diversification programs, the current water shortage problem in the Muda river basin requires an action plan to be formulated on water sharing among various water users and to ensure adequate water resources being allocated for crop diversification. The results of the potential evaluation for Pulau Pinang State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	6	-	-	5
2	-	11	-	-
3	5	6	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	3	-	6	-
8	-	-	-	-

(4) Perak

There are 65 irrigation schemes in the State comprising 63 non-granary irrigation schemes with a total area of 12,722 ha and two granary schemes namely Krian/Sungai Manik (30,058 ha) and Seberang Perai (9,510 ha).

For the non-granary areas, double cropping of paddy is possible in 43 schemes covering an area of 12,236 ha. The performance of the schemes is such that 15 schemes are completely idle and another 15 schemes are cultivated with about 50% of the main season area. 39% of the total non-granary irrigable area is idle. The results of the potential evaluation for Perak State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	6	20	-	25
2	37	14	9	-
3	6	11	-	20
4	-	-	-	-
5	-	7	24	-
6	10	-	-	-
7	4	19	13	-
8	-	-	-	-

(5) Selangor

There are 18 irrigation schemes in the State comprising 17 non-granary schemes with a total area of 939 ha and one granary scheme namely Barat Laut Selangor of 119,022 ha.

The performance from the non-granary irrigated areas in terms of paddy production has not been satisfactory. This is due to the State being located in the vicinity to the capital city Kuala Lumpur and the existence of more better off-farm opportunities. Of the 17 schemes, 6 schemes of them are cultivated during the main season with planted intensity of more than 50% while 5 schemes have planted intensity less than 50%. The remaining 6 schemes are completely idle.

Thus for the 17 non-granary irrigated schemes, it is difficult to justify continuing paddy cultivation with the exception of one scheme which is located nearby the Barat Laut Granary area. The results of the potential evaluation for Selangor State are as follows:

Category	Super category	Possible categories		
		2nd priority	3rd priority	4th priority
1	-	-	-	1
2	10	6	-	1
3	-	-	-	1
4	-	-	-	-
5	-	8	6	-
6	-	-	-	-
7	7	-	1	-
8	-	-	-	-

(6) Negeri Sembilan

There are 156 non-granary irrigation schemes in the State with a total area of 10,934 ha. The problem of idle paddy land situation is very serious considering the large extent of unutilized paddy land. From the inventory survey it is found that 83 schemes are cultivated during the main season with planted intensity less than 50% while 43 schemes are completely idle. As the results of the categorization indicate that Category 2 is the preferred option, it is recommended

that an organization be established for managing the conversion of the paddy fields into tree crop cultivation areas. The results of the potential evaluation for Negeri Sembilan State are as shown below:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	14	-	-	9
2	140	9	6	-
3	-	6	-	8
4	-	-	-	-
5	-	34	5	-
6	1	-	-	-
7	1	41	7	-
8	-	-	-	-

(7) Melaka

There are 54 irrigation schemes in the State with a total area of 7,149 ha. There exists 8 idle schemes and 23 schemes with paddy planted intensity of less than 50% during the main season. Many crop diversification programs have been carried out under the Melaka IADP. There is therefore the need to extend the program to include the other non-granary schemes as well. The results of the potential evaluation for Melaka State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	9	-	-	11
2	39	13	-	1
3	1	5	-	1
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	5	29	9	-
8	-	-	-	-

(8) Johor

There are 23 irrigation schemes in the State with a total area of 4,010 ha. The results of the potential evaluation for Johor State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	9	6	-	3
2	5	4	6	1
3	3	7	-	2
4	-	-	-	-
5	-	1	2	-
6	4	-	-	-
7	2	3	5	-
8	-	-	-	-

(9) Pahang

The problem of idle paddy land is the most severe in the State of Pahang. During the main season, the planted intensity is only 12% while the completely idle schemes amounted to 195 schemes. The labor shortage, remoteness in terms of location of schemes, difficulty of access and the level of existing irrigation and drainage facilities have contributed the cause of the problem of idle paddy land. There are currently 290 irrigation schemes in the State with a total area of 17,430 ha. A basic strategy plan needs to be set up for future crop diversification programs playing special attention to the manpower and budget resources. The results of the potential evaluation for Pahang State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	77	-	-	9
2	45	39	-	-
3	-	16	-	4
4	-	-	-	-
5	-	-	-	-
6	2	-	-	-
7	18	14	18	-
8	148	-	-	-

(10) Trengganu

There are 40 irrigation schemes in the State comprising 39 non-granary schemes with a total area of 9,083 ha and one granary scheme namely Besut with an area of 5,100 ha.

In view of the different features of the farmers behavior between the different regions in the State, crop diversification plans need to be formulated according to local conditions. The results of potential evaluation for Trengganu State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	-	12	-	13
2	13	8	2	5
3	5	2	-	12
4	-	-	-	-
5	-	-	-	-
6	8	-	-	-
7	12	5	8	-
8	1	-	-	-

(11) Kelantan

There are 79 irrigation schemes in the State comprising 77 non-granary schemes with a total area of 10,667 ha and two granary schemes namely Kemasin-Semerak (7,330 ha) and KADA (31,477 ha).

Paddy cultivation in the State is consistently being carried out. Out of the 77 non-granary schemes, 57 schemes have main season planted intensity greater than 50% while 5 schemes are completely idle. The results of the potential evaluation for Kelantan State are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	16	13	-	27
2	18	10	22	9
3	12	14	-	27
4	-	-	-	-
5	-	1	6	-
6	11	-	-	-
7	20	16	25	-
8	-	-	-	-

(12) Sabah

There are 56 non-granary irrigation schemes in the State with a total area of 17,163 ha. Of the planted areas, 29 schemes have main season planted intensity greater than 50% while 8 schemes are completely idle. The results of the potential evaluation for Sabah State are as shown below. Full results of the possible categories are not presented due to insufficient information.

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	-	-	-	-
2	3	17	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	1
6	16	-	-	-
7	32	1	-	-
8	5	-	-	-

(13) Sarawak

There are 38 non-granary irrigation schemes in the State with a total area of 15,136 ha. Out of the 38 non-granary schemes, 14 schemes have main season planted intensity greater than 50% while 3 schemes are completely idle. Out of the 38 schemes 26 of them are located in the low lying coastal areas. Besides crop diversification for agricultural purposes, there is the potential for converting such coastal schemes into brackish water fish and prawn culture.

The results of the potential evaluation for Sarawak are as follows:

Category	Super category	Possible categories 2nd priority	3rd priority	4th priority
1	-	6	-	-
2	1	7	5	-
3	-	1	-	-
4	-	-	-	-
5	-	3	-	7
6	-	-	-	-
7	37	-	-	-
8	-	-	-	-

6. CROP DIVERSIFICATION STUDY ON SELECTED SCHEMES

6.1 Selection of Schemes

The crop diversification study has been conducted for the purpose of confirming several criteria used for the categorization and identifying direction towards promotion of crop diversification plans in non-granary irrigated areas. In this regard, typical schemes are selected for the Study. The selected schemes have the following features.

- Schemes with potential for crop diversification under Category 1, where paddy cultivation is presently carried out and promotion of high value crop cultivation can be expected because paddy farmers show a strong tendency to earn more farm income through crop diversification,

- Schemes with potential for crop diversification under Category 2, where labor-saving farming practices are required and promotion of conversion to oil palm and cocoa can be expected, and

- Schemes with potential for crop diversification under Category 3, where irrigated double cropping of paddy is not possible due to water resource limitation. In this case two cropping systems i.e. the main season paddy with the off season high-valued upland crops can be encouraged.

Based on the categorization results and through the discussions with the Steering and Technical Committees, three areas are selected for Feasibility Studies. They are Kulim area in Pulau Pinang, Mampong area in Negeri Sembilan and three schemes in Kelantan. These areas have 12 non-granary irrigation schemes with a total area of 3,209 ha.

State	Scheme	Irrigable Area (ha)
Pulau Pinang	Sungai Kulim I	434
	Sungai Kulim II	1,328
Negeri Sembilan	Ulu Sepri	72
	Mampong	64
	Ampang Limau	131
	Chembong	173
	Ulu Chembong	24
	Anak Air Tontong	33
	Kampung Chuai	20
Kelantan	Hilir Sat I	396
	Repek	454
	Rawa Bechah Laut	80
	Total	3,209

Direct application of crop diversification under Category 1 to the Kulim area is quite difficult due to the current behavior of the paddy farmers. Thus, two cropping systems under Category 3 will be applied initially for periods of up to three years. Then full application of Category 1 will be carried out. In Mampong area, the potential for switching to tree crops such as oil palm and cocoa under Category 2 is studied, while in Kelantan Category 3 options are being studied.

The Study is made referring to information obtained through the Inventory Survey as well as supplemental data collected from additional field investigations carried out by the Study Team. The results of the Study are presented in Volume 3 of this Report: Pulau Pinang in Part I, Negeri Sembilan in Part II and Kelantan in Part III. Although the procedure of the Study is applicable to other schemes with similar conditions and constraints, undertaking of a study is necessary for formulating specific crop diversification plans with emphasis on the physical and socio-economic features.

6.2 Crop Diversification Plan for Categories 1 and 2 in Pulau Pinang

6.2.1 Study area

(1) Present conditions

The Kulim Irrigation Scheme with a total area of 3,223 ha is situated in the Perai river basin, on the Mainland side of Peninsular Malaysia. This area is located within the Balik Pulau Seberang Perai IADP area now currently under implementation.

The existing water supply for irrigation for the Kulim area is obtained from the Kulim River, a tributary of the Perai river. Water resource from the Kulim river is insufficient to meet the irrigation demand for double cropping of paddy for the whole of the Kulim area. Under the such circumstances, there is a need to formulate crop diversification plans for the area as well as to plan to transfer water from the Jarak river through the existing Jarak/Kulim link canal.

The Kulim area is divided into six irrigation blocks i.e. K1 to K6 as shown in Fig. 9. In view of the physical land conditions and higher productivity, irrigation blocks K2, K3, and K4 are designated as granary areas and lie within the overall Seberang Perai granary area. The remaining blocks i.e. K1, K5, and K6 are considered as non-granary irrigated areas which are targeted for crop diversification under the Study. The current land use of the Kulim irrigation scheme is shown as follows:

Block	Irrigable Area (ha)	Double Crop. Area (ha)	Two Crop. Area (ha)	Converted Area (ha)	Idle Area (ha)
K1	434	342	50	42	-
K2	679	401	-	278	-
K3	397	397	-	-	-
K4	385	295	-	90	-
K5	997	315	-	-	468
K6	331	152	-	-	393
Total	3,223	1,902	50	410	861

The results of the Inventory Survey indicate that the paddy planted area has been affected by the available quantity of irrigation water supply to the Sungai Kulim I and II scheme areas although farmers wish to continue paddy cultivation. In particular, the downstream parts of K5 and K6 blocks in the Sungai Kulim II scheme have been left idle due to poor chances of getting irrigation water.

The average utilization ratio of K5 and K6 blocks for the past three years (1985 to 1987) has been 35%. In the Sungai Kulim I scheme area, farmers grow vegetables and sweet corn as the off season crop in an area of 50 ha and sugar cane as the converted crop covering 42 ha.

In the Kulim area, DOA has encouraged group farming activities, and advising technical know-how on modernized farming practices. Presently 10 farming groups are active as shown below:

	Kulim Area	Seberang Perai Tengah	State Total
- Total No. of Farming Groups	10	24	105
- Total No. of Group Farming Projects	10	24	105
- No. of Participating Farmers	344	746	3,718
- Area Covered (ha)	706	1,110	4,367

The main agricultural products of group farmings operated in and nearby Kulim area are paddy (640 ha) and vegetables (66 ha).

(2) Water resources and irrigation system

To confirm available water resources for the whole Sungai Kulim area and the previous IADP's hydrological study, a water balance study is carried out. The basic concept is to allocate available water resources of the Kulim river to the IADP granary area as the first priority and to utilize the remaining discharge for K1, K5 and K6 blocks. Resulting from this water balance examination, it is confirmed that the available water resources of the Kulim river can meet irrigation

water demand for the double cropping of paddy in the granary area to the full extent. The remaining discharge on the monthly basis is as below. For reference, comparison is made between this available discharge and irrigation water demand when double cropping of paddy is fully carried out in the three blocks. Even if available water is conveyed from the Jarak, the irrigation water demand for the dry months in the off season can be met partly but not fully as below.

Unit: m^3/sec

	J	F	M	A	M	J	J	A	S	O	N	D
Kulim discharge	2.3	1.6	1.6	2.4	3.0	2.0	2.0	1.7	2.6	4.5	5.5	4.0
IADP demand	0.9	0.2	1.4	2.0	1.6	1.2	1.1	0.6	1.2	1.5	1.1	1.2
Available discharge	1.4	1.4	0.2	0.4	1.4	0.8	0.9	1.1	1.4	3.0	4.4	2.8
K1/K5/K6 demand	1.3	0.4	1.8	3.0	2.5	1.8	1.7	0.8	1.8	2.4	1.7	1.8
Jarak discharge	2.2	1.2	0.9	1.6	2.2	1.7	1.6	1.3	1.9	2.3	2.2	2.3

(3) Farmers' intentions

Although more than half of K5 and K6 block areas are left idle at present, about 800 farm households still continue cultivating paddy and some upland crops. To grasp intentions of these paddy farmers with respect to crop diversification, detailed socio-economic survey was carried out under the Study. The results are compiled in Annex I-1 of Volume 3 of this Final Report.

Out of the 209 sample farmers, 58% are middle aged between 36 and 55 years old and 25% is over 55 years. Their size of paddy fields range from 0.4 to 1.2 ha for 51% of the respondents.

In general, 55% of the respondent farm households consider the crop diversification program as an interesting project as shown in Table 13 are met. On the other hand, 41% of the respondents consider crop diversification as difficult or impossible because of land suitability, intention of land owners, labor shortage and no possibility of introducing profitable crops other than paddy.

In respect to high profitable crops, the respondents show keen interest in growing sweet corn, okra, cucumber and chili. For the marketing of those crops, 47% of the respondents feel "a little bit worried", while 17% consider them as very promising crops and 27% are reluctant because of difficulty in marketing these crops. Regarding possible markets, 53% of the respondents target for a local market while 30% consider neighboring markets.

6.2.2 Crop diversification plan

(1) Development concept

The target of crop diversification in the Kulim area is to realize both high value crop cultivation in irrigated areas and profitable tree crop cultivation in non-irrigated areas based on rationalization of use of water and land resources.

Direct application of crop diversification under Category 1 to the Kulim area will be quite difficult due to the current inclinations of the paddy farmers. Thus, two cropping systems under Category 3 will be applied initially for periods of up to 3 years. Then full application of Category 1 will be carried out.

Reflecting farmers adherence to paddy cultivation and misgivings about the success of crop diversification, it is essential to promote the crop diversification program step by step. It is recommended that pilot operation be commenced in a selected farm to encourage the officers concerned and leading farmers in diversified cropping with provision of all measures in an integrated manner.

A stepwise procedure to introduce crop diversification is proposed for the Kulim area with the following targets on condition that the supply of irrigation water is to be assured:

Initial stage;	to introduce non-paddy crops in the off season
Transition stage:	to switch main season paddy to upland crops and achieve 200% cropping intensity of upland crops
Final stage:	to achieve intensive upland crop cultivation by 300% cropping intensity

For areas where the irrigation water supply cannot be assured (downstream part of K5 and K6 blocks), promotion of fruit and industrial tree crops cultivation is proposed.

(2) Selection of crops

The prevailing soils in the Kulim area are suitable for promoting crop diversification with in high value crops such as vegetables and fruits. Drainage facilities have to be provided. From the soil and agro-ecological viewpoints, possible crops are selected. These are sweet corn, bittergourd, cucumber, lowland cauliflower, lowland cabbage, okra, longbean and chili as vegetables, lime, rambutan, mango and pineapple as fruits and cocoa as industrial crop. Crop profitability of these crops as expressed in terms of net income is higher than that of single cropped paddy. As for crop marketability, there is an active demand for the selected crops in local markets as well as in the State of Pulau Pinang.

(3) Crop diversification plan

In order to promote crop diversification in the existing paddy cultivation area, it is a prerequisite to apply stepwise approach paying special care to paddy farmers' behavior and abilities towards the application of new farming technology and practices. From the agronomic viewpoint, proper crop management is essential to control pests and diseases. Also multiple cropping system growing by two or more crops in rotation should be practised to reduce peak labor requirement and to minimize market price fluctuations.

Based on the foregoing, it is proposed to introduce the following six cropping systems step by step as follows:

Cropping System	Stage	Crops and Practice
CS-1	Initial	Main season paddy and off season upland crops under irrigated condition for areas presently grown with paddy
CS-2	Initial	Irrigated double cropping of upland crops for presently converted areas
CS-3	Transition	Irrigated double cropping of upland crops for the above two cropping areas under the cropping systems 1 and 2
CS-4	Final	Irrigated upland crops grown three times a year intensified from the cropping system 3
CS-5	Transition and Final	Permanent tree crops grown under rainfed but improved drainage conditions for areas presently idle and with no possibility of being irrigated.
CS-6	Transition and Final	Rainfed short-term fruits planted in the transition stage and then irrigated upland crops grown in the final stage for areas presently idle.

The proposed cropping patterns for the three stages are shown in Figs. 10 to 12. The target cropping intensity is 200% for the initial and transition stages and 300% for the final stage.

6.2.3 Upgrading plan of infrastructures

(1) Approach to the development

For successful introduction of the crop diversification program, upgrading of the on-farm service facilities including irrigation, drainage and road networks is prerequisite. For the Initial stage development, augment the irrigation water source for the Kulim area by improvement of the existing Jarak/Kulim link canal system will be considered.

(2) Irrigation plan

The basic concept is to utilize the remaining water resource after meeting irrigation water demand for double cropping of paddy in the IADP granary area for the initial and transition stages. Prior to shifting to the final stage, irrigation water resource needs to be enhanced for securing irrigation water to intensive upland crop cultivation. The proposed irrigation plan for each stage is shown below.

Scheme & Block	Area (ha)	Present Condition	Initial Stage	Transition Stage	Final Stage
Sungai Kulim I					
K1	434	Irrigated	Irrigated	Irrigated	Irrigated
Sungai Kulim II					
K5	315	Irrigated	Irrigated	Irrigated	Irrigated
	204	Idle	Idle	Rainfed	Irrigated
	478	Idle	Idle	Rainfed	Rainfed
K6	153	Irrigated	Irrigated	Irrigated	Irrigated
	61	Idle	Idle	Irrigated	Irrigated
	117	Idle	Idle	Rainfed	Rainfed

To estimate irrigation water demand, on-farm crop water requirement is calculated based on information from IADP office and reference prepared by FAO. The effective rainfall was estimated from 1 in 5 year probable rainfall. The percolation rate is assumed to be 1 mm/day for paddy fields. The overall irrigation efficiency is assumed to be 60% for paddy and 45% for upland crop cultivation.

Based on the estimated irrigation water demand, a water balance examination is made to determine the maximum extent of irrigation area. The result of water balance is as shown below.

(Unit: m^3/sec)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Kulim remaining water	1.40	1.40	0.15	0.40	1.34	0.84	0.94	1.14	1.39	2.99	4.39	2.80
Enhanced water from Jarak	3.64	2.60	1.10	2.06	3.52	2.47	2.50	2.44	3.48	5.25	6.65	5.06
Water use for initial stage	0.72	0.17	0.06	0.19	0.46	0.82	0.80	0.82	0.97	1.22	0.89	0.98
Water use for transition stage	0.99	0.57	0.09	0.12	0.38	0.69	0.93	0.58	0.35	0.13	0.28	0.56
Water use for final stage	1.90	0.92	1.10	1.82	1.70	0.93	1.02	1.46	0.95	0.06	0.60	1.49

As a result of water balance confirmation, the total target area of the irrigated upland crop cultivation is 1,167 ha i.e. 434 ha for K1 block, 519 ha for K5 block and 214 ha for K6 block. The remaining 595 ha are to be converted to perennial tree crop cultivation such as planting lime, rambutan and cocoa.

(3) Upgrading plan of infrastructures

The density of on-farm tertiary irrigation and drainage canals and farm road is to be upgraded to the level double that of the IADP standard of 50 m/ha used in the granary area of K2 to K4 blocks. Drainage canals is designed so as to drain out once-in-5 year design rainfall of within 24 hours. The design capacity of drain is set at 1.5 $m^3/sec/km^2$ for K1 block and 1.75 $m^3/sec/km^2$ for K5 and K6 blocks.

The followings are the summary of proposed works.

Initial stage

- On-farm development for 902 ha (K1, K5 & K6)
- Rehabilitation of pump station in K6 block
- Construction of 3 tidal gates

Transition stage

- On-farm development for 860 ha (K5 & K6)
- Rehabilitation of secondary canals in K5 & K6

Final stage:

- On-farm development for 572 ha (K2, K4 & K5)
- Rehabilitation of Jarak/Julim link canal
- Construction of Jarak river bund

(4) Investment costs

The construction cost required for each stage is estimated based on the unit construction cost of the on-going IADP in the Kulim area. The estimated cost is summarized below.

Stage	Main Work Items	Construction Cost (M$'000) Direct Cost	Total Cost
Initial	On-farm development 902 ha	9,207	11,647
Transition	On-farm development 860 ha	3,247	4,107
Final	Jarak/Kulim link canal and other infrastructures	5,599	7,083
Total		18,053	22,837

6.2.4 Benefits and evaluation

(1) Benefits

The annual net benefit without project condition is estimated at M$1,956/ha. In this calculation, the unit yield of paddy is assumed to be the same as the present level of 2.25 tons/ha. The incremental benefits with project condition are summarized below.

Cropping Schedule	Crop by Season Main	Off	Cropping Intensity (%)	Net income at full Development Stage (M$/ha)
CS-1	Paddy	Upland	200	6,949
CS-2	Upland	Upland	200	7,420
CS-3	Upland	Upland	200	7,695
CS-4	Upland x 3 times		300	14,799
CS-5	Long-term Tree Crops		100	4,667
CS-6	Short-term Tree Crops		100	4,120

(2) Evaluation

The financial evaluation is made assuming a project economic life of 30 years. The financial internal rate of return (FIRR) is estimated by development stage of the project as follows:

Development stage of the Project	FIRR (%)
Initial	22.3
Initial + Transition	21.0
Initial + Transition + Final	27.2

A sensitivity analysis is made to evaluate the soundness of the project against possible adverse changes in the future in the following factors; (1) cost overrun, (2) reduction of net benefit, (3) delay in introducing intensive cropping schedule (CS-3 and CS-4), and (4) combination of the above. The results are presented below.

Alternative case		FIRR (%)
Base		27.2
Case 1-1	cost overrun by 10%	25.9
Case 1-2	cost overrun by 20%	24.8
Case 2-1	reduction of benefit by 10%	24.4
Case 2-2	reduction of benefit by 20%	21.5
Case 3-1	delay in introducing CS-3 and CS-4 for 1 year each	25.7
Case 3-2	delay in introducing CS-3 and CS-4 for 2 years each	21.1
Case 4-1	combination of Case 1-1, 2-1 and 3-1	20.7
Case 4-2	combination of Case 1-2, 2-2 and 3-2	14.3

The proposed crop diversification program can be justified with FIRR of 27.2%. The sensitivity analysis indicates that viability of the project is rather insensitive to the increase in construction costs or delay in introduction of intensive crop diversification program. However it is rather sensitive to the reduction of benefits by falling of market prices of products and/or reduced crop yields.

6.3 Crop Diversification Plan for Category 3 in Negeri Sembilan

6.3.1 Study area

(1) Present condition

In Negeri Sembilan, crop diversification in terms of conversion to oil palm and cocoa has been promoted mainly by FELCRA to overcome labor shortage problem originated from the outflow of young farmer. In the small Mampong river basin, there exist 11 non-granary irrigation schemes. Of these, seven schemes are located in the upstream river basin.

The present land use condition of selected schemes is summarized below:

Scheme	Irrigable Area (ha)	Main Season Paddy (ha)	Upland Crop (ha)	Perennial Crop (ha)	Idle Area (ha)
Ulu Sepri	72	18	2	22	30
Anak air Tontong	33	20	-	-	13
Ulu Chembong	24	7	-	-	17
Ampang Limau	131	22	2	36	71
Chembong	173	54	2	-	117
Kampong Chuai	20	3	-	-	17
Mampong	64	49	-	-	15
Total	517	173	6	58	280

In Negeri Sembilan, group farming activities have been encouraged by DOA and also idle land rehabilitation schemes have been implemented by FELCRA. In the Rembau District, FELCRA has successfully developed the Gugusan Durian Daun scheme covering 602 ha with oil palm and rubber. The present conditions of group farming activities are summarized below:

	Mampong Area	Rembau District	State Total
Total No. of Farming Groups	16	53	299
No. of Farm Households	1,327	4,536	21,719
Total No. of Group Farming Projects	4	21	195
No. of Participating Farmers	97	661	6,028
Area Covered (ha)	26.2	291	2,332

Main produce of farming groups in and nearby area of Mampong are cocoa and banana as shown below:

Location	Mukim	Products	Area (ha)	No. of Participants	Established Year
Kg. Seperi	Seperi	Cocoa	17.4	21	1987
Kg. Rendah	Chembong	Cocoa	3.7	39	1986
Chembong Halt	Chembong	Banana	0.8	11	1986
Bongek	Bongek	Cocoa	4.3	26	1987
Total			26.2	97	

(2) Water resources and irrigation system

All the seven irrigation schemes depend on their irrigation water from the Mampong river and its tributaries. Irrigation is by gravity through headworks or small diversion boxes. The intake discharge is 0.4 m^3/sec in the maximum. Most of the main canals are concrete-lined. No secondary and tertiary irrigation canals are concrete lined. The estimated once-in-5 year flood discharge at Mampong headworks is about 60 m^3/sec which coincides with the drainage capacity of the Mampong river.

(3) Farmers' intention

According to findings obtained through the Socio-economic Sample Survey under the Study and MARDI's interview survey carried out in 1985, house wives usually participate in paddy cultivation from plowing to harvesting. Due to insufficient return from paddy farming, they used to earn supplemental income from temporary rubber tapping works. Remittance from their children working in urban areas is also an important cash income sources for their living expenses. Under such circumstances, most paddy farmers intend to convert their paddy fields to oil palm and cocoa planting.

6.3.2 Plan formulation

(1) Crop diversification plan

From the viewpoint of crop management, a longer tree growing period is required for the both crops, oil palm and cocoa, before the fruits can be harvested. Also, farmers growing these crops need to follow instructions on farming practices given by relevant agencies. In this regard, crop diversification to oil palm planting should be incorporated into FELCRA's scheme. In case of cocoa, smallholders' operation is possible for getting extension services from DOA. In the initial stage of conversion, mixed planting of cocoa with other cash crops such as banana is preferable to protect young cocoa trees from the sunshine and to create a farm income source until cocoa trees becomes productive.

(2) Drainage requirement and upgrading plan

Based on DID's design criteria, the drainage requirement for growing oil palm is 0.67 $m^3/sec/km^2$ in order to drain 72-hour rainfall within 72 hours. Upgrading works of on-farm service facilities for a 100-ha unit in area as shown as follows:

The density of facilities provided to the scheme area is proposed to be 25 m/ha for the feeder drain with a drainage control structure at every 10 ha, and 10 m/ha for the access road. The total quantity of on-farm structures in the 7 selected schemes is estimated as follows:

Item	Quantity	
Site clearance	459	ha
Feeder drain	11,500	m
Drainage control structure	46	nos.
Farm road (4 m)	4,600	m

The construction cost required for drainage improvement works is estimated by referring to unit prices obtained from the State DID. The direct construction cost is estimated at M$333,340 for the

selected area of 459 ha. The total project cost is estimated at M$430,000; equivalent to M$937/ha.

6.3.3 Benefits and evaluation

(1) Benefits

The annual net benefit without project condition is estimated at M$358/ha. In this calculation, the unit yield of crops is assumed to be 2.25 tons/ha for main season paddy and 53,000 cobs/ha for maize (fresh).

The incremental benefit for oil palm will be realized from the sixth year of the project implementation and will reach its maximum at the 10th year, M$1,252/ha, while for cocoa it will be born from the third year and will reach its maximum at the 12th year, M$2,515/ha. It is obvious that cultivation of banana contributes large to secure the net income during unmatured period of cocoa (see Part-II of Vol. 3).

(2) Evaluation

To confirm the investment efficiency, the financial evaluation is made assuming a project economic life of 25 years. The financial internal rate of return (FIRR) is estimated by crop as follows:

Type of crop	FIRR (%)
Oil palm	12.5%
Cocoa	23.0%

The proposed plan to convert paddy field to both oil palm and cocoa fields is justifiable.

(3) Selection of crops

The cumulative labor requirements of both crops are 272 man-day/ha for cocoa and 25 man-day/ha for oil palm as shown in Appendix E of Volume 2. Cultivation of cocoa is beneficial but labor intensive.

The selection of type of crops to the selected schemes should be considered not only from the viewpoint of expected net benefit but also from labor requirement as well as preference by farmers.

6.4 Crop Diversification Plan for Category 3 in Kelantan

6.4.1 Study area

(1) Present condition

In Kelantan, flooding from the Kelantan river and its tributaries affect directly or indirectly non-granary irrigation schemes often. Paddy farmers are familiar with the flood problem and plan their paddy planting schedules accordingly to avoid. As a result, single cropping of paddy is common in irrigated areas. Under such background, the possibility of introducing two cropping system i.e. Category 3 is examined aiming at the increase in the off season cropping intensity and farm income.

Three schemes are selected as below (see Location map).

Scheme	Flooded Period	Irrigable Area (ha)	Main Season Paddy (ha)	Converted Area (ha)	Idle Area (ha)
Hilir Sat I	1 to 2 days	396	396	-	-
Rawa Bechah Laut	None	80	50	-	30
Repek	1 week	454	146	7	301
Total		930	592	7	331

In Kelantan, DOA is encouraging farmers to form farming groups. At present 299 groups or 17% of the total in the State are active as below:

	District			State
	Machang	Pasir Mas	Tanah Merah	Total
Total No. of Farming Groups	85	120	94	1,208
No. of Farm Households	-	-	-	-
Total No. of Group Farming Projects	53	39	76	527
No. of Participating Farmers	7,453	13,396	7,147	81,570
Area Covered (ha)	40,180	57,905	86,794	183,315

(2) Water resources and irrigation facilities

Each scheme has adequate water resource to meet irrigation water demand even for double cropping of paddy.

In Hilir Sat I scheme, irrigation water is diverted by a headwork with four gates and the maximum intake discharge of about 1.0 m^3/sec. In Rawa Bechah Laut scheme, irrigation water supply depends on a single gate headworks constructed on the Manal river commanding 23 ha, while the remaining 57 ha is served by controlled drainage system. In Repek scheme, irrigation water is pumped up from the Lemal river through a Repek pump house with one pump of 0.565 m^3/sec in capacity. At present, a new pump house with three pumps is under construction and scheduled to be completed by end 1991.

Drainage conditions at on-farm level are largely affected by the fluctuations of water level in the main river. During the off season, the field conditions are good for upland crop cultivation in these three schemes.

(3) Farmers' intention

At present, around 600 ha are planted with paddy in three schemes by about 1,300 farm households. To grasp the intentions of these paddy farmers toward crop diversification, a detailed socio-

economic survey was carried out under the Study. The results are compiled in Annex 2 of Volume 3 of this Report.

Out of 105 sample farmers, 59% are middle aged between 36 and 55 years old and 28% are over 55 years old. The size of their paddy fields ranges from 0.4 to 1.2 ha for 23% of the respondents, while 1.3 to 3.0 ha for 46% and more than 3.0 ha for 22%. Owner operators comprise 63% of the respondent farmers and the rest are pure tenants.

All the respondent farmers agree to the proposal to carry out two cropping system as the first step to overall crop diversification in the presently paddy cultivated area. Without such an approach, 66% of the respondent farmers show negative intention and 31% show positive or conditional intention.

In respect to high profitable crops, the respondents show keen interest in sweetcorn, okra, cucumber and chilli. For marketing of those crops, 47% of the respondents feel "a little bit worried", while 37% consider as very promising crops and 15% are reluctant because of difficulty in marketing these crops. Regarding possible markets, 77% of the respondents target a local market and 11% consider neighboring markets.

6.4.2 Plan formulation

(1) Selection of crops

The prevailing soils have no limitations or one soil moisture to grow of upland crops. The crops selected based on soil and agro-climatic conditions are fresh sweet corn, groundnuts, tobacco, chilli, and lowland cabbage. Tobacco even though is suitable is not incorporated in the proposed cropping pattern, because of limitation of quota system. Crop profitability of these crops as expressed in terms of net income is higher than that of single cropped paddy. As for crop

marketability, there is active demand for the selected crops in local markets and in the State.

(2) Crop diversification plan

For effective performance of the farming practices, the off season upland crops require the optimum timing of planting and harvesting schedules. Thus, the growing period of the main season paddy is restricted to a certain duration. For this purpose, it is desirable to extend mid-term rice variety of 135 days. The off season upland crops such as sweet corn, groundnut, lowland cabbage and chilli should be grown between March and September.

To minimized marketing risk and peak labor requirements, four types of the off season upland crops are selected in each unit of farm either operated through individual or group farming as below.

Crop	Main Season (%)	Off Season (%)
Paddy	100	-
Sweetcorn	-	30
Lowland cabbage	-	30
Groundnut	-	20
Chilli	-	20

(3) Upgrading plan of infrastructures

To introduce upland crop cultivation in the off season, provision of intensive on-farm facilities including irigation canal, drains and farm roads is required. The density of these on-farm facilities is 50 m/ha for irrigation canals and drains and 100 m/ha for farm roads. This works will cover all the selected scheme areas: 454 ha for Repek scheme, 396 ha for Hilir Sat I scheme and 23 ha for Rawa Bechah Laut scheme. In addition to this, minor rehabilitation work will be done for all schemes.

Drainage systems are designed to cater for once-in-5-year rainfall within 24 hours. Drainage facilities need to be upgraded to meet the design value of 1.5 to 1.6 $m^3/sec/km^2$.

(4) Flood mitigation

Flood mitigation is required for the Repek and the Hilir Sat I schemes. For the southern part of the Repek scheme, construction of flood diked proposed in the "Gorok River Basin Development Study" will solve the problem. For the Hilir Sat I scheme, the "Feasibility Study on the Flood Mitigation Project in Machang, Kelantan" proposed the channel widening and replacement of structures on the Sat river and desilting of its tributaries. Drainage conditions in these scheme is expected to be improved when these flood mitigation project are realized.

(5) Cost estimate

The cost for proposed upgrading works is estimated at M$10.4 million as summarized below.

Stage	Main Work Items	Construction Cost (M$'000) Direct Cost	Total Cost
Repek	On-farm development 454 ha	4,337	5,486
Hilir Sat I	On-farm development 396 ha	3,685	4,662
Rawa Bechah Laut	On-farm development 23 ha	214	271
Total		8,236	10,419

6.4.3 Benefits and evaluation

(1) Benefits

The annual net benefit without project condition is estimated at M$900/ha for the Hilir Sat I and Rawa Bechah Laut schemes, and

M$947/ha for the Repek scheme. In this calculation, the unit yield of paddy is assumed to be the same as the present level of 2.25 tons/ha.

The incremental benefit will be realized from the third year of the commencement of the project and will reach its maximum at the 5th year of the project implementation, Annual net benefit with project condition at the full development stage is estiamated below.

Item		Repek	Hilir Sat I	Rawa B. Laut
Cropping area (ha)				
Present	main	153	396	23*
	Off	7	0	0
Without Project	main	454	396	23
	Off	7	0	0
With Project	main	454	396	23
	Off	454	396	23
Incremental benefit at full development stage (M$'000)		2,146	1,901	110

Note; * = *excluding controlled drainage area of 57 ha*

(2) Evaluation

The financial evaluation is made assuming a project economic life of 30 years. The financial internal rate of return (FIRR) is estimated by schemet as follows:

Selected scheme	FIRR (%)
Repek	22.5
Hilir Sat I	23.3
Rawa Bechah Laut	23.3
Overall	22.9

A sensitivity analysis is made to evaluate the soundness of the project against possible adverse change in the future in the following factors; (1) cost overrun, (2) reduction of net benefit due to drop of

market price of products and/or reduced crop yield, and (4) combination of the above. The results are presented below.

Alternative case		FIRR (%) Repek	FIRR (%) Hilir S.I & Rawa B.I.
Base		22.5	23.3
Case 1-1	cost overrun by 10%	20.9	21.6
Case 1-2	cost overrun by 20%	19.5	20.1
Case 2-1	reduction of benefit by 10%	19.0	19.7
Case 2-2	reduction of benefit by 20%	15.7	16.3
Case 3-1	combination of Case 1-1 and 2-1	17.6	18.2
Case 3-2	combination of Case 1-2 and 2-2	13.5	14.0

The proposed crop diversification program can be justified with FIRR of about 23% for all selected schemes. The sensitivity analysis indicates that viability of the project is rather insensitive to the increase in construction costs, but rather sensitive to the reduction of benefits by falling of market prices of products and/or reduced crop yields.

6.5 Role of Government Agencies Involved in Promoting Crop Diversification

(1) To promote Categories 1 and 3

To promote crop diversification in non-granary irrigation scheme areas under Categories 1 and 3, it is recommended that the existing coordinating committees such as State Planning Coordination Committee and District Agricultural Planning Coordinate Committee need to have the initiative to increase the coordination of their departments and of the agencies concerned and their interlinkages with DID, DOA, FOA, LPN, FAMA and BPM.

The State DID is responsible for planning, design, construction, operation and maintenance, budget arrangement and monitoring of required for upgrading works including irrigation, drainage and farm

access roads in each scheme area up to on-farm level. These engineering works are prerequisite to introduction of high value crop diversification in existing irrigated paddy areas.

The role of the State DOA is to set up the cropping schedule, to provide extension and technical services, to supply farm inputs and to promote grouping of farmers participating in crop diversification. The responsibility of FOA is timely provision of farm machinery services for land preparation and harvesting works. As for marketing services, LPN purchases paddy on a subsidy basis, while FAMA makes the necessary arrangement for marketing upland crops. Provision of short-term credit to cover annual farm operation costs is handled by BPM.

(2) To promote Category 2

For effective implementation of crop diversification program under Category 2, it is proposed to set up a separate organization within the framework of State Government along the same lines as FELCRA.

This organization will comprise a group of management and agricultural experts responsible for the financial and marketing aspects of the tree crop conversion project. They should have the necessary manpower to manage and liaise with the farmers and various Departments in order to ensure the success of the project. This organization needs to have its own financial resources for the implementation of the projects. The technical and agricultural inputs can be provided by DID, DOA and other various Departments, with the organization providing the managers and personnel for liaising with the Departments. This organization will be responsible for identifying the best crop for each project and working out the economic viability as well as the financial arrangement between the farmers and the organization for the implementation of the project.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Agricultural diversification with a view to growing a number of export crops and to avoid the over dependence of a single export such as rubber has long been the policy of the Government of Malaysia. In respect to crop diversification within non-granary irrigated areas, the Study represents an important step taken by the Government before formulating strategies and programs for the promotion of crop diversification. The findings of the Study indicate encouraging trend in the crop diversification process especially for those non-granary irrigated areas which are facing problems of idle land.

The results of evaluation of crop diversification potential for 924 non-granary irrigation schemes show that 144 schemes have the highest potential for crop diversification with high-value upland crops under the irrigated condition (Category 1), and 333 schemes with fruit tree planting and also short term upland crops (Category 2) if market is available, while 47 schemes are most suitable for growing paddy for the main season and high value non-paddy crops for the off-season (Category 3).

From the results of the analysis of the Inventory Survey, it is noted that there exist many good small and medium sized irrigation schemes which are ideally suited for continuing paddy cultivation. These schemes have adequate water resource for double cropping, are provided with adequate irrigation and drainage facilities in addition to being well maintained and operated. Such schemes have shown to perform consistently well in terms of high paddy planted intensities and productivity coupled with farmers willingness to continue paddy cultivation. The number of schemes falling under this category i.e. Category 6 (be maintained as Mini-granary Areas) is 74 covering a total area of 28,400 ha. In view of the high investment cost for the new development of irrigation and drainage infrastructures and the scarcity of new suitable land for paddy farming, it is recommended that such

schemes be maintained as mini-granary areas for long-term contribution towards the national rice production.

There are also schemes that are temporarily required to be maintained as paddy cultivation areas due to farmers' preference to continue paddy cultivation and limitations on the physical land conditions. The number of schemes under this category i.e. Category 7 is 172.

The results of the feasibility study indicate that the provision of intensive on-farm facilities including irrigation, drainage and road networks is prerequisite to introduce upland crop cultivation in paddy fields. Proposed density of the on-farm facilities is 50 m/ha for irrigation and drainage canals and about 100 m/ha for farm roads. Investment of such upgrading works can be justified with the financial internal rate of return of more than 23% for selected schemes both in Pulau Pinang and Kelantan. In Negeri Sembilan, the currently idle schemes are confirmed as suitable for converting to permanent tree cultivation area resulting from the Study in Mampong area.

7.2 Recommendations

(1) Formulation of specific crop diversification plan

Under the Study, crop diversifications plan have been examined for the selected schemes in the States of Pulau Pinang, Negeri Sembilan and Kelantan. Among the remaining States, additional feasibility studies are required in seven States such as Perlis, Kedah, Perak, Pahang, Trengganu, Sabah and Sarawak, taking into consideration the different features and constraints on each State. It is recommended that this study will be carried out on a regional basis focussing upon formulation of crop diversification plan, rationalization of the management system for non-granary irrigation schemes., and the provision of services in an integrated manner to beneficial farmers.

(2) Upgrading of irrigation database

For full use of the evaluation results of crop diversification potential, it is necessary to update input data on each non-granary irrigation scheme. To do so, this will require upgrading of the information network to a nationwide system linking DID Headquarters and State DIDs for the purpose of collecting fresh information materials.

(3) Operation of a pilot scheme

In general, paddy farmers need to gain experience and have the confidence to manage independently. In the initial stage for promoting crop diversification a description of support services, both technical and non-technical, should be prepared in a package form and be given and explained to the intended paddy farmers. To enable conservative paddy farmers participate in crop diversification, it is recommended to operate a pilot demonstration scheme in which diversified cropping is carried out incorporating all the necessary support services.

The pilot project is proposed to is promoted and managed in the Sungai Kulim non-granary irrigation scheme in Pulau Pinang and in the Repek scheme in Kelantan. For the Kulim pilot scheme, it is recommended that the Project Implementation Team of the Balik Pulau/Seberang Perai IADP should be responsible. The operation of a pilot scheme in Kelantan is proposed to be handled under direct control of the State DID.

(4) Crop Diversification Master Plan

In the short-term, the results of the Study can provide the recommendations necessary for the identification and formulation of crop diversification action programs for the non-granary irrigated areas. However for the purpose of preparing a master plan in the national context for crop diversification, it is necessary to take into

account agricultural production from the available resources located outside the non-granary irrigated areas. In this connection there is a need to study and evaluate the potential of the paddy rainfed areas now estimated to cover 280,000 ha.

It is further recommended that a comprehensive database be established as the first step which will be utilized to identify potential areas for promoting crop diversification. Finally an overall marketing study is recommended to evaluate demand and supply projections paying special attention to promotion of diversified cropping in the both irrigated and non-irrigated rainfed paddy fields.

Tables

Table 1 List of JICA Study Team Members and Malaysian Counterpart Personnel

JICA Study Team

Name	Speciality
Dr. Y. Kunihiro	Team Leader
Y. Matsumoto	Agronomist (Co-Team Leader)
N. Sambe	Hydrologist
N. Nakagawa	Irrigation and Drainage Engineer
G. Kimura	Land Use Expert
N. Tsuchihashi	Marketing and Institutional Expert
Y. Kameishi	Agro-economist
S. Sato	System Engineer
A. Yuasa	Design Engineer
F. Furuichi	Sociologist

Counterpart Personnel from Malaysian Government

Name	Speciality
Ir. Sardar Ali	Chief Counterpart (up to Dec. 31, 1989)
Ir. Ng Chau Chen	Data Management Engineer (up to Dec. 31, 1989)
	Chief Counterpart (from Jan. 1, 1990)
Ir. Mohd Adnan bin Mohd Nor	Irrigation and Drainage Engineer
Ir. Leong Tat Meng	Meteo-Hydrologist
Mrs. Salmah bt Mohd Soom	Design Engineer
Dr. Zulkifli bin Kamaruzzman	Pedologist/Land Use Expert
Mrs. Kamariah Osman	Agronomist
Mr. Zulkefli bin A. Hassan	Agricultural Institutional Expert
Dr. Mohd Hatta bin Dagap	Agro-economist
Mr. Samusuddin	Sociology
Mr. Zulkefli bin A. Hassan	Sociology

- Ms. Naimah bt. Ramli, MOA
- Mr. Abudul Kadir Abd. Hadi, DOA
- Dr. Mohd. Shahrin Yab, MARDI
- Mr. Kheriah Arif, FAMA
- Mr. Nyanen Thiran, FOA
- Mr. Mohd. Yusoff Ramli, Melaka IADP
- Ir. Soo Thong Phor, DID/Kedah Valley IADP
- Mr. Mohd. Nasarudin Idris, Kedah Valley IADP

3. State Coordinator

Perlis	-	Mr. Abdul Bakar bin Sudin
Kedah	-	Ir. Chong Chee Han Ir. Hanapi bin Mohamad Noor
P. Pinang	-	Mr. Phuah Kian Ghee
Perak	-	Ir. Ng Sui Wan
Selangor	-	Ir. Ng Chee Hock
N. Sembilan	-	Mr. Zainal Abidin bin Manaf
Melaka	-	Mr. Chua Jon Hee
Johor	-	Mr. K. Balakrishnan
Pahang	-	Ir. Ahmad Faud b. Embi
Trengganu	-	Ir. Md. Khairi Selamat
Kelantan	-	Mr. Song Teng Hock
Sabah	-	Ir. Richard Tand Chok Ing.
Sarawak	-	Ir. Wong Wen Ho

Table 2 List of Malaysian Personnel Directly Involved and Concerned to the Study

1. Steering Committee

Chairman	-	Dr. Abdul Aziz Mohd. Yaacob, EPU
Member	-	Ir. Quah Tek Hoe, DID
	-	Ir. Shaik Ahmad Soekarno, MOA
	-	Ms. Aminah Mohamad Nawi, MOA
	-	Mr. Thomas Mathew, MOA
	-	Mr. Mohd. Tamin Yusoff, MOA
	-	Mr. Zohari Said, MOA
	-	Ir. Wong Kok Fiu, DID
	-	Ir. Lim Teik Keat, DID
	-	Ir. Ng Chau Chen, DID
	-	Mr. Abudul Kadir Abd. Hadi, DOA
	-	Mr. Roseley Hj. Khalid, DOA
	-	Mr. Rohizad Ridzwan, FAMA
	-	Mr. Lee Lim Chwee, FOA
	-	Ms. Tan Sai Eng, FELCRA
	-	Mr. Abullah Chek Sahamat, SEPU Sarawak
	-	Mr. K. Zulkifli Harrith, MOA Sabah
	-	Ir. Richard Tan Chok Ing, DID Sabah
	-	Ms. Lin Mui Kiang, EPU
	-	Mr. Ramli Hj. Hasan, EPU

2. Technical Committee

Chairman	-	Ir. Quah Tek Hoe, DID
Member	-	Ir. Sardar Ali, DID
	-	Ir. Chan Gak Kok, DID
	-	Ir. Lim Teik Keat, DID
	-	Ir. Ng. Chau Chen, DID
	-	Ir. Law Kong Fook, DID
	-	Ir. Ong Siew Heng, DID
	-	Mr. Thomas Mathew, MOA
	-	Mr. Jaafar bin Said, MOA

Table 3 Ratio of Food Imports to Total Exports

Unit: M$ million

Year	Total Imports	Gross Food Import	% Food to Total Imports	Rice Imports	% Rice to Food Imports	% Rice to Total Imports	Total Exports Earning	Palm Oil Exports	% Food to Export Earnings	% Rice to Export Earnings
1961	2,816	665	23.6	130	19.5	4.6	3,238	61	20.5	4.0
1962	3,056	670	21.9	132	19.7	4.3	3,260	65	20.6	4.1
1963	3,193	783	24.5	165	21.0	5.2	3,330	70	23.5	4.9
1964	3,205	835	26.1	157	18.8	4.9	3,382	81	24.7	4.6
1965	3,356	750	22.3	113	15.0	3.4	3,783	107	19.8	3.0
1966	3,380	748	22.1	105	14.0	3.1	3,846	120	19.4	2.7
1967	3,325	762	22.9	158	20.7	4.7	3,724	116	20.5	4.2
1968	3,552	766	21.6	136	17.8	3.8	4,133	125	18.6	3.3
1969	3,605	728	20.2	100	13.7	2.8	5,055	153	14.4	2.0
1970	4,288	787	18.3	96	12.1	2.2	5,163	264	15.2	1.8
1971	4,416	736	16.7	73	9.9	1.7	5,017	380	14.7	1.5
1972	4,543	809	17.8	76	9.4	1.7	4,854	363	16.7	1.6
1973	5,934	1,078	18.2	208	19.3	3.5	7,372	467	14.6	2.8
1974	9,891	1,585	16.0	358	22.6	3.6	10,195	1,086	15.5	3.5
1975	8,530	1,402	16.4	148	10.6	1.7	9,231	1,320	15.2	1.6
1976	9,713	1,41	14.8	138	9.6	1.4	13,442	1,155	10.7	1.0
1977	11,165	1,644	14.7	176	10.7	1.6	14,959	1,680	11.0	1.2
1978	13,646	1,979	14.5	321	16.2	2.4	17,074	1,871	11.6	1.9
1979	17,161	2,052	12.0	227	11.1	1.3	24,222	2,471	8.5	0.9
1980	23,451	2,444	10.4	141	5.7	0.6	28,172	2,603	8.7	0.5
1981	26,604	2,941	11.1	256	8.7	1.0	27,110	2,836	10.8	0.9
1982	29,795	2,999	10.1	282	9.4	0.9	28,108	2,742	10.7	1.0
1983	30,795	2,956	9.7	240	8.0	0.8	32,771	2,995	9.1	0.7
1984	32,926	3,227	9.8	258	8.0	0.8	38,647	4,542	8.4	0.7
1985	30,558	3,075	10.1	238	7.7	0.8	38,327	3,951	8.0	0.6
1986	27,980	2,558	9.1	117	4.5	0.4	35,801	3,561	7.1	0.3
1987	31,934	2,965	9.3	91	3.1	0.3	45,138	3,250	6.6	0.2
1988	43,411	3,839	8.8	207	5.4	0.5	55,334	4,528	6.9	0.4

Source: MOA, LPN, DOS and Bank Negara

Table 4 Trend of Planted Area of Various Crops in Malaysia

Unit: ha

Year	Rubber	Oil Palm	Cocoa	Coconut	Tea	Pepper	Paddy	Pineapple	Sago & Tapioca	Coffee	Tobacco	Fresh Fruit	Food Crops	Spices & Oth. Crops	Total Area
1960	1,752,655	54,681	577	246,293	4,322	264	467,769	14,890	14,348	4,403	2,213	39,936	9,637	34,532	2,646,520
1961	1,816,669	57,169	2,115	262,435	3,869	290	483,681	14,452	14,768	5,735	3,402	43,002	7,161	34,366	2,749,114
1962	1,892,233	62,079	2,529	241,632	3,847	296	486,699	15,054	20,958	5,705	4,065	51,299	6,944	32,712	2,826,052
1963	1,938,164	71,030	2,617	248,390	3,281	299	490,720	15,626	24,273	5,636	4,256	43,468	6,260	31,645	2,885,665
1964	2,003,317	83,200	2,812	248,007	3,794	431	509,011	16,186	20,325	5,650	4,485	43,791	5,482	20,599	2,967,090
1965	2,025,322	96,945	2,950	251,703	3,675	441	507,789	17,129	18,430	5,389	3,988	46,832	8,366	19,564	3,008,523
1966	2,050,837	122,703	3,468	249,267	3,792	465	515,453	18,144	16,789	6,140	3,570	49,275	5,515	20,753	3,066,171
1967	2,044,675	150,610	3,658	251,605	3,332	723	595,853	19,510	23,012	6,188	3,691	50,592	24,058	18,293	3,195,800
1968	2,022,364	190,765	4,239	260,451	3,062	874	657,480	19,422	19,568	6,500	3,340	51,888	23,769	17,811	3,281,533
1969	2,022,939	231,176	5,237	267,071	3,419	861	687,185	17,796	20,269	6,535	3,321	53,179	22,799	15,822	3,357,609
1970	2,019,457	290,967	7,386	271,366	3,220	886	703,470	20,539	20,305	6,553	3,624	54,679	27,184	15,617	3,445,253
1971	2,015,990	339,512	16,573	272,247	3,258	901	731,259	20,076	17,603	6,610	7,521	51,856	35,218	15,398	3,534,022
1972	2,001,670	401,038	17,504	273,954	3,163	919	884,257	22,319	15,843	6,457	7,409	52,523	35,218	15,683	3,737,957
1973	1,991,028	471,458	21,974	269,391	3,409	951	746,314	22,596	14,444	7,436	6,839	52,738	35,872	43,595	3,688,045
1974	1,988,949	565,766	22,556	271,216	3,351	1,016	754,113	21,825	14,197	8,872	8,211	63,364	32,264	11,784	3,767,484
1975	1,991,775	641,791	29,189	287,446	3,241	983	757,797	19,241	17,979	8,451	11,872	64,642	42,056	10,736	3,887,199
1976	1,980,904	714,600	32,678	316,906	3,123	1,066	750,023	20,371	33,753	10,202	8,895	72,613	43,785	10,457	3,999,376
1977	1,981,472	781,814	44,862	296,897	3,105	1,101	743,686	19,387	20,604	9,621	8,212	65,116	39,402	9,456	4,024,735
1978	1,999,169	852,979	49,213	295,802	3,192	943	625,354	19,527	20,045	10,701	11,118	67,105	50,780	8,655	4,014,583
1979	2,006,577	938,863	71,818	297,303	3,130	963	740,534	19,000	18,712	11,979	12,146	65,848	41,728	8,671	4,237,272
1980	2,006,577	1,023,306	123,355	300,327	3,035	743	716,530	15,756	14,507	14,916	12,450	60,697	42,311	7,414	4,320,538
1981	2,005,864	1,140,538	125,784	305,604	3,410	262	709,412	10,189	14,092	15,427	12,493	61,205	35,598	4,696	4,454,230
1982	1,991,590	1,200,104	209,399	207,767	2,223	208	676,888	11,806	8,867	16,865	9,571	63,764	29,140	3,914	4,489,386
1983	1,973,686	1,258,009	231,080	291,170	4,764	127	668,588	11,886	7,447	17,545	11,615	65,284	32,428	4,425	4,531,591
1984	1,968,059	1,349,192	265,510	385,141	3,239	136	628,138	14,009	5,684	25,832	9,856	107,477	40,254	4,830	4,791,415
1985	1,953,365	1,468,214	303,899	270,776	3,206	132	662,319	12,430	6,472	23,031	11,125	109,381	51,250	4,716	4,851,093
1986	1,931,495	1,599,311	322,344	387,131	2,716	128	688,207	9,759	5,942	22,500	15,020	114,252	59,620	4,572	5,346,517
1987	1,903,453	1,685,581	341,000	215,525	2,788	140	623,828	7,690	6,636	24,750	12,314	115,070	65,582	4,644	5,009,001
1988	1,890,853	1,745,581	396,600	211,362	2,654	138	647,439	8,700	6,701	23,176	9,600	121,174	66,274	4,719	5,134,971

Source: DOS and MOA

Table 5 Trend of Agricultural Production in Malaysia

Unit: ton

Year	Rubber	Oil Palm	Cocoa	Copra	Tea	Pepper	Paddy	Pineapple	Tobacco	Fisheries	Beef	Mutton	Poultry	Pork
1960	790,470	91,793	–	206,360	11,747	7,966	951,000	195,673	45	141,701	11,570	1,280	21,200	38,450
1961	818,038	94,846	–	197,900	12,124	16,729	1,021,800	195,673	91	153,060	12,460	1,260	28,100	40,170
1962	793,583	108,171	–	173,800	12,872	19,039	1,135,800	213,284	341	172,930	11,520	1,280	34,800	44,240
1963	832,201	125,691	–	183,200	12,421	18,163	1,188,600	230,894	1,409	186,574	11,450	1,160	37,200	45,060
1964	870,751	122,913	–	158,900	14,166	14,339	1,103,400	271,986	2,500	195,233	13,405	1,330	40,800	47,756
1965	916,940	150,411	–	169,100	15,303	18,800	1,256,800	297,423	7,886	201,551	13,971	1,330	41,400	49,536
1966	972,945	189,687	–	176,500	15,889	14,200	1,234,100	297,423	8,409	240,393	14,771	1,270	42,600	52,712
1967	991,142	225,758	–	179,700	14,217	20,500	1,194,700	321,242	13,968	355,427	14,677	1,130	48,400	51,148
1968	1,100,382	282,984	–	189,200	15,741	23,900	1,433,700	283,003	16,282	394,274	13,903	920	54,200	49,887
1969	1,268,190	352,096	–	178,600	16,044	30,100	1,597,200	306,424	19,655	341,198	13,446	970	57,500	56,838
1970	1,263,353	431,069	2,000	195,799	15,519	25,800	1,678,900	313,407	18,941	339,331	14,448	1,030	60,900	59,760
1971	1,318,610	580,389	4,000	193,820	14,439	28,800	1,817,000	306,278	39,291	368,111	16,345	1,200	64,000	59,026
1972	1,304,363	718,580	5,000	198,932	15,031	27,900	1,837,000	292,825	72,114	358,990	18,272	1,410	65,800	59,026
1973	1,542,523	812,614	9,000	216,300	14,689	24,300	1,980,000	266,947	72,909	444,848	13,912	990	72,800	58,758
1974	1,524,803	1,045,975	10,000	209,300	14,062	30,400	2,095,000	257,562	76,332	526,821	16,592	910	78,200	54,007
1975	1,459,331	1,257,573	13,000	234,000	13,926	33,400	2,013,000	215,243	92,026	474,591	14,443	834	92,900	56,552
1976	1,612,481	1,391,965	15,434	232,000	14,758	39,800	1,995,000	200,989	46,797	517,303	15,103	826	97,800	55,650
1977	1,588,053	1,612,747	16,708	218,000	14,995	29,400	1,898,000	200,215	72,900	618,621	14,392	804	99,300	59,773
1978	1,582,453	1,785,525	17,564	207,000	13,513	36,600	1,590,000	195,710	92,118	684,922	14,064	823	103,900	61,798
1979	1,570,127	2,188,439	26,580	213,000	14,397	40,300	2,095,000	200,776	75,505	696,329	13,705	696	107,800	59,215
1980	1,529,997	2,575,865	36,500	210,000	14,873	31,700	2,171,000	185,273	99,414	743,679	15,238	762	114,300	112,627
1981	1,510,222	2,824,464	45,200	208,000	13,649	28,900	2,177,000	158,631	67,924	766,588	15,939	641	115,300	127,276
1982	1,494,182	3,514,169	66,200	206,000	14,449	25,200	1,832,000	153,003	82,655	693,528	16,977	578	115,900	135,918
1983	1,563,717	3,018,333	69,000	219,000	14,557	23,500	1,818,000	148,206	91,948	740,403	15,952	586	124,100	125,766
1984	1,530,583	3,715,739	88,000	214,000	16,262	16,600	1,755,000	144,284	72,036	670,934	15,723	618	181,000	134,350
1985	1,469,453	4,133,398	103,000	216,000	16,445	19,100	1,895,000	152,547	88,009	628,464	15,564	579	220,000	133,469
1986	1,541,878	4,543,084	131,000	215,000	17,236	15,400	1,947,600	144,387	118,975	634,456	17,100	600	268,000	153,022
1987	1,581,000	4,533,000	191,000	214,000	1,896	14,200	1,622,900	150,200	109,000	903,200	18,100	800	284,100	166,300
1988	1,666,000	5,030,000	230,000	216,000	20,856	19,000	1,785,500	152,000	119,900	930,500	19,100	800	289,500	176,400

Source: DOS and FOA

Table 6 Trend of Paddy Production in Malaysia

Year	Paddy Production ('000 tons)	Change in Production (%)	Area Planted ('000 ha)	Yield (ton/ha)	Change in Yield (%)
1974	2,095		754	2.78	
1975	2,013	-3.9	758	2.66	-4.3
1976	1,995	-0.9	750	2.66	-1.1
1977	1,898	-4.9	744	2.55	-4.1
1978	1,590	-16.2	625	2.54	-0.4
1979	2,095	31.8	741	2.83	11.4
1980	2,171	3.6	717	3.03	7.1
1981	2,177	0.3	709	3.07	1.3
1982	1,832	-15.8	677	2.71	-11.7
1983	1,818	-0.8	669	2.72	-3.3
1984	1,755	-3.5	628	2.79	2.6
1985	1,895	8.0	662	2.86	2.5
1986	1,948	2.8	688	2.83	-1.7
1987	1,623	-16.7	624	2.60	-8.1
1988	1,786	10.0	647	2.76	6.2

Source: DOS

Table 7 Distribution of Paddy Fields by State

Unit: ha

State	Irrigated Paddy Fields			Rainfed Wet and Dry Paddy Fields	Total
	Granary Areas	Non-granary Areas	Total		
Perlis	19,500	4,215	23,715	2,045	25,750
Kedah	75,500	17,133	92,633	31,955	124,588
Pulau Pinang	13,000	3,541	16,541	1,274	17,815
Perak	39,568	12,722	52,290	3,399	55,689
Selangor	19,022	939	19,961	701	20,662
Negeri Sembilan	0	10,934	10,934	3,819	14,753
Melaka	0	7,149	7,149	4,348	11,497
Johor	0	4,010	4,010	229	4,239
Pahang	0	17,430	17,430	560	17,990
Terengganu	5,100	9,083	14,183	14,953	29,136
Kelantan	38,807	10,667	49,474	34,862	84,426
Sabah	0	17,163	17,163	32,937	50,100
Sarawak	0	15,136	15,136	128,764	143,900
Total	210,497	130,122	340,619	259,926	600,545

Source: MOA

Table 8 List of On-going Integrated Agricultural Development Project

Project	State	Proposed Agricultural Development Area (ha)	Main Crop
Perlis	Perlis	29,334	Paddy, Orchard
Muda I	Kedah/Perlis	95,855	Paddy
Muda II	Kedah/Perlis	the same area as Muda I	
Lembah Kedah	Kedah	355,500	Rubber, Paddy, Orchard
Balik Pulau/Seberang Prai	P. Pinang	77,619	Rubber, Paddy
Krian/Sg. Manik	Perak	66,240	Paddy
Tumboh Block	Perak	-	(pending)
Barat Laut Selangor	Selangor	82,044	Paddy, Oil palm, Cocoa, Coconuts
Negeri Sembilan Timur	N. Sembilan	166,392	Rubber, Coconuts
Melaka	Melaka	127,223	Rubber, Vegetables
Johor Barat I	Johor	134,037	Pineapple, Oil palm
Johor Barat II	Johor	137,294	Oil palm, Cocoa
Rompin/Endau	Johor/Pahang	-	(cancelled)
Pahang Barat	Pahang	1,224,602	Oil palm, Cocoa
Besut	Terengganu	10,122	Paddy
Kembu	Kelantan	54,228	Paddy
Kemasin Semarak	Kelantan	46,560	Paddy, Tobacco
Sg. Nal/Sg. Sokor	Kelantan	-	(pending)
Sg. Golok	Kelantan	-	(pending)
Sg. Samarahan	Sarawak	57,037	Oil palm, Cocoa
Kalaka Salibas	Sarawak	61,000	Oil palm, Cocoa
Total		2,725,087	

Source: MOA

Table 9 Trend of Rice Production, Consumption and Self-sufficiency Level in Malaysia

Year	Production ('000 tons)	Imports ('000 tons)	Consumption ('000 tons)	Population (million)	Per Capita Consumption (kg)	Self-sufficiency Level (%)
1978	966	394	1,304	13,201	99	74
1979	1,130	301	1,334	13,513	99	85
1980	1,318	203	1,485	13,879	108	89
1981	1,303	267	1,620	14,240	115	80
1982	1,098	391	1,606	14,610	111	76
1983	1,048	378	1,475	14,990	99	76
1984	940	494	1,436	15,364	94	70
1985	1,175	421	1,673	15,800	108	75
1986	1,122	215	1,313	16,206	81	85
1987	1,092	196	1,297	16,627	78	84
1988	1,161	290	1,501	17,059	88	77

Source: MOF, MOA, DOS and LPN

Table 10 Transfers on Rice in Malaysia in 1988

Unit: M$

	Imports	Domestic Supplies
Cost per ton (ex mill/c.i.f.)	836.0	1,077.0
Wholesale price per ton	950.0	852.0
Net gain/(loss) per ton	114.0	(225.0)
Quantity (million tons)	0.3	1.2
Total gain/(loss) (million)	34.2	(270.0)

Source: LPN and DOS

Table 11 Estimated Cost of Direct Assistance to Paddy and Rice Industry in Malaysia

Unit: M$ million

Direct Assistance	1982	1983	1984	1985	1986	1987	1988
Input Subsidies							
Fertilizer	112.6	92.4	62.9	82.2	98.4	76.6	73.6
Fertilizer delivery	6.7	5.4	10.7	4.9	7.6	6.0	5.8
Credit	14.9	24.9	22.1	18.55	18.0	15.0	14.8
Irrigation O & M	42.0	37.0	36.0	39.0	51.0	58.0	65.0
Mechanization	27.0	20.0	16.0	6.0	1.4	1.4	1.5
Subtotal	203.2	179.7	147.7	150.6	176.4	157.0	160.7
Output Subsidies							
Paddy bonus	180.0	175.0	164.0	201.0	210.0	218.0	223.0
LPN loss on local paddy	54.1	63.2	31.4	95.0	96.2	92.7	65.9
Subtotal	234.1	288.2	195.4	296.0	315.2	310.7	288.9
Total Cost	437.4	417.9	343.1	446.6	491.6	467.7	449.6

Source: MOA, LPN and MOF

Table 12 Guaranteed Minimum Offer Price for Paddy in Peninsular Malaysia

Unit: M$/100 kg

Year of change	Guaranteed Minimum Price	Minimum Offer Price*	Medium grain	Price Subsidy
1949	24.80			
1950/51	23.15			
1951/52	24.80			
1952/54	28.11			
1955/56	19.84			
1961/62	24.80			
1962/73	26.46			
20/7/73		38.03	31.42	
29/1/74		42.99	36.38	
2/08/74		46.30	39.68	
5/01/79		49.60	46.30	
10/1/80		49.60	46.30	16.54
16/7/80		49.60	46.30	16.54

Source: MOA
Remarks: *; Excluding the price subsidy of M$16.54/100 kg.

Table 13 Distribution of Idle Paddy Fields by State in Peninsular Malaysia in 1986

Unit: ha

State	Total Paddy Field	Idle Paddy Fields		
		Long Term	Off Season	Total
Perlis	25,750	1,580	–	1,580
Kedah	124,588	7,339	–	7,339
P. Pinang	17,815	4,017	–	4,017
Perak	55,689	10,466	2,666	13,132
Selangor	20,662	1,427	293	1,720
N. Sembilan	14,753	10,285	166	10,451
Melaka	11,497	3,250	3,334	6,584
Johor	4,239	2,018	881	2,899
Pahang	17,990	20,282	1,745	22,027
Terengganu	29,136	7,141	12,353	19,494
Kelantan	84,426	23,398	12,614	36,012
Total	406,545	91,203	34,052	125,255

Source: MOA and FOA

Table 14 Rehabilitated Idle Paddy Fields by State for 5MP Period

Unit: ha

State	Rehabilitated Area					Total
	1986	1987	1988	1989	1990*	
Perlis	–	–	–	–	–	–
Kedah	2,134	30	714	2,760	670	6,308
P. Pinang	2,021	1,250	1,294	2,342	294	7,201
Perak	36	859	472	1,180	805	3,352
Selangor	–	85	227	270	30	617
N. Sembilan	83	140	238	502	87	1,050
Melaka	–	160	150	4	24	338
Johor	–	120	85	35	38	278
Pahang	–	104	67	1,509	588	2,268
Terengganu	75	231	34	1,313	361	2,014
Kelantan	1,298	549	1,261	425	2,733	6,266
Total	5,647	3,528	4,542	10,340	5,630	29,687

Remarks: *; Estimated area
Source: FOA

Table 15 Progress of Unutilized Land Rehabilitation Project by FELCRA

State	Nos. of Projects	Area (ha)	Crops
Kedah	18	1,024	Oil palm
P. Pinang	13	293	Oil palm
Perak	9	1,216	Oil palm
Selangor	2	676	Oil palm/fruit/vegetables
N. Sembilan	63	2,340	Oil palm/cocoa/rubber
Melaka	31	881	Oil palm/cocoa
Pahang	18	872	Oil palm
Terengganu	3	228	Oil palm
Kelantan	6	286	Oil palm
Total	164	7,816	

Source: FELCRA

Table 16 Crops Planted under FELCRA Project

Unit: ha

State	Oil palm	Cocoa	Rubber	Fruit & vegetables	Total
Kedah	1,216	–	–	–	1,024
P. Pinang	92	201	–	–	293
Perak	1,216	–	–	–	1,216
Selangor	644	–	–	32	676
N. Sembilan	2,101	153	86	–	2,340
Melaka	631	250	–	–	881
Pahang	872	–	–	–	872
Terengganu	228	–	–	–	228
Kelantan	262	24	–	–	286
Total	7,070	628	86	32	7,816

Source: FELCRA

Table 17 Distribution of Non-granary Irrigation Schemes by Type of Diversion Structure

State	Gravity	Pump	Gravity & Pump	Control Drainage	Gravity & C. Drain	Inun-dation	Pump & Inundation	Others	Converted	No Record	Total
Perlis	16	2	1	3	-	-	-	-	-	-	22
Kedah	38	25	9	1	-	-	-	-	-	2	75
P. Pinang	5	5	2	1	-	1	-	-	-	-	14
Perak	51	12	-	-	-	-	-	-	-	-	63
Selangor	15	1	-	1	-	-	-	-	-	-	17
N. Sembilan	142	5	1	-	-	-	-	-	6	2	156
Malaka	48	2	-	2	-	-	-	-	2	-	54
Johor	12	11	-	-	-	-	-	-	-	-	23
Pahang	78	17	4	-	1	186	2	-	1	1	290
Terengganu	9	18	-	11	-	-	-	1	-	-	39
Kelantan	54	20	2	-	-	-	-	1	-	-	77
Sabah	23	26	2	4	-	-	-	1	-	-	56
Sarawak	3	9	-	26	-	-	-	-	-	-	38
Total	494	153	21	49	1	187	2	3	9	5	924

Table 18 Distribution of Non-granary Irrigation Schemes by Water Availability Condition

State	Sufficient for Double Cropping	Insufficient for Off Season Puddling Time	Limited to Main Season Cropping	Insuficient for Main Season Cropping	Control Drainage and Data Insufficient	Total
Perlis	5	12	2	-	3	22
Kedah	44	21	7	-	3	75
P. Pinang	15	5	2	-	6	14
Perak	43	14	6	-	-	63
Selangor	16	-	-	-	1	17
N. Sembilan	99	23	16	-	18	156
Melaka	9	34	4	1	6	54
Johor	15	5	3	-	-	23
Pahang	106	32	130	12	10	290
Terengganu	19	2	6	-	12	39
Kekutan	24	14	37	-	2	77
Sabah	45	2	4	-	5	56
Sarawak	10	-	-	-	28	38
Total	436	164	217	13	94	924

Table 19 Major Concerns about Introduction of Other Crops in Paddy Fields

Unit: Number (%)

Item	PR	KH	PP	PK	SG	NS	MA	JR	PH	TR	KN	SA	SK	Total
a. Finance	108	369	25	197	0	258	212	28	311	213	335	325	210	2,591
	(45)	(56)	(25)	(53)	(0)	(51)	(68)	(18)	(49)	(70)	(56)	(65)	(66)	(55)
b. Technique	47	151	18	90	0	55	158	14	84	81	98	197	149	1,142
	(19)	(23)	(18)	(24)	(0)	(11)	(51)	(9)	(13)	(27)	(16)	(39)	(47)	(24)
c. Marketing	46	234	19	151	1	79	168	25	119	147	279	108	199	1,575
	(19)	(36)	(19)	(40)	(3)	(16)	(54)	(16)	(19)	(48)	(47)	(22)	(62)	(33)
d. Labour	26	154	21	109	13	289	152	26	356	73	87	71	37	1,414
	(11)	(24)	(21)	(29)	(33)	(57)	(49)	(17)	(56)	(24)	(15)	(14)	(12)	(30)
e. Others	108	112	26	83	12	92	20	24	183	110	203	37	44	1,054
	(45)	(17)	(26)	(22)	(30)	(18)	(6)	(16)	(29)	(36)	(34)	(7)	(14)	(22)
f. None	20	77	39	82	14	105	49	84	66	17	18	84	45	700
	(8)	(12)	(39)	(22)	(35)	(21)	(16)	(55)	(10)	(6)	(3)	(17)	(14)	(15)
Total No. of Responses*	355	1,097	148	712	40	878	759	201	1,119	641	1,020	822	684	8,476
	(147)	(168)	(148)	(191)	(100)	(174)	(244)	(132)	(177)	(210)	(171)	(165)	(214)	(179)
Total No. of Respondents	242	654	100	373	40	504	311	152	631	305	597	499	320	4,728

Remarks: *; Multiple answers are given.
PR; Perlis, KH; Kedah, PP; Pulau Pinang, PK; Perak, SG; Selangor,
NS; Negeri Sembilan, MA; Melaka, JR; Johor, PH; Pahang, TR; Terengganu,
KN; Kelantan, SA; Sabah, SK; Sarawak

Table 20 Farmers' Opinions on Crop Diversification

Unit: Number (%)

Item	PR	KH	PP	PK	SG	NS	MA	JR	PH	TR	KN	SA	SK	Total
a. Repair drains/better drainage system	58 (24)	42 (6)	0 (0)	5 (1)	0 (0)	1 (0)	13 (4)	9 (6)	18 (3)	59 (19)	25 (4)	20 (4)	44 (14)	294 (6)
b. Improve or extend roads	11 (5)	4 (1)	0 (0)	2 (1)	2 (5)	1 (0)	1 (0)	4 (3)	8 (1)	7 (2)	36 (6)	14 (3)	15 (5)	105 (2)
c. More mechanization and modernized farming	5 2	1 0	2 2	6 2	8 20	3 1	4 1	3 2	43 7	23 8	175 29	52 10	30 9	355 8
d. More knowledge about farming and introduction of modern technique	18 (7)	43 (7)	1 (1)	18 (5)	0 (0)	6 (1)	10 (3)	5 (3)	20 (3)	21 (7)	195 (33)	36 (7)	21 (7)	394 (8)
e. Increase Govt. help fore more crops harvest	12 (5)	29 (5)	19 (19)	7 (2)	2 (5)	34 (7)	52 (17)	18 (12)	83 (13)	89 (29)	189 (31)	111 (22)	68 (22)	713 (15)
f. Supply agricultural inputs	39 (17)	21 (3)	1 (1)	22 (6)	1 (3)	16 (3)	49 (16)	6 (4)	19 (3)	32 (11)	182 (30)	120 (24)	76 (23)	584 (12)
g. Better market for their crops	5 (2)	2 (0)	5 (5)	5 (1)	0 (0)	2 (0)	17 (5)	3 (2)	5 (1)	20 (7)	26 (4)	4 (1)	7 (2)	101 (2)
h. Promote crop diversification project	24 (10)	59 (9)	5 (5)	39 (10)	1 (3)	48 (10)	23 (7)	3 (2)	21 (3)	3 (1)	14 (2)	33 (7)	19 (6)	292 (6)
i. Introduce other crops which require less manpower and care	29 11	17 3	13 13	35 9	0 0	29 5	26 8	7 4	29 4	6 2	9 1	22 4	15 5	237 4
j. Introduce crops which are more profitable with better yield	12 (5)	25 (4)	4 (4)	39 (10)	1 (3)	30 (6)	21 (7)	7 (5)	20 (3)	7 (2)	10 (2)	15 (3)	17 (5)	208 (4)
k. Conduct surveys and plant crops which are suitable for paddy field	13 (5)	67 (10)	6 (6)	62 (17)	6 (15)	90 (18)	37 (12)	14 (9)	117 (18)	8 (3)	44 (7)	53 (11)	35 (11)	552 (11)
l. Project to be formunated to increase income	15 (6)	30 (5)	4 (4)	21 (6)	0 (0)	12 (2)	4 (1)	3 (2)	15 (2)	1 (0)	16 (3)	33 (7)	46 (14)	200 (4)
m. Good irrigation water supply better irrigation	56 (23)	102 (16)	1 (1)	15 (4)	0 (0)	12 (2)	17 (5)	25 (16)	34 (5)	32 (10)	78 (13)	64 (13)	35 (11)	471 (10)
n. Recommendation on group farming	4 (2)	25 (4)	3 (3)	12 (3)	1 (3)	7 (1)	73 (23)	4 (3)	44 (7)	4 (1)	1 (0)	5 (1)	1 (0)	184 (4)
o. Prevention of major problems like pests and predator animals	4 (2)	6 (1)	2 (2)	15 (4)	0 (0)	9 (2)	6 (2)	3 (2)	24 (4)	24 (8)	20 (3)	5 (1)	6 (2)	124 (3)
p. Land improvement/ make the most of it	8 (3)	3 (0)	2 (2)	5 (1)	0 (0)	11 (2)	14 (5)	2 (1)	29 (5)	9 (3)	9 (2)	16 (3)	6 (2)	114 (2)
q. Paddy field not suitable for other crops	9 (2)	153 (23)	17 (17)	28 (8)	6 (15)	42 (8)	75 (24)	5 (3)	54 (9)	9 (3)	1 (0)	7 (1)	1 (0)	407 (9)
r. Paddy staple food - cannot change	0 (0)	25 (4)	4 (4)	3 (1)	1 (3)	31 (6)	24 (8)	6 (4)	22 (3)	1 (0)	0 (0)	14 (3)	3 (1)	134 (3)
s. No suggestion	23 (10)	96 (15)	28 (28)	130 (35)	15 (38)	156 (31)	41 (13)	41 (27)	154 (24)	52 (17)	95 (16)	120 (24)	51 (16)	1,002 (21)
t. Others	25 (9)	46 (7)	19 (19)	56 (15)	4 (11)	66 (12)	66 (23)	21 (14)	98 (15)	29 (10)	47 (8)	49 (9)	44 (13)	570 (10)
Total No. of Responses*	370 (153)	796 (122)	136 (136)	525 (141)	48 (120)	606 (120)	573 (184)	189 (124)	857 (136)	436 (143)	1,172 (196)	793 (159)	540 (169)	7,041 (149)
Total No. of Respondents	242	654	100	373	40	504	311	152	631	305	597	499	320	4,728

Remarks: *; Multiple answers are given.
PR; Perlis, KH; Kedah, PP; Pulau Pinang, PK; Perak, SG; Selangor,
NS; Negeri Sembilan, MA; Melaka, JR; Johor, PH; Pahang, TR; Terengganu,
KN; Kelantan, SA; Sabah, SK; Sarawak

Table 21 Distribution of Non-granary Irrigation Schemes based on Super Category by State

State	Category 1		2		3		4		5		6		7		8		Total	
	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)
Perlis	3	503	2	476	5	331	0		0		11	2,500	1	405	0		22	4,215
Kedah	4	449	21	3,556	9	435	0		0		11	6,646	30	6,037	0		75	17,123
Pulau Pinang	6	496	0		5	2,626	0		0		0		3	419	0		14	3,541
Perak	6	825	37	4,481	6	270	0		0		10	3,771	4	3,375	0		63	12,722
Selangor	0		10	393	0		0		0		0		7	546	0		17	939
Negeri Sembilan	14	402	140	10,223	0		0		0		1	134	1	175	0		156	10,934
Melaka	9	867	39	5,115	1	140	0		0		0		5	1,027	0		54	7,149
Johor	9	629	5	2,120	3	94	0		0		4	771	2	396	0		23	4,010
Pahang	77	5,115	45	2,487	0		0		0		2	1,307	18	1,773	148	6,748	290	17,430
Trengganu	0		13	1,564	5	292	0		0		8	5,370	12	1,825	1	32	39	9,083
Kelantan	16	644	18	1,468	12	431	0		0		11	2,341	20	5,783	0		77	10,667
Sabah	0		3	371	0		0		0		16	5,601	32	10,876	5	315	56	17,163
Sarawak	0		1	120	0		0		0		0		37	15,016	0		38	15,136
Total	144	9,930	334	32,374	46	4,619	0	0	0	0	74	28,441	172	47,653	154	7,095	924	130,112

Remarks : Category
1 Schemes converted to high-value upland cropping areas
2 Schemes converted to perennial cropping areas
3 Schemes converted to two cropping areas
4 Schemes converted to animal raising areas
5 Schemes converted to freshwater fish ponds
6 Schemes used as mini-granary areas
7 Schemes temporarily maintained as paddy growing areas
8 Schemes converted to non-agricultural fields

Table 22 Distribution of Non-granary Irrigation Schemes with Second Priority Potential Categories by State

State	Possible Category 1 Nos	1 Area (ha)	2 Nos	2 Area (ha)	3 Nos	3 Area (ha)	4 Nos	4 Area (ha)	5 Nos	5 Area (ha)	6 Nos	6 Area (ha)	7 Nos	7 Area (ha)	8 Nos	8 Area (ha)	Total Nos	Total Area (ha)
Perlis	9	996	10	2,192	5	897	0		0		0		3	501	0		27	4,586
Kedah	12	1,064	37	11,458	3	629	0		1	40	0		13	2,174	0		66	15,365
Pulau Pinang	0		11	3,122	6	496	0		0		0		0		0		17	3,618
Perak	20	1,645	14	4,547	11	1,588	0		7	260	0		19	3,412	0		71	11,452
Selangor	0		6	396	0		0		8	257	0		0		0		14	653
Negeri Sembilan	0		9	335	6	201	0		34	728	0		41	5,938	0		90	7,202
Melaka	0		13	1,874	5	363	0		0		0		29	4,731	0		47	6,968
Johor	6	703	4	264	7	1,054	0		1	44	0		3	573	0		21	2,638
Pahang	0		39	3,375	16	1,132	0		0		0		14	780	0		69	5,287
Trengganu	12	661	8	5,370	2	85	0		0		0		5	993	0		27	7,109
Kelantan	13	885	10	1,530	14	995	0		1	49	0		16	1,403	0		54	4,862
Sabah	0		17	7,444	0		0		0		0		1	40	0		18	7,484
Sarawak	6	4,882	7	5,609	1	115	0		3	444	0		0		0		17	11,050
Total	78	10,836	185	47,516	76	7,555	0	0	55	1,822	0	0	144	20,545	0	0	538	88,274

Remarks : Category
1 Schemes converted to high-value upland cropping areas
2 Schemes converted to perennial cropping areas
3 Schemes converted to two cropping areas
4 Schemes converted to animal raising areas
5 Schemes converted to freshwater fish ponds
6 Schemes used as mini-granary areas
7 Schemes temporarily maintained as paddy growing areas
8 Schemes converted to non-agricultural fields

Table 23 Distribution of Non-granary Irrigation Schemes with Third Priority Potential Categories by State

State	Possible Category																Total	
	1		2		3		4		5		6		7		8			
	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)
Perlis	3	432	7	1,047	3	432	0		0		0		7	809	0		20	2,720
Kedah	0		8	852	0		0		9	313	0		9	435	0		26	1,600
Pulau Pinang	0		0		0		0		0		0		6	496	0		6	496
Perak	0		9	1,497	0		0		24	1,333	0		13	1,143	0		46	3,973
Selangor	0		0		0		0		6	396	0		1	30	0		7	426
Negeri Sembilan	0		6	201	0		0		5	116	0		7	211	0		18	528
Melaka	0		0		0		0		0		0		9	867	0		9	867
Johor	0		6	833	0		0		2	83	0		5	337	0		13	1,253
Pahang	0		0		0		0		0		0		18	1,161	0		18	1,161
Trengganu	0		2	102	0		0		0		0		8	432	0		10	534
Kelantan	0		22	819	0		0		6	187	0		25	972	0		53	1,978
Sabah	0		0		0		0		0		0		0		0		0	0
Sarawak	0		5	2,818	0		0		0		0		0		0		5	2,818
Total	3	432	65	8,169	3	432	0	0	52	2,428	0	0	108	6,893	0	0	231	18,354

Remarks : Category
1 Schemes converted to high-value upland cropping areas
2 Schemes converted to perennial cropping areas
3 Schemes converted to two cropping areas
4 Schemes converted to animal raising areas
5 Schemes converted to freshwater fish ponds
6 Schemes used as mini-granary areas
7 Schemes temporarily maintained as paddy growing areas
8 Schemes converted to non-agricultural fields

Table 24 Distribution of Non-granary Irrigation Schemes with Potential Categories requiring Extensive Marketing Promotion by State

State	Possible Category																Total	
	1		2		3		4		5		6		7		8			
	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)	Nos	Area (ha)
Perlis	5	1,726	1	405	4	1,403	0		0		0		0		0		10	3,534
Kedah	14	8,105	1	500	13	7,935	0		0		0		0		0		28	16,540
Pulau Pinang	5	2,626	0		0		0		0		0		0		0		5	2,626
Perak	25	5,259	0		20	4,959	0		0		0		0		0		45	10,218
Selangor	1	69	1	150	1	69	0		0		0		0		0		3	288
Negeri Sembilan	9	1,249	0		8	1,196	0		0		0		0		0		17	2,445
Melaka	11	2,937	1	148	1	33	0		0		0		0		0		13	3,118
Johor	3	1,932	1	100	2	458	0		0		0		0		0		6	2,490
Pahang	9	2,957	0		4	1,627	0		0		0		0		0		13	4,584
Trengganu	13	6,534	5	325	12	6,332	0		0		0		0		0		30	13,191
Kelantan	27	6,610	9	1,589	27	6,610	0		0		0		0		0		63	14,809
Sabah	0		0		0		0		1	21	0		0		0		1	21
Sarawak	0		0		0		0		7	6,270	0		0		0		7	6,270
Total	122	40,004	19	3,217	92	30,622	0	0	8	6,291	0	0	0	0	0	0	241	80,134

Remarks : Category
1 Schemes converted to high-value upland cropping areas
2 Schemes converted to perennial cropping areas
3 Schemes converted to two cropping areas
4 Schemes converted to animal raising areas
5 Schemes converted to freshwater fish ponds
6 Schemes used as mini-granary areas
7 Schemes temporarily maintained as paddy growing areas
8 Schemes converted to non-agricultural fields

Figures

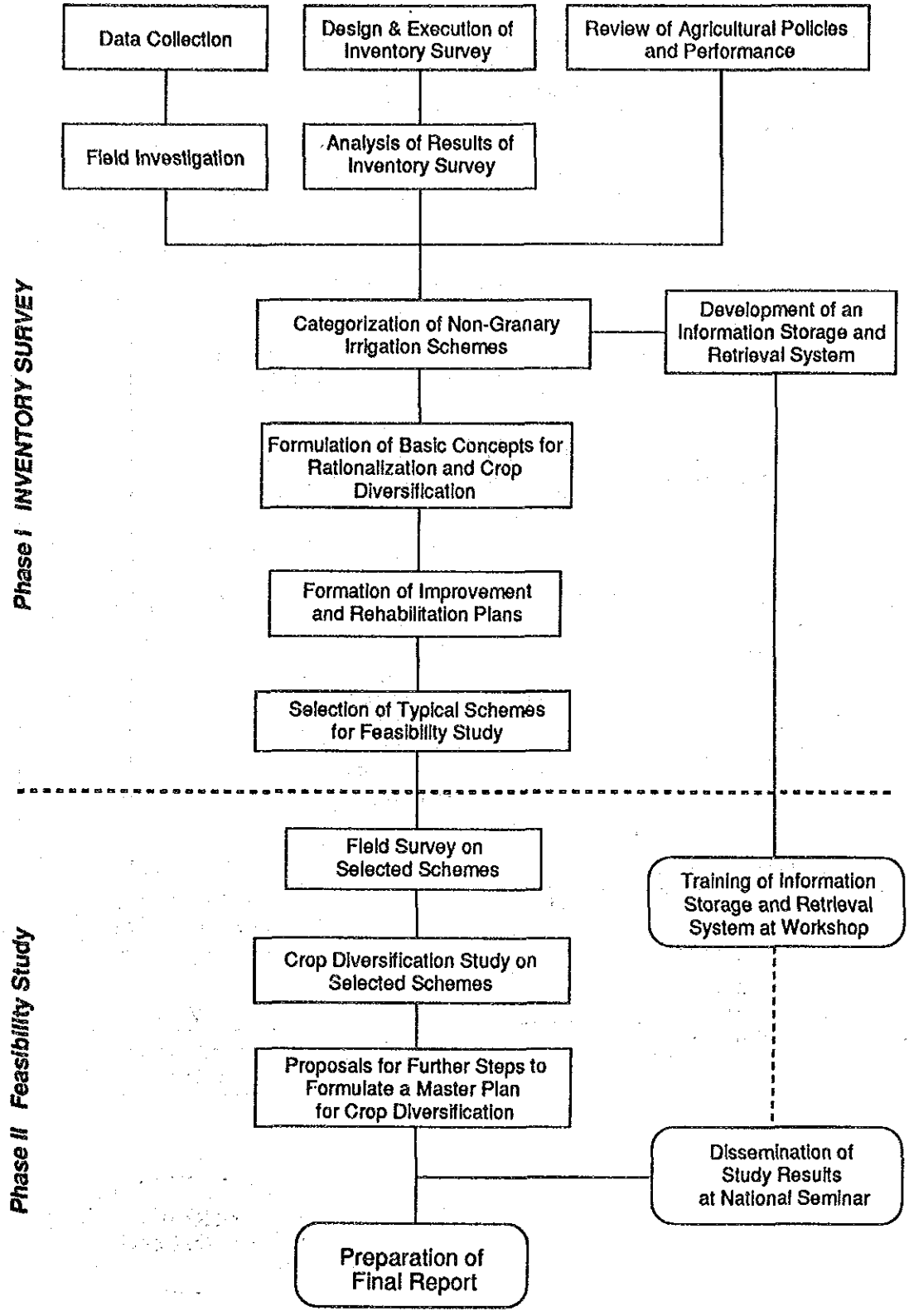

Fig. 1
Flow Chart of the Study

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

Japan International Cooperation Agency

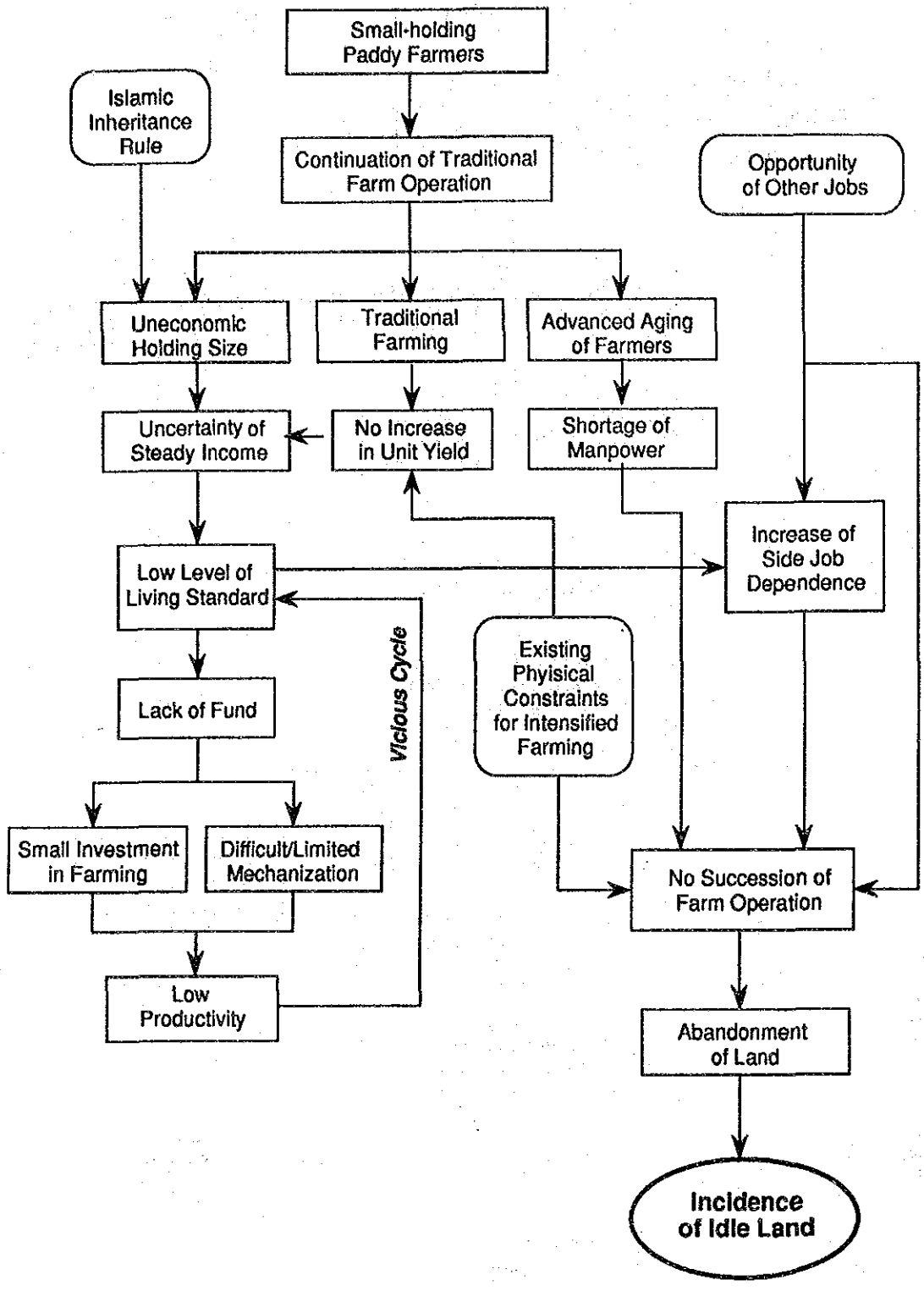

Fig. 2
Incidence Mechanism of Idle Land

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

Japan International Cooperation Agency

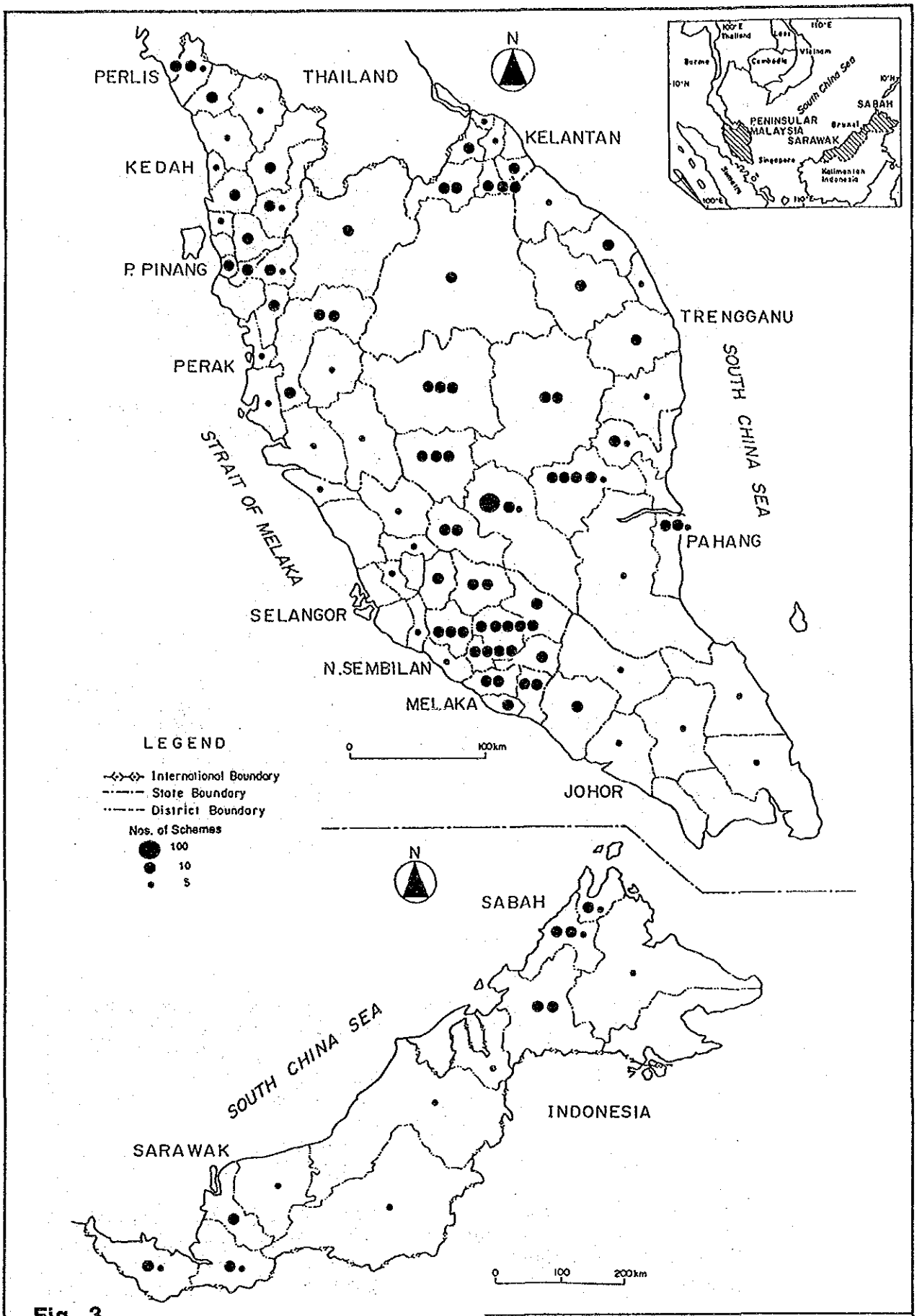

Fig. 3

Distribution of Non-granary Irrigation Schemes by District

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

Japan International Cooperation Agency

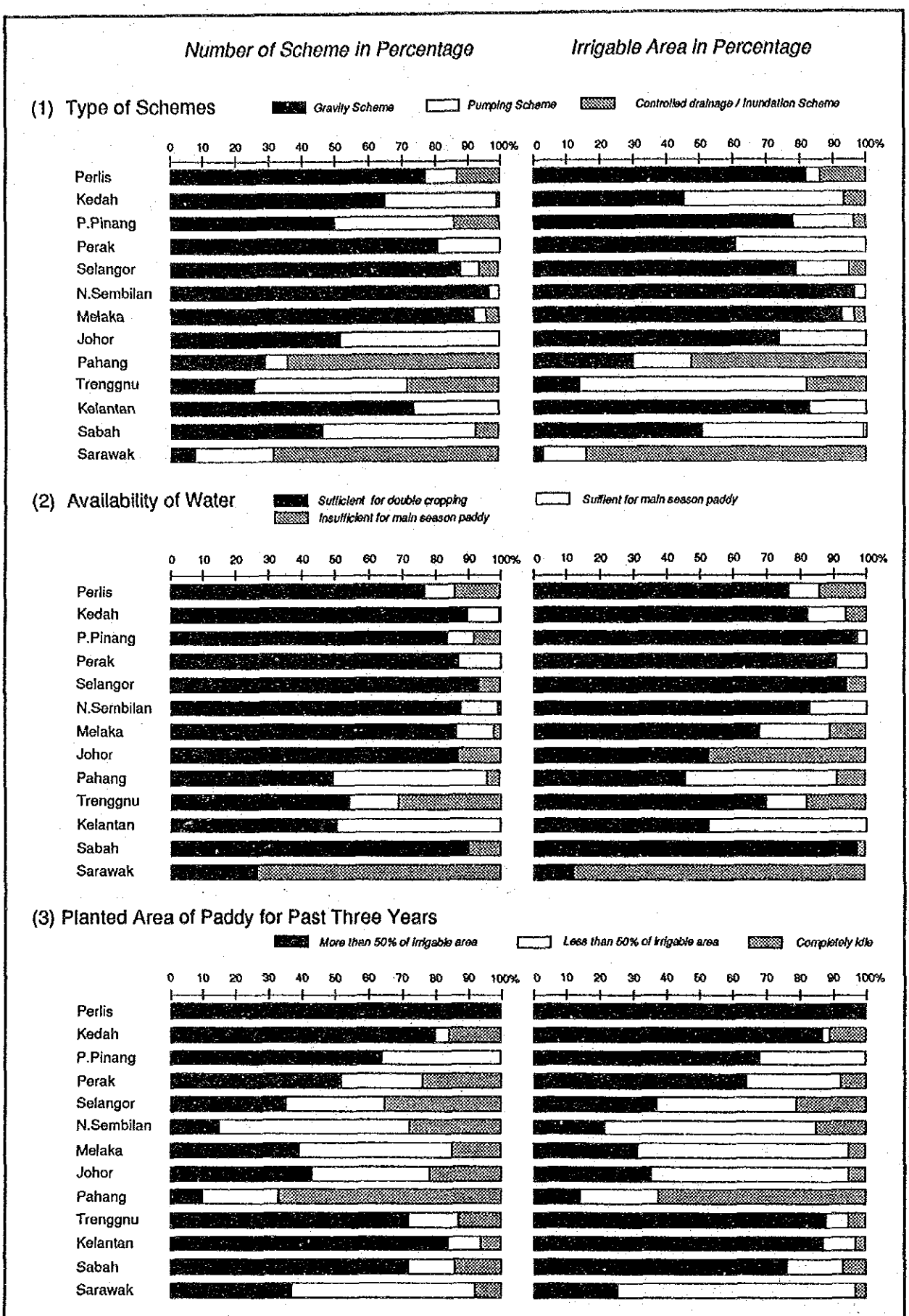

Fig. 4

Present Situation of Non-granary Irrigation Scheme by State

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

Japan International Cooperation Agency

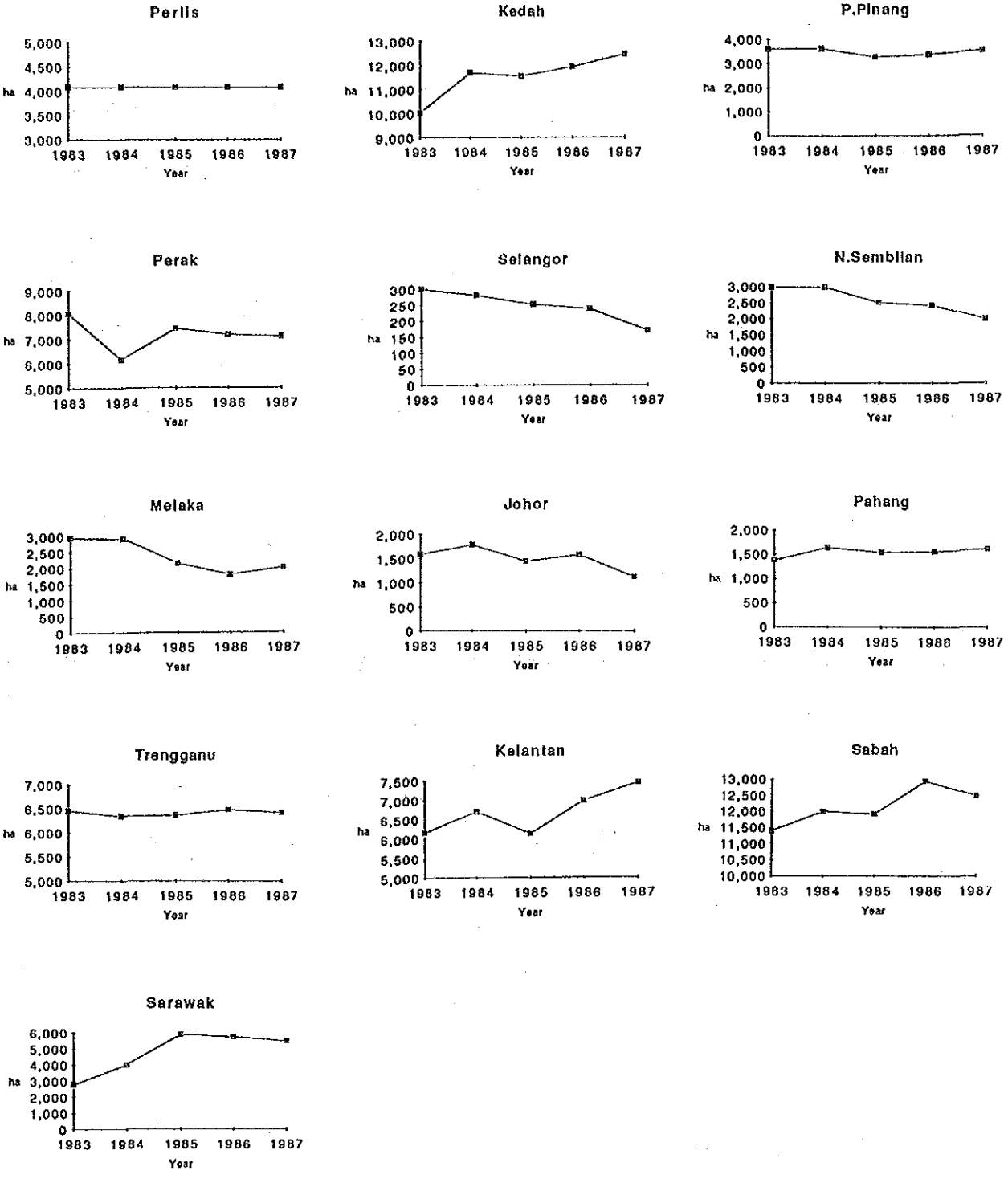

Fig. 5
Trend of Planted Area of Paddy by State

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

Japan International Cooperation Agency

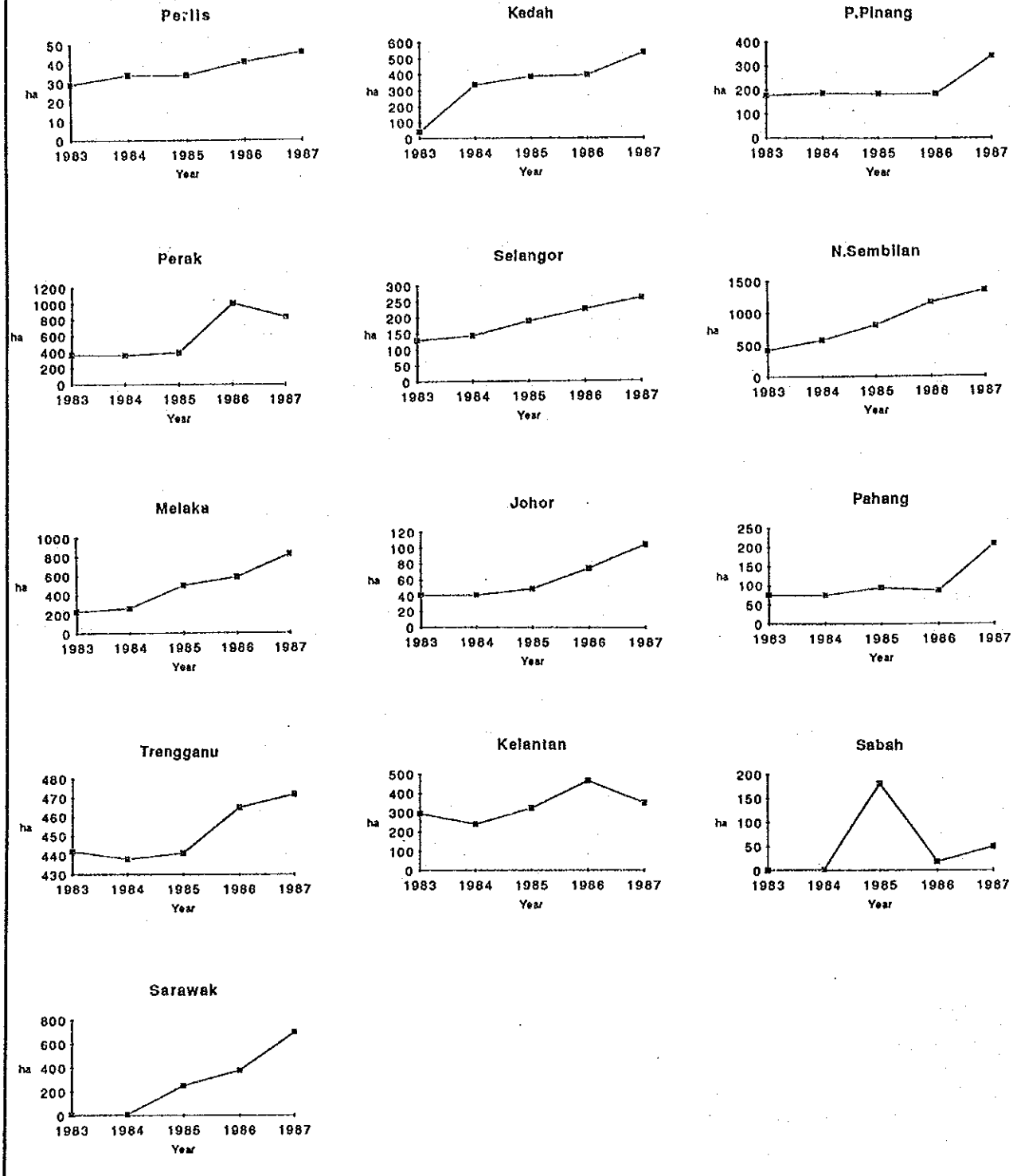

Fig. 6

Trend of Planted Area of Upland Crops by State

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

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Fig. 7

Criteria and Procedure of Evaluation for Crop Diversification Potential

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

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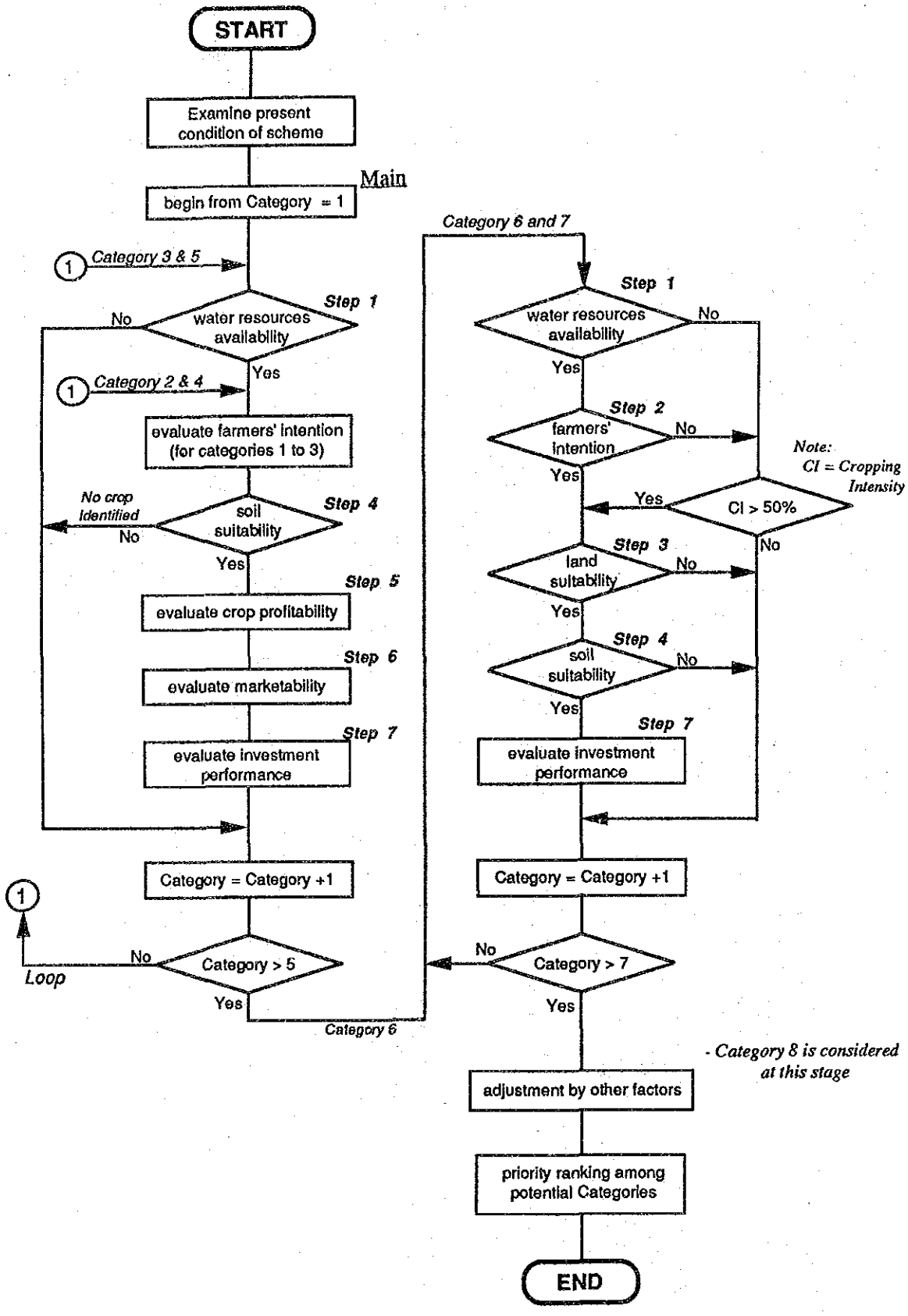


Fig. 8

General Flow of Evaluation for Crop Diversification Potential

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

Japan International Cooperation Agency

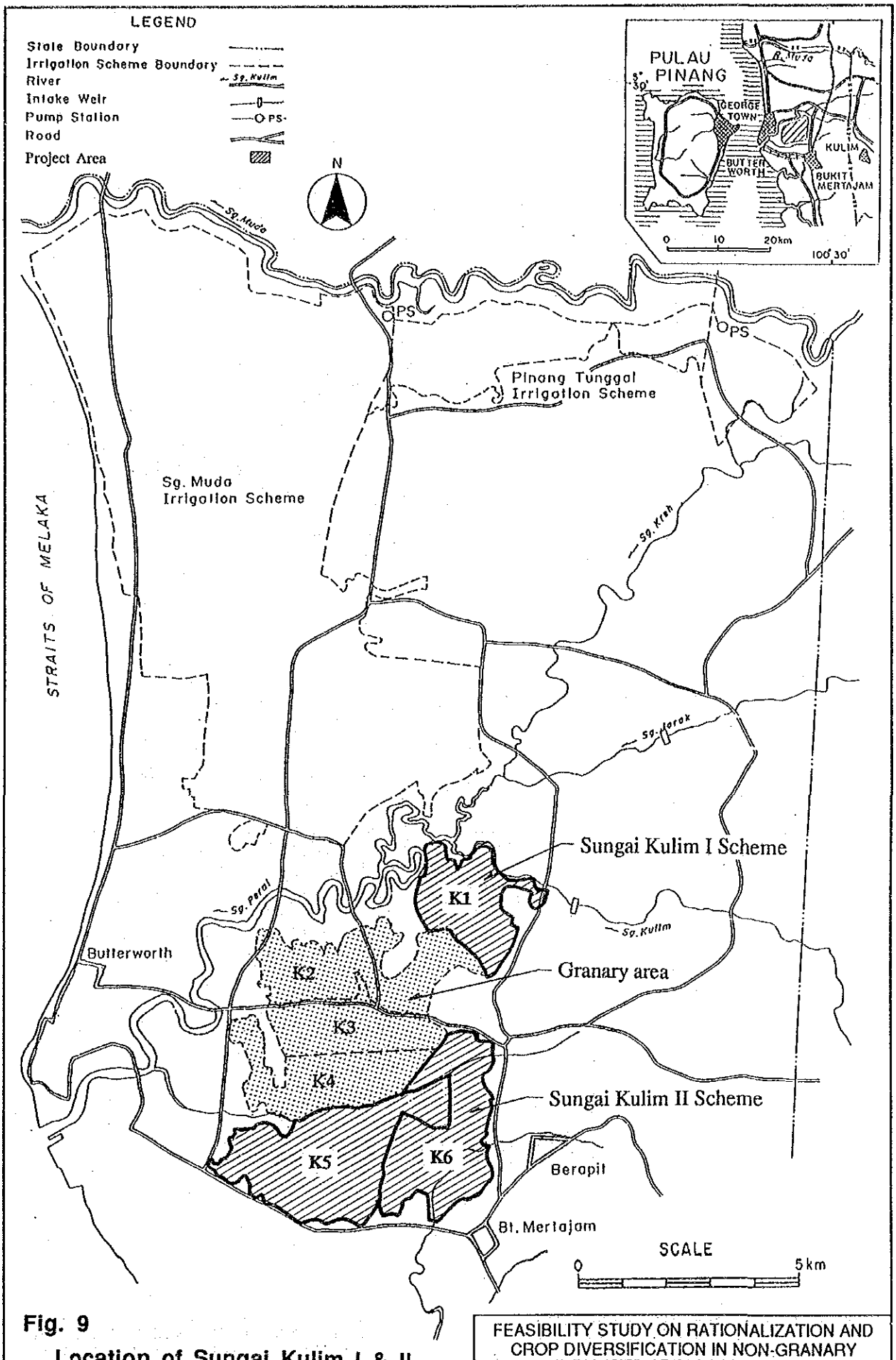
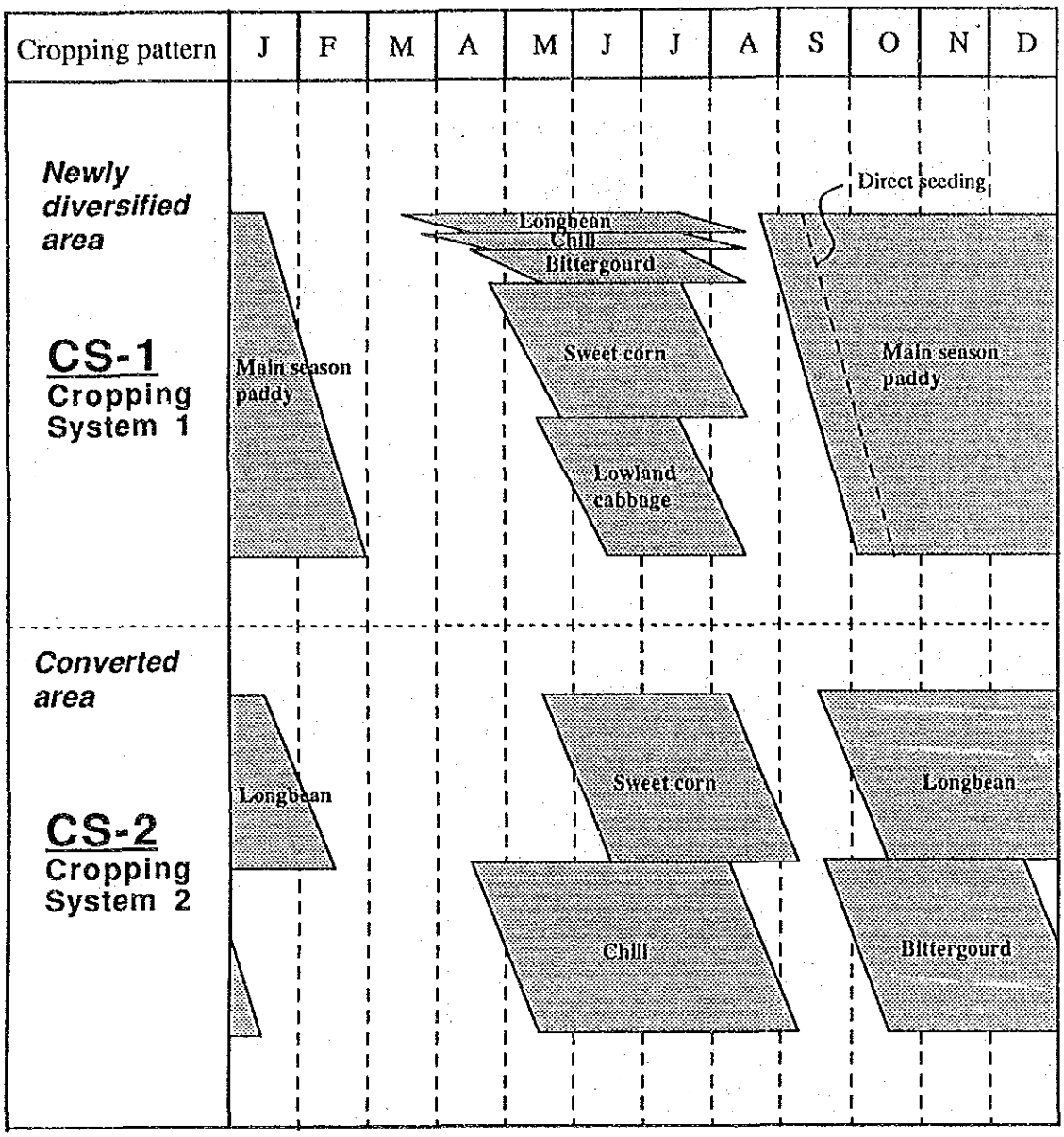


Fig. 9

Location of Sungai Kulim I & II Schemes

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

Japan International Cooperation Agency



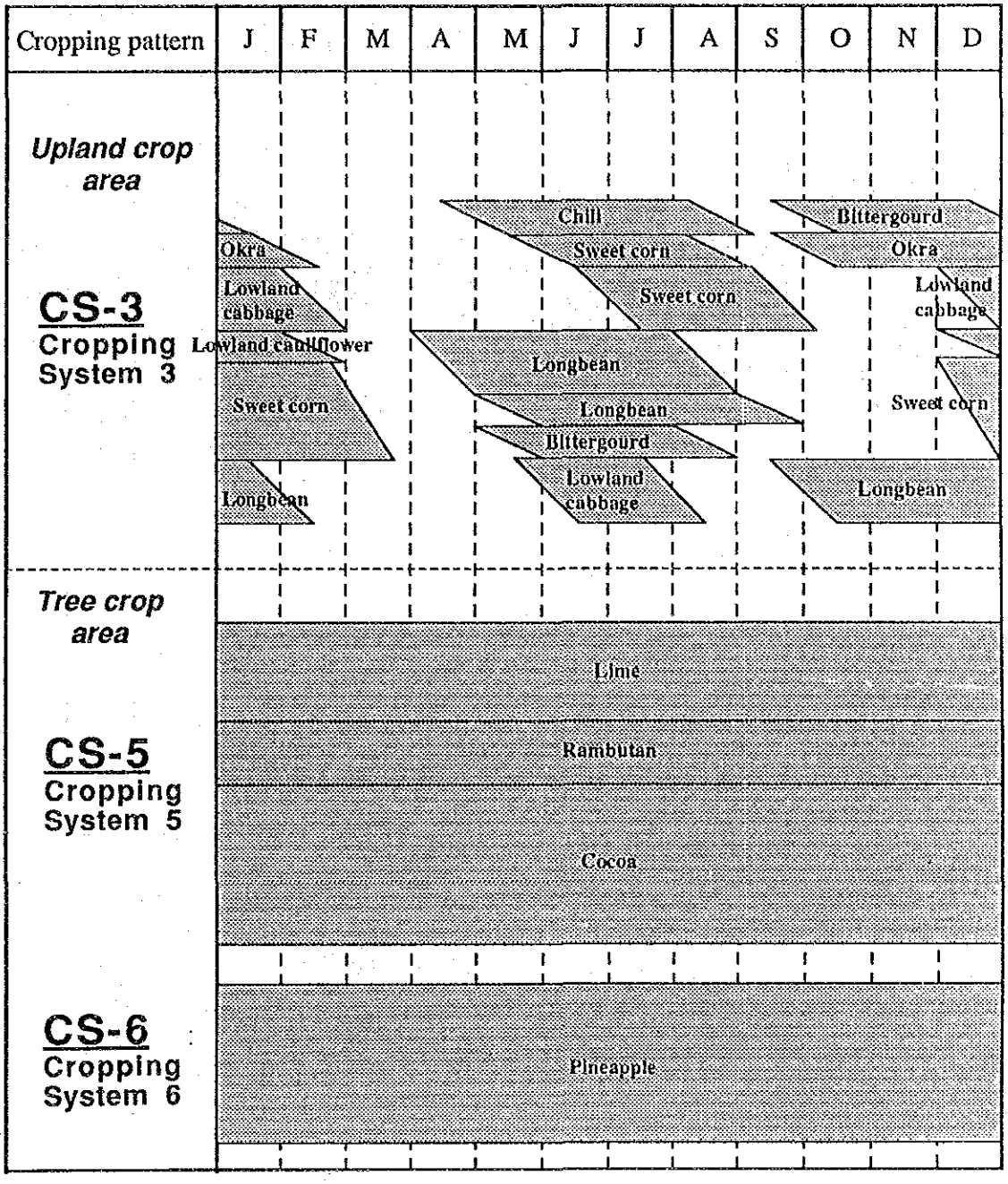
Cropping Pattern A

Fig. 10

Proposed Cropping Calendar for Initial Stage for the Kulim Area

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

Japan International Cooperation Agency



Cropping Pattern B

Fig. 11

Proposed Cropping Calendar for Transition Stage for the Kulim Area

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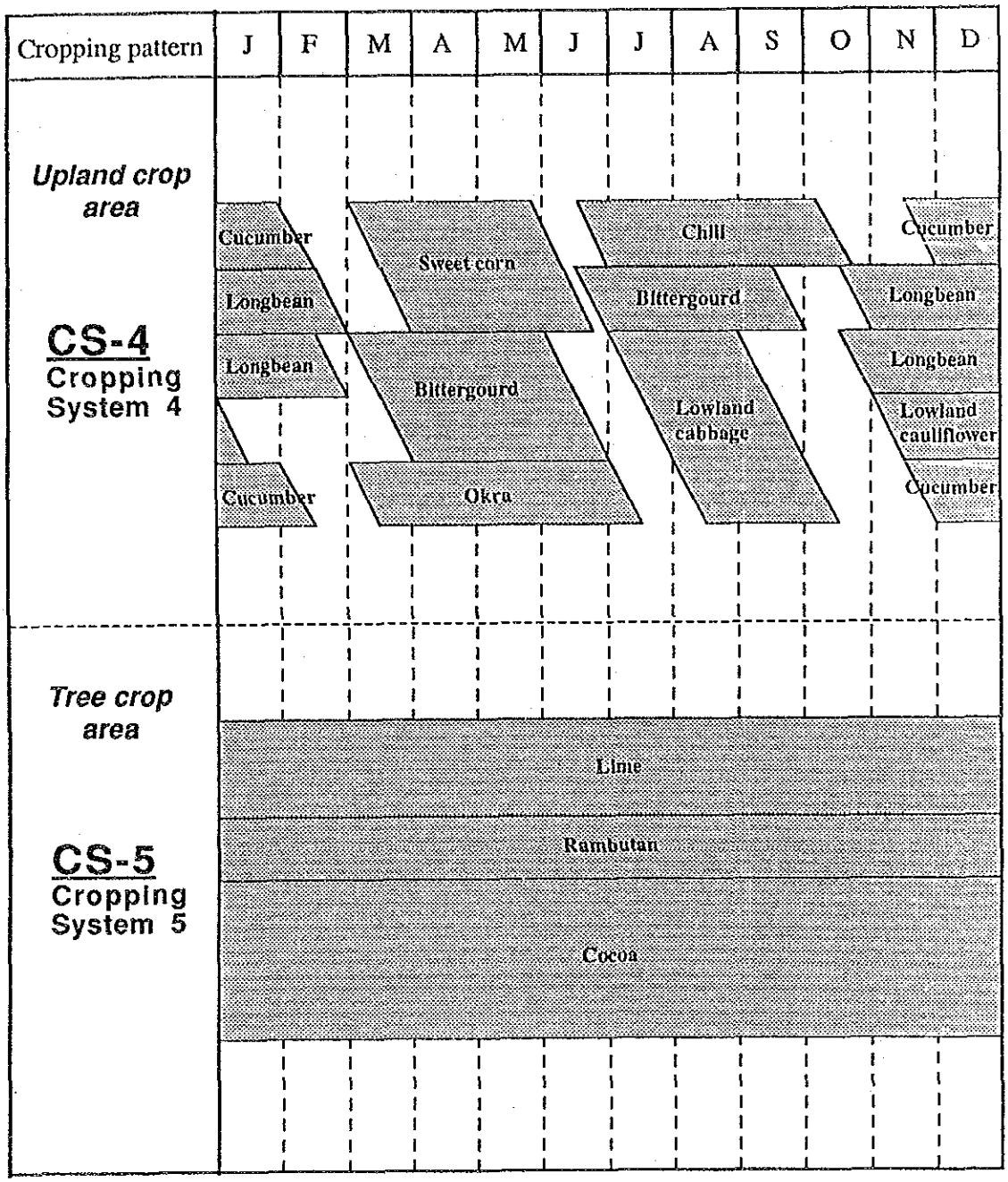

Cropping Pattern C

Fig. 12
Proposed Cropping Calendar for Final Stage for the Kulim Area

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Appendix

Scope of Work for the Study

SCOPE OF WORK

FOR

THE FEASIBILITY STUDY

ON

RATIONALIZATION AND CROP DIVERSIFICATION

IN

NON-GRANARY IRRIGATED AREAS

IN MALAYSIA

AGREED UPON BETWEEN

THE ECONOMIC PLANNING UNIT

OF

THE PRIME MINISTER'S DEPARTMENT

ON BEHALF OF

THE GOVERNMENT OF MALAYSIA

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Kuala Lumpur

20th July, 1988

HUSMI BIN MOHD NOOR
DEPUTY DIRECTOR-GENERAL,
ECONOMIC PLANNING UNIT,
PRIME MINISTER'S DEPARTMENT,
on behalf of
THE GOVERNMENT OF MALAYSIA

SEIEI SAKAUE
LEADER,
PRELIMINARY SURVEY TEAM
on behalf of
JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of Malaysia, the Government of Japan has decided to conduct a Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas (hereinafter referred to as "the Study"), and in accordance with the relevant laws and regulations in force in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities of Malaysia.

The present document sets forth the Scope of Work with regard to the Study.

II. OBJECTIVES OF THE STUDY

1. To carry out an Inventory Survey of the existing non-granary irrigated areas in Malaysia.

2. To carry out the Feasibility Study on selected representative schemes for the purpose of maximising returns from these schemes through crop diversification.

III. SCOPE OF THE STUDY

1. Study Area

The Study covers 847 schemes in the existing non-granary irrigated areas operated and maintained by the Drainage and Irrigation Department, Malaysia (hereinafter referred to as "DID").

2. Scope of the Study

The Study consists of the following two phases.

1) Phase I : Inventory Survey

(1) To make preparatory works for survey and investigation such as determination of items to be surveyed and investigated, preparation of forms for data compilation, establishment of evaluation criteria, etc.

(2) To carry out survey and investigation in the non-granary irrigated schemes with regard to the following items.

- Meteorology and Hydrology
- Topography, soil and land suitability
- Land use
- Irrigation and Drainage and other agricultural infrastructures
- Land holding and tenure system
- Population and socio-economy
- Farmers' economy
- Agricultural supporting services
- Other agricultural and farming conditions

(3) To review and evaluate programmes and/or projects that have been undertaken to promote crop diversification and other agricultural development utilizing idle paddy schemes.

(4) To compile the results of survey and investigation and to categorize the constraints and problems.

(5) To select representative schemes for the feasibility study for crop diversification in phase II.

(6) To develop an information storage and retrieval system.

2) Phase II : Feasibility Study

The phase II study shall be carried out on the selected schemes for crop diversification focusing on the improvement and/or rehabilitation of the irrigation/drainage facilities.

(1) To collect additional data and information relevant to the selected schemes.

(2) To formulate detailed agricultural development plans for the selected schemes including preliminary design of facilities and operation/maintenance plans.

(3) To propose suitable implementation schedule of these schemes in due consideration of on-going farming operation.

(4) To carry out cost estimation for the selected schemes.

(5) To carry out economic analysis of the schemes together with the evaluation of social, economic and environmental impacts.

(6) To propose suitable farm management, marketing systems and agricultural supporting services required for the selected schemes.

(7) To propose further steps that are required to be undertaken for the formulation of a Master Plan for the crop diversification of non-granary irrigated areas.

IV. SCHEDULE OF THE STUDY

The Study will be conducted in accordance with the attached tentative schedule.

V. REPORTS

1. JICA shall prepare and submit the following reports in English to the Government of Malaysia.

(1) Inception Report : 25 copies at the commencement of the phase I study.

(2) Progress Report (I) : 25 copies at the end of the second field work in phase I study.

(3) Interim Report : 25 copies at the end of the phase I study.

(4) Progress Report (II) : 25 copies at the end of the field work in phase II study.

(5) Draft Final Report : 25 copies at the end of the phase II study.

The Government of Malaysia will provide JICA with its comments within one month after the receipt of the Draft Final Report.

(6) Final Report : 100 copies within two months after the receipt of the Government of Malaysia's comments on the Draft Final Report.

2. The Japanese Study team shall ensure that all data, information, maps, materials and findings connected with the Study are kept confidential and not disposed of or revealed to any third party except with the prior written consent of the Government of Malaysia. Such maps and aerial photographs are to be returned to the Government of Malaysia immediately upon completion of the Study. All reports when finalized and submitted to the Government of Malaysia shall remain the property of the Government of Malaysia.

VI. UNDERTAKINGS OF THE GOVERNMENT OF MALAYSIA

To facilitate the smooth conduct of the Study, the Government of Malaysia shall take the following necessary measures:

1. To inform the members of the Japanese study team of any existing risk in the Study area and to take any measures deemed necessary to secure the safety of the Japanese study team.

2. To secure the necessary entry permits for the Japanese study team to conduct field survey in Malaysia and exempt them from consular fees.

3. To exempt the members of the Japanese study team from taxes and duties, as normally accorded under the provision of Malaysian General Circular No. 1 of 1979, on equipment, machinery and other materials brought into and out of Malaysia for the conduct of the Study.

4. To exempt the members of the Japanese study team from Malaysian income tax on their official emoluments in respect of their period of assignment in Malaysia in connection with the conduct of the Study, but the Government of Malaysia shall retain the right to take such emoluments into account for the purpose of assessing the amount to be applied to income from other sources.

5. To provide the necessary facilities to the Japanese study team for remittance as well as utilization of funds introduced into Malaysia from Japan in connection with the conduct of the Study.

6. To secure permission for entry into private properties or restricted areas for the conduct of the Study.

7. To provide the Japanese study team with medical services when needed but the expenses will be chargeable to the members of the Japanese study team.

8. To make arrangements for the Japanese study team to take back to Japan the data, maps and materials connected with the Study, subject to the approval of the Government of Malaysia, in order to prepare the reports.

9. To provide the Japanese study team with available data, maps and information necessary for the execution of the Study.

10. To appoint counterpart personnel to the Japanese study team during the Study period.

11. To provide the Japanese study team with suitable office space with clerical service and necessary office equipment in Kuala Lumpur and the project area.

12. To provide the Japanese study team with adequate means of local transport for official travel only.

13. To indemnify any members of the Japanese study team in respect of damages arising from any legal action against him in relation to any act performed or omissions made in undertaking the Study except when the two Governments agree that such a member is guilty of gross negligence or wilful misconduct.

14. To nominate DID to act as the main counterpart agency for the Study and the Economic Planning Unit as the main coordinating body in relation to other relevant Governmental and non-Governmental organisations.

VII. UNDERTAKINGS OF JICA

In order to conduct the Study, JICA shall take the following measures:

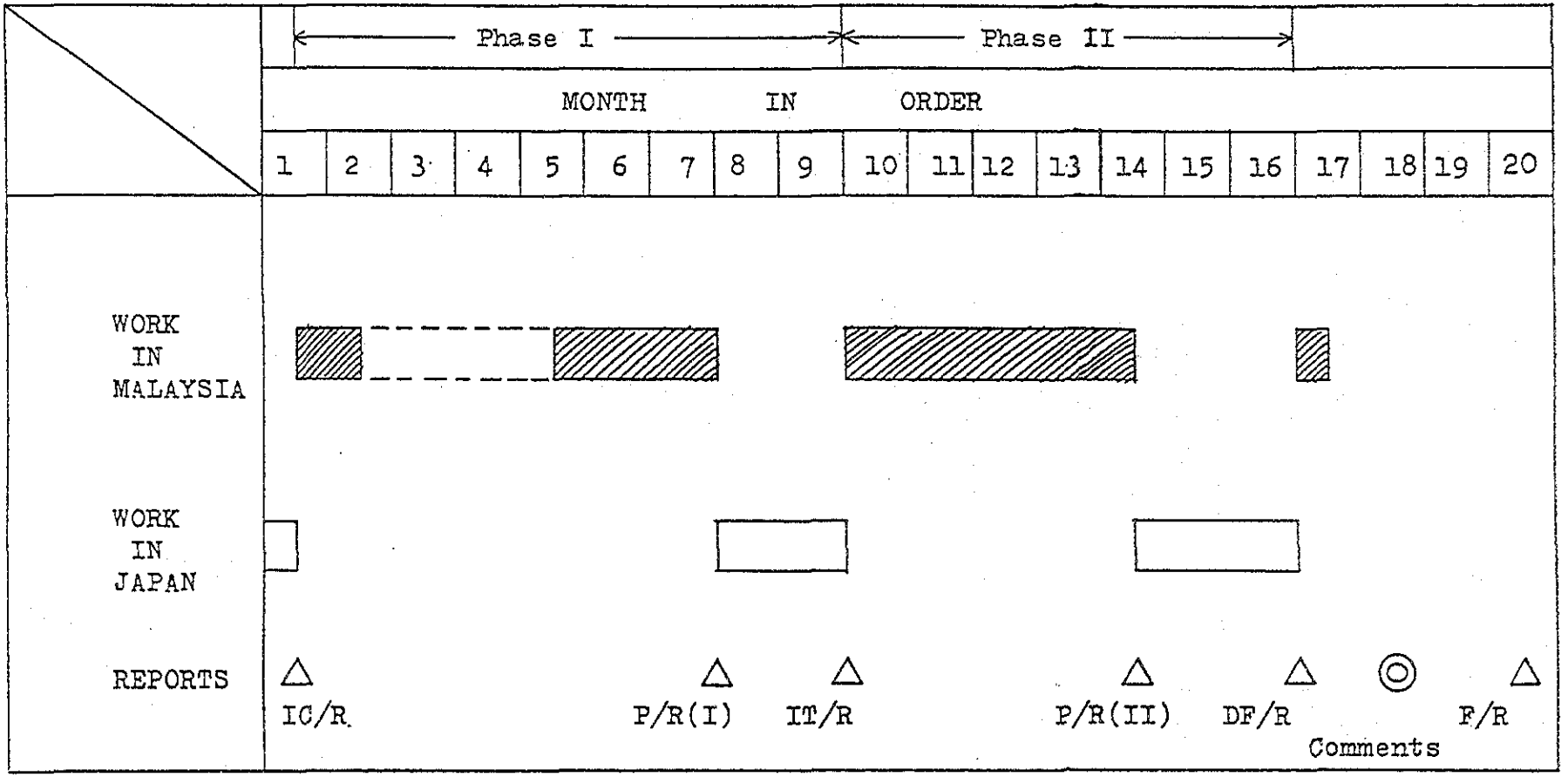
(1) To despatch, at its own expense, the Japanese study Team to Malaysia.

(2) To pursue technology transfer to the Malaysian counterpart personnel in the course of the Study.

VIII. CONSULTATION

JICA and the Government of Malaysia shall consult each other in respect of any matter that is not agreed upon in this document and which may arise from or in connection with the Study.

T E N T A T I V E S C H E D U L E



IC/R : Inception Report P/R : Progress Report IT/R : Interim Report

DF/R : Draft Final Report F/R : Final Report

Term for data collection