

Proposals for agricultural development of the Samarahan and Sadong - Krang Padi Project areas, Sarawak: a pre-feasibility study

Volume 1 Executive Summary

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PROPOSALS FOR AGRICULTURAL DEVELOPMENT OF THE SAMARAHAN AND SADONG-KRANG PADI
PROJECT AREAS, SARAWAK; A PRE-FEASIBILITY STUDY

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This study is presented in three volumes. Volume 1, the Executive Summary is a condensed version of Volume 2, the Main Report. Volume 2 describes the background to the study, records the findings of the LRD/ODM Mission and then makes recommendations for agricultural development in the two study areas. Volume 3, Appendixes, comprises more detailed information on specialist aspects of the study.

A glossary of Malay terms and a list of abbreviations and acronyms are included in Volume 2.

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SUMMARY WITH
BRIEF RECOMMENDATIONS

PART 1 SUMMARY

An LRD/ODM Mission undertook a pre-feasibility study into the agricultural development potential, particularly for rice production, of two riverain areas of First Division - Samarahan (11 700 ha) and Sadong-Krang (7 000 ha), Sarawak.

The soils of the areas have a potential for intensive annual cropping and for tree crops. Current levels of production are low and much of the land is unused in any given year.

The greater part of both areas is held by residents under some form of native land tenure.

The potential for (irrigated) double-cropping of rice is limited by the lack of suitable water in the Samarahan area and the liability to severe flooding in the Sadong-Krang area.

Very substantial increases in annual crop production could be achieved by bringing the entire area now used periodically for rice into annual cultivation with an off-season crop of maize or soya beans; the market prospects for all three crops are good. To achieve this increase, the basic requirements are land redistribution, the introduction of a mechanised land cultivation service and improved methods of water control and crop production. Substantial increases could also be obtained in tree crop production.

It is therefore recommended that:

1. In view of the area's particular potential for crop production, the Samarahan area and contiguous hill land should be designated an Agricultural Development Area and an Action Committee established.
2. The following schemes should be developed immediately as examples of what can be achieved through land redistribution, mechanised land cultivation, good water control and improved methods of crop production with a view to similar schemes being developed subsequently throughout the areas (see Location Map).

Samarahan

Lower Samarahan 900 ha of rainfed annual cropping of rice and soya beans and 300 ha of tree crops, principally coconuts underplanted with cacao or robusta coffee.

Empila A total of 400 ha of irrigated double-cropped smallholder's rice developed in four stages.

Sadong-Krang

Gedong Four small (53-90 ha) irrigated rice schemes for communities in the Gedong-Gumpeh area.

Kuala An area of 385 ha to be cultivated to rainfed annual crops by the small resident population together with settlers from other parts of Serian district. Later, irrigation may be added.

These schemes can be implemented by the existing State organisations but technical cooperation will be required in the field of agricultural engineering and probably also in drainage and irrigation engineering, agronomy and sociology.

Further studies are required in a number of fields and the scope of this work is outlined.

PART 2 INTRODUCTION

PART 2 INTRODUCTION

BACKGROUND TO THE STUDY

The mid-term review of the Second Malaysia Plan coincided with the period in 1972/3 when crop failures in traditional rice exporting countries had caused supplies of rice on the world market to become scarce and costly. This situation highlighted Sarawak's dependence on rice imports which were then estimated to comprise some 40% of all the rice consumed in the State. The State Government therefore decided that greater emphasis should be laid on increasing rice production with the eventual aim of achieving self-sufficiency.

Both hill and wet rice are grown but the potential for increased production of hill rice is considered to be very limited. With the aim of increasing wet rice cultivation, eight areas were identified on the basis of the reconnaissance soil survey of the State as having soils suitable for intensive production of wet rice. Investigations were therefore planned into the other determinants of their production potential.

Arrangements were made for a pre-feasibility study of the potential of two of the selected areas, Samarahan and Sadong-Krang, in the First Division, to be undertaken by a team from the Land Resources Division (LRD) of the UK Ministry of Overseas Development (ODM). The field work for this study was undertaken from July to October 1976 and the results are now presented in three volumes. Volume 1 is a condensed version of the main report (Volume 2) which describes the background to the study, records the findings of the LRD/ODM mission and makes recommendations for agricultural development in the two study areas. Volume 3, Appendixes, comprises more detailed information on specialised aspects of the study.

TERMS OF REFERENCE FOR THE LRD/ODM STUDY

The full terms of reference (see Volume 2) required the LRD/ODM mission to undertake a study enabling it to prepare terms of reference for detailed

feasibility studies for maximising rice production in the two study areas. During the course of the study the mission was asked by the State Padi Production Unit (PPU) to address itself in particular to the following points:

1. Within the Sadong-Krang and Samarahan study areas, to identify those sites best suited to increasing rice production either through raising yield per acre or by expansion of the existing rice areas and with reference to blocks both above and below 500 acres in extent.
2. Identify areas planted with existing crops such as rubber, coconuts, etc. within the project areas where improvement leading to increased agricultural production is possible.
3. Examine the possibility of agricultural development projects on those sites comprising either rice production alone or a combination of rice production together with production of coconuts, rubber, etc. as appropriate.

PART 3 THE STUDY AREAS

PART 3 THE STUDY AREAS

LOCATION

The location of the two study areas is shown on the Location Map and in the Separate Maps in Volume 2. They are confined to those soils considered suitable for wet rice cultivation which lie between the main river and areas of unsuitable soils (deep peat, strongly saline gley or hill soils). The Samarahan area runs from Kampong Reban down-river (Samarahan) to the confluence with Loba Batu Belat. It also includes land lying on either bank of the Sungai Tuang between Kampong Endap and Muara Tuang and on the Sungai Entingan as far as Kampong Nangka. The total area is 11 635 ha (28 755 ac).

The Sadong-Krang area runs down-river (Batang Sadong) from Kampong Serian Ilir to Tanjong Maong (Stage 3 of the mid-Sadong Scheme). On the Krang it lies between Sungai Merakai Kechil and Gedong. The total area is 7 025 ha (17 360 ac).

The study further took account of farming activity by residents of the areas in contiguous hill land and also involved an examination of the catchment areas of the rivers of the study areas.

CLIMATE

Both study areas have a climate characterised by uniform high temperatures and abundant rainfall. Only one season, the *landas* or wet season, running from November to March, can be readily identified; during this, 55% of annual rainfall is received. The climate is suitable for the production without irrigation of a wet rice crop during the *landas* and, except during very occasional dry years, an off-season crop of maize or soyabeans.

Average annual rainfall lies in the range 3 700 to 4 050 mm. Daily rainfall may be high with falls of more than 150 mm not uncommon. Furthermore, wet days tend to be grouped together so that temporary flooding during the *landas* may be unavoidable.

Average daily temperatures remain at about 27°C throughout the year with a diurnal range of 15-20°C. Average daily humidity also varies little and is about 83% but, through the day, falls from about 100% in the early morning to less than 70% in the afternoon on days without rain.

HYDROLOGY

The Batang Samarahan upstream of the tidal limit has a small catchment and the study area lies in the lower reaches of the river. Consequently, flooding from heavy catchment discharge is absent except when combined with spring (King) tides in which case some flooding with very saline water may occur at the tidal peak. The major hydrological problem in this area is saline water intrusion during the period May to September. It is at this time that irrigation would be needed but for an off-season crop of rice the water in this river and its main tributaries within the study area is unsuitable for irrigation.

Much of the Sadong-Krang study area is liable to severe flooding from the rivers during the *landas*. Flood depth and duration at Serian have been estimated; this indicates that flooding of 1 m or more may be expected for 4½ days once in every 5 years while once in every 10 years this depth might be exceeded during 9 days. Downstream of Serian, as far as Kampong Tanah Puteh, flooding tends to be slightly deeper and of longer duration, but towards Kampongs Sebeban and Gumpeh it becomes less severe. On the Krang, flooding is limited to the area upstream of Sungai Midin.

WATER RESOURCES

Because of the salinity of the water in the main river and tributaries in the Samarahan area during the off-season, the only source of irrigation water are the minor rivers. The critical period for irrigation of rice in the off-season will be in May. On the basis of the present scanty data on river flows, an estimate was made of the water available and therefore the area irrigable in the Samarahan study area (Table 1).

TABLE 1 Estimates of water available for irrigation in the Samarahan study area

River	Water available in May (l/sec)	Area irrigable (ha)
Tuang	1 000	700-850
Entingan (at Nangka)	500	350-425
Empila (at Empila)	200	140-165
Ensengei (via S. Sok)	600	425-500

Additional irrigation water might also be obtained by tapping the limited supplies from the peat swamps but techniques for doing this have not been established.

Throughout the Sadong-Krang area there is an abundance of irrigation water throughout the off-season.

SOILS

The two study areas were identified on the basis of the potential of their soils for wet rice cultivation. These soils may be placed into four groups - recent alluvial, saline gley, gley and peat. The major difficulty in exploiting their potential will be in achieving optimum soil water conditions for the different crops; this is discussed in the section on development strategy (Part 4).

In the Samarahan area, potentially acid sulphate soils are known to be present. On drainage these become extremely acid and would inhibit plant growth. The semi-detailed soil survey indicates that soils with acid sulphate layers at depths greater than 50 cm occur in certain soil families. Their extent and spatial distribution within these families is not known but they are not considered to constitute a major hazard. Amelioration of this soil condition is difficult and expensive; however it is not expected to be widespread. Where it occurs it might affect tree crops adversely but it is unlikely to affect rice.

The peat soils comprise a layer 25-100 cm deep with an organic matter content of 35% and sometimes 65% or more overlying clay (soils with deeper layers of peat are extensive but were excluded from the area investigated). The peat is a poor medium for plant growth and it is essential therefore that this layer be consolidated and incorporated into the underlying clay as quickly as possible. The most extreme condition is found where the land lies under primary forest and the peat layer is the full 100 cm deep and of high organic matter content. Here, clearing and draining can reduce the depth of the peat layer to 50-70 cm within one year. Subsequent change will depend on the degree of drainage, the quantity of timber within the peat and the type of land use practised. The change will be most quickly achieved if the area is adequately drained, buried timber is removed and the land is cropped twice annually. This work has largely to be done manually. In the early years crop yields will be low. For the extreme condition it may take 5 years or more to bring the land into good heart. With cleared areas of shallower peat the problem will be substantially less.

INFRASTRUCTURE

Road access to the two study areas is a recent development and remains very limited (see Location Map). In the Samarahan area only Muara Tuang and the area near the Samarahan estate are accessible by road. The Sadong-Krang area benefitted from the opening in 1973 of the Serian-Gedong road. Essentially, however, internal transport and the evacuation of produce is achieved by river transport.

The major Government services in the areas cover administration, agricultural extension, education and medical services. The Land and Survey Department have also been active in the registering of land rights.

POPULATION AND LAND

The population of the two study areas is predominantly Malay and Iban, though there is also a small number of Land Dayaks (Bidayuh) along the southern part

of the Sadong. The 1970 population census showed that the Samarahan area had a resident population of 9 883 people and the Sadong-Krang 8 657. The LRD/ODM Mission estimated the 1976 population to be 11 450 and 10 030 respectively. Iban villages tend to have greater areas of land available to them than Malay villages. There is also a greater degree of tenancy in Malay villages. Further the uneven distribution of rice land among householders has led to many having an inadequate area for their needs, although overall there is a superfluity.

THE FARMING SYSTEM

Agriculture in the two study areas is undertaken entirely by smallholders residing in villages or longhouses. There are no estates, land settlement schemes or cooperative farms. A number of the communities also farm hill land adjacent to the riverain land of the areas.

The major crops are rice, coconuts and rubber; on the adjacent hill soils, pepper is becoming of increasing importance to the Native farmer. Because farming is undertaken on a nuclear family basis and the activities of the family are confined to the areas of land over which they have rights, the distribution of crops throughout the areas gives the appearance of being random and crops are often found on unsuitable sites.

Rice is fundamentally a subsistence crop grown under rainfed conditions where traditional manual methods are used. Usually the crop is followed by a period of tumbledown fallow of 1 to 4 or 5 years: thus most of the rice area is uncultivated in any given season. There is practically no cropping in the off-season. The Department of Agriculture has shown that annual cropping of rice under the conditions of the two study areas is possible but few planters practise it. Apart from labour, inputs are very small. Yields vary widely but average over 2000 kg/ha. Substantial areas of tall coconuts have been planted under the Coconut Planting Scheme (CPS) over the last 15 years. In the Sadong-Krang areas the growth and yield of the palms has been almost universally poor. Production in the Samarahan area varies; with good maintenance, satisfactory yields of nuts and copra can be achieved, in general though, drainage is inadequate and its improvement would raise yields.

Rubber in the area is all seedling material and probably none would yield more than 400 kg/ha even with intensive tapping. The crop is popular with the farmer, though, because it is the source of a readily exploitable and saleable product.

MARKETING AND CREDIT

Farm produce is usually sold in the village although some, particularly copra and pepper, is sold direct to Kuching. The quantity of produce exported from the two study areas is not known but it has been estimated that there was an export of 400 t of padi from the Samarahan basin through Muara Tuang in 1976.

Credit for the purchase of consumer goods is given by the village shopkeeper. There is little use of credit for productive purposes.

LAND TENURE

Most of the two study areas are Interior Area land and thus can only be farmed by Natives. The Department of Lands and Surveys has adjudicated the rights over part of the areas and issued titles (Native Area land). Limited areas of State land exist but are largely peat soils under primary forest.

PART 4 DEVELOPMENT STRATEGY

INTRODUCTION

Although the present use of traditional methods of crop husbandry is resulting in only a modest level of production in the two study areas, there is the potential for a substantial increase even with only limited use of irrigation. Indeed the potential per unit area for annual crop production is probably greater than that of over 90% of the State.

It is recommended that the development objectives for the areas should be:

1. To bring all cultivable land into continuous cultivation as soon as possible.
2. To concentrate, as far as practicable, on annual crops, confining tree crops to existing well-grown stands and areas where trees are required for flood or erosion control.
3. To obtain any labour required for development, in the first instance, from the locally based population.

The present low level of production is partly attributable to maldistribution of landholdings amongst the existing population. Land redistribution allied to an increase in the present extension work of the Department of Agriculture could increase production and incomes with relatively little capital expenditure. Such development, though, would be difficult to implement and would be very slow. Furthermore, it is considered essential to introduce mechanisation for the cultivation of annual crops and to improve water control. It is thus clear that what is required is a "package" approach of which the main elements would be soil water control, mechanisation, land redistribution and improved methods of crop production; this approach has therefore been incorporated in the proposals of the LRD/ODM mission.

PACKAGE COMPONENTS

Soil water control

There has been very little improvement to the naturally rather poor drainage of the study areas. In consequence, tree crops are usually inadequately drained and in rice areas it is not possible to ensure that the land is either inundated or drained according to the needs of the crop. In some areas there is also a need to build bunds to prevent flooding from the river. Because of their different requirements for soil water it is necessary to separate rice and other annual crops from the tree crops; that is, specific areas must be designated for each. This can be done over relatively small areas (20 ha).

In the Samarahan study area, water control can be achieved by construction of low perimeter bunds and internal drainage ditches which discharge into the tidal river via flap gates. Irrigation facilities can be provided at only a few locations and on a limited scale.

In the Sadong-Krang study area, severe flooding frequently occurs and, except on land close to the confluence of the two rivers, adequate water control through bund and drain construction is not possible. The full agricultural potential of this area and of the floodplain upstream of Serian can only be realised by control of the floods: this would require the construction of storage dams higher up the catchment. Such measures would be expensive and might not eliminate flooding entirely.

Mechanisation

Experience with the Assistance to Padi Planters Scheme (APPS) has shown that farmers using manual methods are unable to work their land into a suitable condition for regular biannual cropping. Furthermore, the area that can be prepared each season is limited and the standard of land preparation achieved

is poor. These problems can only be overcome by the introduction of mechanisation. Two separate services will be required. The first will be undertaken once only and will follow the destumping of the area: it will involve ploughing, raking, harrowing and levelling. The second service will be required to undertake the seasonal land preparation for the crops. The first service will require 4-wheeled 80-100 hp or tracked tractors. The second may be undertaken by either 4-wheeled or pedestrian tractors. The economics of this are discussed later.

Land administration

In the areas proposed for development schemes land is mostly held under customary rights but there are also lands held under title (mostly Native Area Land). In order to rationalise the administration of the schemes it is recommended that in areas where land is held according to customary rights the whole of the area should be designated a Native Communal Reserve. In areas where land is mostly held under title, all rights to land should be adjudicated. Existing titles should be withdrawn. There should be sufficient redistribution of landholdings to relate them to the family's needs and the new titles issued to all landholders should be issued subject to conditions that the land is cultivated etc. Where a large surplus of land exists it should either be made available to settlers or cultivated by the Sarawak Land Development Board (SLDB) until population growth enables residents to take the land in hand.

Crop production

Annual crop production will be confined to rice in the *landas*. Irrigation will be available over only a very limited area to which a second crop of rice in the off-season will be confined. Elsewhere, off-season cropping of soyabean and maize is recommended.

In the Samarahan area, coconuts will be the principal tree crop: the yields of existing palms can be raised by improving the drainage. Returns per man day and per unit area can be further increased with mature coconuts by underplanting

them with cacao or robusta coffee. Coconuts have largely failed in the Sadong-Krang area and further planting should be confined to compounds and narrow river bank strips with naturally good drainage. Fruit trees would be suitable for planting on levees both for production and as a flood and erosion protection.

It is recommended that rubber, oilpalm and pepper should not be encouraged in the study areas and that subsidy schemes for these crops should be confined to hill areas of the State.

ECONOMIC ANALYSIS

Commercial prospects

There is a substantial internal market for rice, maize and soybeans as import substitutes. Systematic development should lead to a rapid increase in the volume of marketed products and both study areas are favourably placed in relation to Kuching. Nevertheless such increases may overload the existing system leading to marketing inefficiencies of various kinds. The Federal Agricultural Marketing Authority (FAMA) could assist in alleviating these problems and should therefore be involved in development planning from the earliest stages.

There will also be a higher demand for production inputs and credit. Arrangements must be made to meet this demand, and the Farming Organisation would be an appropriate agency for this.

Crop production costs and returns

The LRD/ODM Mission has prepared estimates which suggest that, under rainfed conditions, the most economic use of land is to have a maximum area under a rice-soya bean rotation. However, the conversion of existing, mature, good stands of coconuts to rice cultivation is considered to be impracticable and

therefore development proposals for the Samarahan area incorporate a substantial area of coconuts underplanted with cacao on naturally better-drained land in association with a significantly greater level of rice production.

Where irrigation is possible, the comparison must be made between double-cropped rice and rainfed rice followed by soya bean cultivation. Both alternatives are attractive in terms of returns to producers and to society as a whole. For rainfed crops, the Net Present Value (NPV) and the Internal Rate of Return (IRR) will be higher, but irrigation will bring relatively high levels of rice production, producer incomes and employment. The establishment of pilot irrigated rice schemes is thus justified.

The economics of soil water control and mechanisation in rainfed areas

It has been stated earlier that increased agricultural production in the study areas requires good soil water control and the introduction of mechanised land preparation. Except for the control of flooding in the Sadong-Krang area, these conditions could be achieved either through large scale schemes or on small scale (20 ha) discrete schemes. The two approaches were therefore analysed in connection with the largest compact block in the Samarahan area, the left bank of the lower Samarahan. The first approach, termed Option 1, involves extensive bunding (for flood control and access), draining of the entire area and the introduction of 4-wheeled tractors for land preparation. The land predominantly covered by existing good stands of coconuts would be designated tree crop areas and planted entirely with palms or palms and cacao. The remaining land would be cropped twice yearly with rice following the soya beans.

The second approach, Option 2, involves the development of the land by self-help schemes. Farm drains would be constructed on a *gotong royong* basis and pedestrian tractors would be introduced to assist with land cultivation for annual crops. In the lower Samarahan area, the mission considers that virtually all the land which is currently under rice fallow could be developed in this way, but only 40% of the area would be suitable for soya beans in the off-season because of adverse soil water conditions. The existing coconut areas would either remain in their present state or be tackled on the basis of small-scale improvements.

Under both options it is assumed that the area actually planted to soya beans will be limited to 75% of the suitable area. It is also assumed that development progresses at the same pace under both options. Experience with the APPS and CPS suggests that the piecemeal approach of Option 2 would in fact result in much slower development. Further, while this option promises a very satisfactory economic return in relation to capital expenditure, other benefits including employment, farm income levels and production of rice would all be much higher with Option 1. Therefore, unless capital is a major constraint, the Mission recommends the large scale, more capital intensive approach represented by Option 1.

This analysis relates to a specific area but the findings are likely to be broadly applicable to other comparable parts of the study areas also. One such area lies near Kampong Kuala to the south of Gedong. It presents some very difficult technical problems but, if these can be overcome, the rate of return should be at least on a par with that expected from the lower Samarahan area. Development schemes for both areas are presented in Part 5.

PART 5 PROPOSALS FOR DEVELOPMENT

PART 5 PROPOSALS FOR DEVELOPMENT

INTRODUCTION

The findings of the LRD/ODM mission confirm the views of the Sarawak Government that the two study areas have considerable potential for increased agricultural production particularly of rice and other annual crops. Furthermore, there is sufficient information available to be able to identify appropriate cropping systems to achieve this increased production although none of them has yet been implemented at village level. It is therefore now necessary, following preliminary studies which are described later, to undertake specific development schemes to confirm and demonstrate the different cropping systems suitable for the areas. Four such schemes, two in each study area, are recommended. Implementation is discussed in Part 6.

Some basic data on three of the schemes is presented in Table 2. Data on the fourth scheme, the Sungai Kuala in Sadong-Krang, cannot be prepared until the cropping system is decided.

TABLE 2 Basic data on the Lower Samarahan, Empila and Gedong schemes

Data	Lower Samarahan	Empila	Gedong	Total
Area of scheme (ha)	1 195	400	268	1 863
Rice production (t)				
Present	634	264	100	998
Under scheme	2 500	2 000	1 340	5 840
Capital cost (\$ 000)				
First stage	1 256	344	157	1 757
Total	2 923	1 358	708	4 989
Construction period (yr)	3	4?	4?	-

The Lower Samarahan scheme is rainfed and will produce soya beans, copra and cacao in addition to rice. The Empila and Gedong schemes will produce two crops of rice per year under irrigation. It will be noted that the three schemes total 1 863 ha and that rice production will be increased from the present annual level of 998 t to 5 840 t.

The schemes will now be discussed in more detail and in relation to their study areas.

SAMARAHAN STUDY AREA

The Samarahan offers a greater prospect for early development than the Sadong-Krang and therefore the two major schemes are sited there. The larger of these, the Lower Samarahan, comprises rainfed production of annual crops (rice/soya beans) and tree crops (coconuts/cacao) and will establish a cropping system that can subsequently be widely adopted throughout the study area. The smaller scheme, the Sungai Empila, will establish the techniques for irrigated double-cropping of rice. If these techniques prove to be attractive, the irrigated area in the Empila can be expanded and the system introduced in other parts e.g. Entingan and Semang.

Lower Samarahan scheme

Objective

To bring into full production 900 ha of rainfed annual crops and 300 ha of tree crops.

Location

The west bank of the Batang Samarahan between Loba Batu Belat and the Muara Tuang road.

Communities involved

Kampongs Baru , Mapar, Pla-i, Sungai Batu and Tanjong Bundong.

Present land use

The Lower Samarahan scheme is the largest compact block in the study area. It is relatively intensively cultivated with coconuts generally growing on the river banks and ricefields sited in the poorer drained areas. There are also two blocks of rubber but little is being tapped. Flooding is a minor hazard with periodic saltwater intrusion during Spring tides in the landas.

Proposals

1. Specific areas should be defined for the production respectively of tree crops and of annual crops and a drainage system appropriate to each should be constructed.
2. The entire area of annual crop land should be planted under an annual rotation of rice and either soya bean or maize.
3. A mechanised land cultivation service should be introduced to assist farmers to accomplish Objective 2.
4. Cadastral survey should be completed throughout the scheme and the area gazetted as Native Communal Reserve.
5. Land holdings should be adjusted so that the area available to a family, both for rice and tree crops, is related to its labour.

Development

Development will be undertaken in two stages: Stage 1 will comprise the southern part of the area which covers 283 ha and adjoins the Muara Tuang-Kuching road - it will correspond to a pilot stage.

Engineering works

The scheme area will be surrounded by a perimeter bund to prevent flooding with salt water and to act as an access route. There will also be an internal bund/access to divide the tree crop area from the area for annual crops. A network of drains will be constructed to discharge into the river through tidal gates. Check structures in the drains will permit controlled flooding of rice areas.

Mechanisation

Following complete clearing of the land, all the annual crop area will be thoroughly cultivated by machine to bring it into good working condition. This should be offered to farmers as a free service. Subsequently the land will be mechanically tilled prior to each rice and off-season crop: this service should be undertaken on a commercial basis. Both the services should initially be carried out by the Department of Agriculture though subsequently they could be taken over by the Farmers' Organisation or contractors. (The mechanised land cultivation service would initially be based at Muara Tuang to serve both the Lower Samarahan scheme and the Sungai Empila).

Sungai Empila scheme

Objective

To establish an area of double cropped irrigated rice production with mechanical land preparation and to identify suitable techniques for such production in similar areas.

Communities involved

Initially the scheme will involve Kampongs Empila and Niup; later stages will also include Kampongs Melayu and Sungai Batu.

Present land use

The area of the scheme is currently used for rice and tree crops; about one third lies under secondary forest. Part of the area is subject to freshwater flooding to a depth of about 1 m for a number of days each landas.

Proposals

Irrigated rice production (double cropping) should be introduced in two phases, with two stages to each. Phase 1 will utilise the water of the Sungai Empila and will comprise two contiguous areas on the right bank of that river. Stage 1 covers 80 ha and Stage 2, 90 ha. On the establishment of Phase 1, the economic, agronomic and sociological aspects of the cropping system will be assessed carefully before proceeding to Phase 2. The latter phase will require the augmentation of the water supply by carrying water by canal from the Sungai Tuang to the Sungai Empila. There should then be sufficient water to irrigate a total of 800 - 1 000 ha. It is recommended that Phase 2 should comprise two stages totalling 230 ha, but the exact location and extent can be altered in the light of the response from the people concerned - Kampongs Niup, Melayu and Sungai Mata.

Cadastral survey should be carried out in the part of Stage 1 (Phase 1) used by Kampong Empila and in Stage 4 (the second stage of Phase 2) on the State Land lying between Kampongs Niup and Melayu. A decision will then have to be made whether to adjudicate rights in the area or declare it all a Native Communal Reserve.

Engineering works

An irrigation canal, large enough to supply both phases, will be constructed. Offtakes from the canal will supply field channels in Phase 1 which will run through the ricefields in the direction of the Sungai Empila. A drainage system to carry away excess rainwater and facilitate drying out the fields before harvest will be installed. Water from the Sungai Empila cannot be raised by a headworks to supply the canal by gravity without causing severe flooding upstream. Pumps will therefore be required for this. These pumps can be installed progressively as each stage is completed.

In order to provide access within the project area, roads will be constructed along the canal routes. A jetty will be needed at the canal end at the Batang Samarahan. On the completion of the S. Tuang headworks (Phase 2), this access route can be linked up with the Kampong Endap - Kuching road, giving full vehicular access to the scheme.

Mechanisation

Mechanical cultivation is proposed for the scheme. This will again involve an initial thorough cultivation of the cleared land and subsequently seasonal cultivation for crops. Initially two 80 - 100 hp 4-wheeled tractors with rice wheels, rotovators and ditching equipment will be required.

SADONG-KRANG STUDY AREA

The incidence of severe flooding is a major constraint on the development of farming in the Sadong-Krang study area. Two exceptions to this, one near Gedong and the other between the Kuala rivers, have been identified and development schemes are proposed for them. The full agricultural potential of the remaining part of the study area could only be realised if measures were taken to alleviate the flooding; this would require the construction of storage dams in the middle reaches of the two main tributaries. Three possible dam sites were identified by the LRD/ODM mission but, at this stage, it is not possible to ascertain whether such structures would be either effective or economic. Further studies are required: these are discussed in Volumes 2 and 3. At the present time, for the remaining part of the study area, it is imperative that suitable annual cropping systems are devised which take account of the liability to flooding. Such systems can only be established on the ground and this should be done by opening up schemes under the APPS at the villages of Tanah Puteh and Munggu Kupi. The system would be based initially on the production of long-term rice cultivars in the *landas* and soya beans in the off-season.

Gedong scheme

Objective

To develop a total of 268 ha of irrigated double-cropped rice on four *tanjongs* upriver from Gedong.

Location

On *Tanjongs Gumpoh, Paoh, Larang and Tajo* on the *Batang Sadong*.

Communities

Kampongs Gumpoh, Tanjong Paoh, Tajo, Lallang and Gedong.

Present land use

On *Tanjongs Gumpoh and Larang* there are considerable areas of ricefields and coconuts: the coconuts are almost universally poor. *Tanjong Paoh* is mainly used for rice cultivation. *Tanjong Tajo* has some good stands of tree crops; half of the *tanjong* is used for rice. The land is held by the local communities under customary rights.

Proposals

It is proposed that:

1. The centre of each of the four *tanjongs* should be developed for irrigated double cropping of rice.
2. Tree crops should be planted along strips of land (averaging 100 m in width) along the river bank, in order to offer protection against flood and erosion.

3. Cadastral survey should be carried out on *tanjongs* Gumpeh, Paoh and Larang and land surplus to the requirements of the population should be determined.

Engineering works

Each of the four *tanjongs* will constitute a stage in the development of the scheme and will be built separately in yearly programmes. Each stage will be provided with a low lift pump sited at the upstream end of the area and supplying water through concrete lined canals. A drainage scheme will also be constructed which would simultaneously service the tree crop area.

Mechanisation

Mechanisation is recommended for the scheme in a similar manner to the Sungai Empila scheme. Each stage will require one tractor and set of implements.

Sungai Kuala scheme

Objective

To develop an area of 385 ha for annual cropping by the resident population of the area and settlers from other parts of the Serian district.

Location

The area lies 3 km south of Gedong on the Gedong-Serian road and between the Kuala Ulu and Hilir rivers.

Communities involved

The existing farming communities from Kampong Kuala and Gedong, augmented by settlers from elsewhere in the Serian district.

Present land use

Near the Sungai Kuala Ulu the people of Kampong Kuala have old seedling rubber and practise extensive rice cultivation (145 ha). Near Sungai Kuala Hilir some Malay farmers from Gedong have rights over 30 ha used for rice growing. The rest of the area is under primary forest and is State Land. One reason why the area of State Land has not been cultivated is that it is covered with peat soil; the problems of developing this were mentioned in Part 2, Soils.

Proposals

It is proposed that 385 ha lying in the area of the Kuala Ulu and Hilir rivers should be developed for intensive annual cropping. The scheme will comprise two parts, namely:

1. The land now farmed by people of Kampong Kuala and Gedong which should be developed for their advantage and declared a Native Communal Reserve.
2. The State Land, now under primary forest, which should be cleared and drained for development as a settlement scheme for indigent rural families from other parts of the Serian district.

Engineering works

Drains and access routes will be installed midway between the two Sungai Kuala. The main drain will then connect to Sungai Kuala Hilir. Reserves for possible future irrigation canals should be included.

Mechanisation

Mechanised land preparation will not be possible in the early years of the scheme but should be introduced later.

PART 6 IMPLEMENTATION

PART 6 IMPLEMENTATION

The LRD/ODM Mission was asked to prepare terms of reference for detailed feasibility studies which, it was anticipated, would be undertaken by consultants. On the completion of the pre-feasibility study, however, the Mission felt that the existing State Government agencies would be able to undertake the responsibility for the development schemes proposed for the study areas if limited technical cooperation were available. The Mission also recommends that a Samarahan Agricultural Development Area be declared. These and other aspects of the implementation of the Mission's proposals are discussed in this section and in greater detail in Part 6 of Volume 2.

TECHNICAL COOPERATION

No expertise is currently available in Sarawak in the field of agricultural engineering related to the cultivation of rice land. Mechanised land cultivation is a fundamental need if annual crop production in the two study areas is to be substantially increased. An agricultural engineer must therefore be engaged either from Peninsular Malaysia or from overseas.

Expertise in other fields is available within Sarawak but, in view of the other commitments of the Departments concerned, it may be necessary to obtain technical cooperation in the fields of agronomy, drainage and irrigation engineering and sociology.

The agronomist will undertake farm level studies on the problems of implementing cropping systems, principally with annual crops both rainfed and irrigated. He will work in close coordination with the specialists at Paya Paloh Experiment Station.

The drainage and irrigation engineer will be responsible for the detailed design and supervision of the construction of the engineering works for the Lower Samarahan and Empila schemes.

The sociologist will be concerned with problems of land tenure, administration and population (see Appendix 8).

SAMARAHAN AGRICULTURAL DEVELOPMENT COMMITTEE (SADC)

In view of the potential of the Samarahan area for early and substantial increases in annual crops, particularly rice production, it is recommended that this area, together with contiguous areas of hill land farmed by its residents, should be declared an Agricultural Development Area, and an Agricultural Development Committee established. The responsibilities of this Committee will be confined to agricultural development and, in this field, its place in the development hierarchy is seen as equivalent to a District Action Committee.

If expeditious and well-coordinated development is to be achieved in the Samarahan area, it is essential that one Department should have overall responsibility for the whole programme: the Department of Agriculture is considered to be the most appropriate Department. The Agricultural Officer, Samarahan area, would be Chairman of the SADC.

The structure of the proposed organisation, shown in Chart 1, is fairly simple. The ADC will be responsible for preparing recommendations for Government approval on such policy matters as target incomes and holding sizes, the forms and extent of Government support for inputs, including credit, and for marketing. Under the chairmanship of the agriculturist, the committee will comprise representatives from the Department of Drainage and Irrigation and Land and Survey, the Administration, FAMA, the Farmers Organisation and the farmers themselves. During the first few years it is assumed that the technical cooperation specialists will be their Departments' representatives on the ADC.

Two smaller sub-committees will be established, one executive and one management.

The executive sub-committee will be responsible for initiation of the schemes including preliminary studies, design and construction. It will comprise the technical representatives from the Departments of Agriculture, Drainage and Irrigation and Land and Survey as well as the Administration and spokesmen of the Farmers' Organisation and the farmers.

The management sub-committee will be responsible for extension, marketing and credit support, applied agricultural research and scheme maintenance. It will comprise representatives from the Departments of Agriculture and Drainage and Irrigation as well as FAMA and the Farmers' Organisation.

IMPLEMENTATION PROGRAMME

For all schemes in both study areas the implementation programme will have four phases:

1. Surveys and studies
2. Scheme design
3. Scheme construction
4. Initiation of cropping

The recommended programme envisages the construction of the first stages of the Lower Samarahan and the Empila schemes during 1978: this implies that the surveys and studies should start immediately. If possible, work on the two schemes in the Sadong-Krang, Gedong and Sungai Kuala, should be undertaken also. Cropping in all four schemes would then begin with rice in the 1978/9 landas.

The surveys and studies need to be undertaken in the following five subject areas - land and administration, labour, marketing and credit, pre-design engineering studies and agronomy.

The purpose of the land and administration studies will be to assess existing land holdings and tenure within scheme areas and to determine the most suitable form of land administration. The farmers should be involved in the land management, and the method by which this can be done must be decided.

Labour studies will assess seasonal and likely long-term trends in population in the scheme and adjacent areas and determine labour availability in relation to crop labour requirements.

In connection with marketing and credit it will be necessary to determine whether the present marketing system can cope with the increased flows of

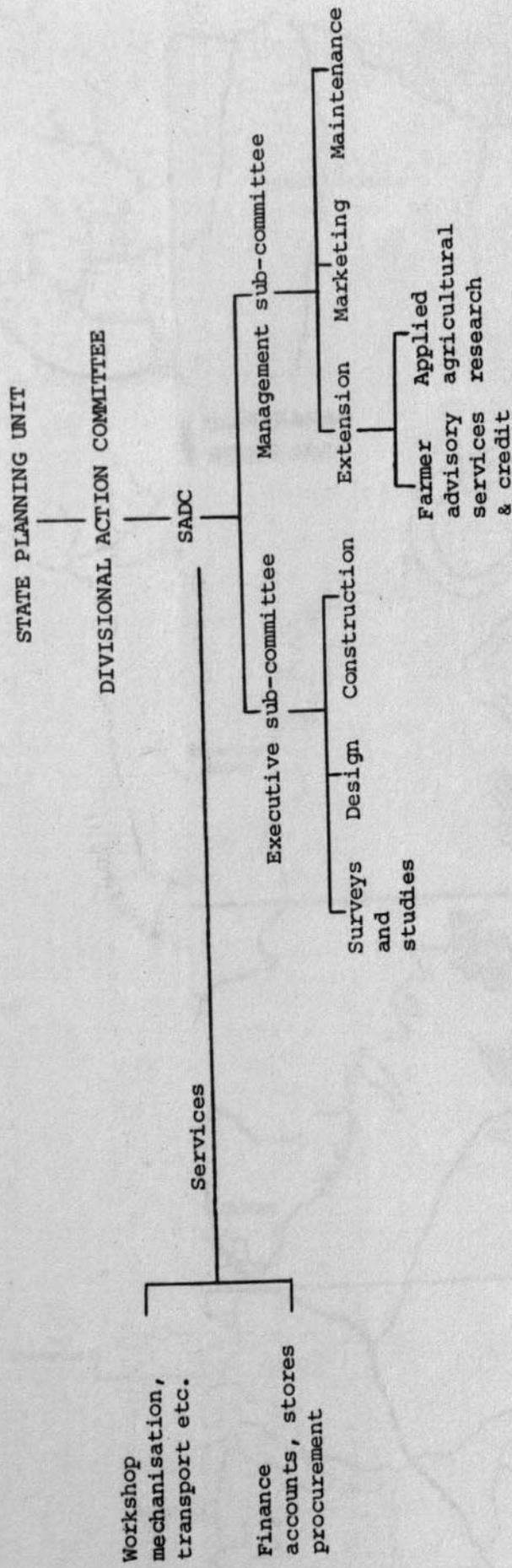
goods the schemes will generate and consider how any problems may be overcome. Means of meeting any producer credit needs must be found.

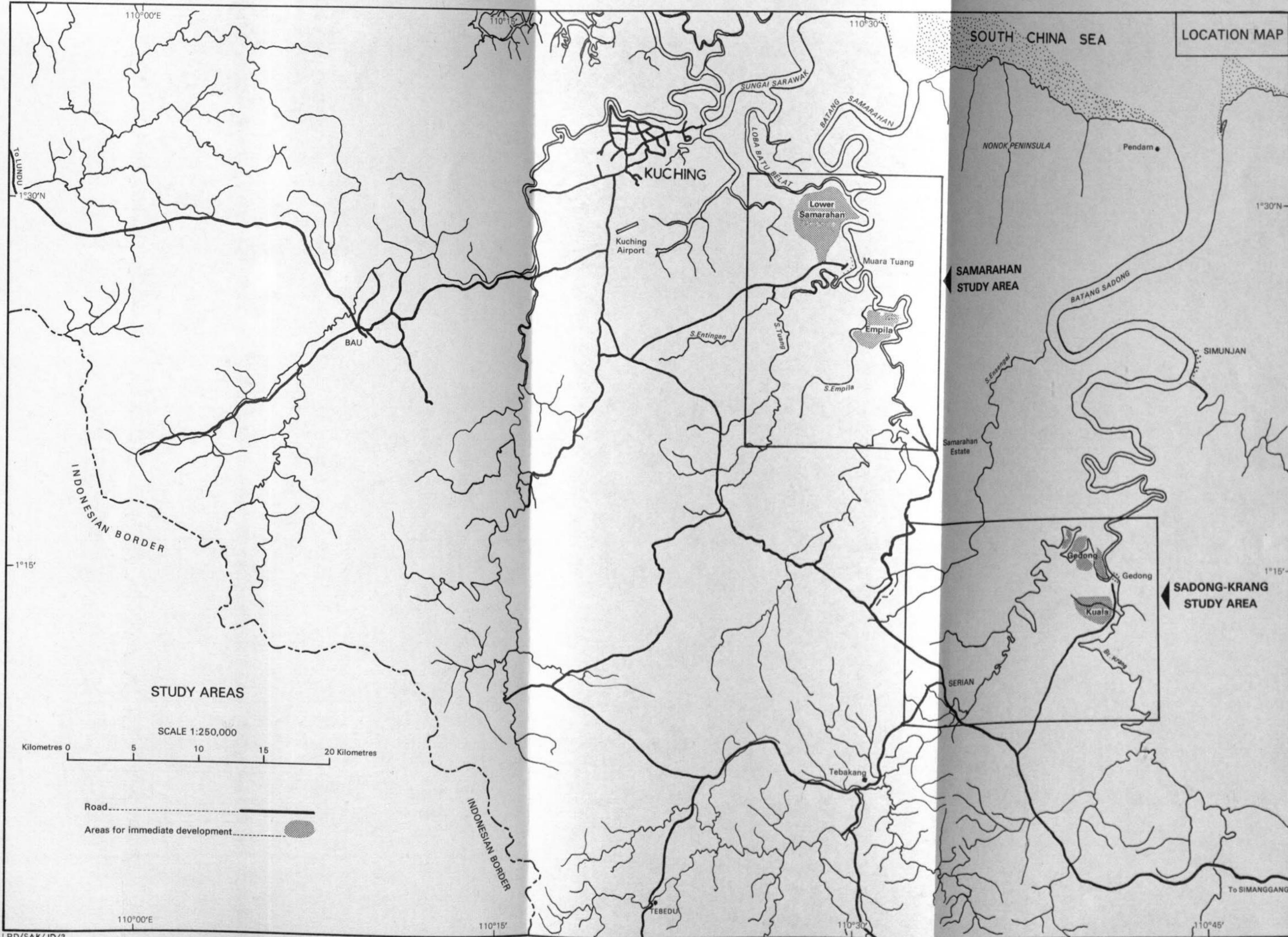
The pre-design engineering studies will comprise the preparation of outline plans of the scheme and, where required, the execution of topographic and site surveys.

The agronomic studies will delineate areas within the schemes which are suitable for the different crops proposed and devise agronomic and mechanisation design standards for drainage and, where appropriate, irrigation.

On the completion of these studies, the design phase will be carried out by the executive sub-committee. This stage covers the layout of the schemes and engineering work, confirmation of the details of the cropping system, the construction phase and then the actual initiation of cropping by land cultivation.

CHART 1 Proposed organisation of the Samarahan Agricultural Development Committee (SADC)





LOCATION MAP

SOUTH CHINA SEA

NONOK PENINSULA

Pendam

SAMARAHAN STUDY AREA

BATANG SADONG

SIMUNJAN

Samarahan Estate

SADONG-KRANG STUDY AREA

Gedong

Kuala

SERIAN

Tebakang

TEBEDU

To SIMANGGANG

110°00'E

110°15'

110°30'

1°30'N

1°30'N

1°15'

1°15'

110°00'E

110°15'

110°30'

110°45'

STUDY AREAS

SCALE 1:250,000

Kilometres 0 5 10 15 20 Kilometres

Road

Areas for immediate development

INDONESIAN BORDER

INDONESIAN BORDER

