

THE GOVERNMENTS OF MALAYSIA AND STATE OF SARAWAK

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MIRI – BINTULU
REGIONAL PLANNING STUDY

MAIN REPORT

ANNEXURE I
INVESTIBLE PROJECTS

JUNE 1974

Hunting Technical Services Limited
London

Hoff and Overgaard
Copenhagen

**THE GOVERNMENTS OF MALAYSIA AND THE
STATE OF SARAWAK**

PREFACE

The Government of Sarawak and the Federal Government of Malaysia have agreed that the study of the Miri-Bintulu region should be undertaken as a pilot study to determine the feasibility of developing a regional planning study.

MIRI BINTULU REGIONAL PLANNING STUDY

The study is divided into three main parts: (a) a study of the regional planning concept, (b) a study of the regional planning process, and (c) a study of the regional planning results. The study is divided into three main parts: (a) a study of the regional planning concept, (b) a study of the regional planning process, and (c) a study of the regional planning results. The study is divided into three main parts: (a) a study of the regional planning concept, (b) a study of the regional planning process, and (c) a study of the regional planning results.

THE MAIN REPORT

**ANNEXURE I
INVESTIBLE PROJECTS AND
DEVELOPMENT PACKAGES**

— 1974 —

**HUNTING TECHNICAL
SERVICES LTD. LONDON**

**HOFF AND OVERGAARD
COPENHAGEN**

PREFACE

The Scope of Work for the Miri-Bintulu Regional Planning Study required that suitable projects or project packages should be prepared up to standards normally accepted for financing by international lending institutions.

In this Annexure several projects are presented in accordance with this request. There are three agricultural projects, requiring public finance, as follows:

- (a) Public development of State Land for estate and smallholder schemes.
- (b) Road-based improvement of agriculture in legally occupied land.
- (c) Establishment of a foundation herd of beef cattle.

Seven industrial projects are also presented in varying degrees of detail. The industries are based on handling local raw materials of wood, glass sand and scrap iron. These are probably most suitable for private sector financing. They consist of:

- (a) Glass Container Factory.
- (b) Sawmill.
- (c) Drying Kilns.
- (d) Moulding Plant.
- (e) Impregnation Plant.
- (f) Prefabrication Housing Plant.
- (g) Iron Foundry.

PLANNED DEVELOPMENT OF STATE LAND FOR ESTATE AND SMALLHOLDER SCHEMES

INTRODUCTION AND SUMMARY

The Planned Development Programme for the Maldivian Study Area is based on the concept of new developing Rural Development Areas (RDAs) for which a complete package of resources development and associated services has been provided. Agricultural development within the RDAs depends to a great extent upon a development of the activities of the State Government's main agency for agricultural development, the National Land Development Board (SLDB). The project now described was evaluated as a potential investment embodies the programmes for that agency during the period 1974-75 to 1980-81 - the Action Programme Period. The Terms of Reference for this Study require that a detailed planned development programme should be drawn up covering approximately 200,000 acres during that period.

While development of the various sectors may proceed independently, certain inter-related features such as roads, drainage, infrastructure and re-vegetation, are inevitably designed to cater for the development programme as a whole.

The project consists of activities in two RDAs - in one development is undertaken in continuation of ongoing schemes; in the other the activities are designed to create a nucleus from which development can be expanded into the surrounding areas. SLDB is planned to develop all the land along estate-type lines to a certain stage when part of it will be handed over to selected smallholders guided and supported by a newly established Agricultural Development Unit within the Department of Agriculture. SLDB will continue management of a nucleus estate.

The area of State Land affected for development by SLDB during the period is roughly 190,000 gross acres, which, after deduction of unsuitable areas and allocation of land to villages and towns, will provide an estimated net crop area of 37,355 acres. 11,690 acres would be on the public estate and 24,165 acres destined, after development, to be sub-leased to smallholders.

Oil palms, rubber, cocoa and rice are the main crops recommended for inclusion in the cropping programme, divided as follows:

Oil palm	24,365 acres
Rubber	7,975 acres
Cocoa	2,385 acres
Rice	1,430 acres

In addition there would be roughly 4,538 acres of good agricultural land allocated in one-acre homestead plots for smallholders on which would be undertaken as small-scale activities such enterprises as growing of pepper, coffee, fruit, vegetables, spices and the rearing of pigs, poultry and pond cultured fish.

PUBLIC DEVELOPMENT OF STATE LAND FOR ESTATE AND SMALLHOLDER SCHEMES

INTRODUCTION AND SUMMARY

The Regional Development Programme for the Miri-Bintulu Study Area is based on the concept of nine interlocking Rural Development Areas (RDAs) for which a complete pattern of resource development and associated services has been provided. Agricultural development within the RDAs depends to a great extent upon a continuation of the activities of the State Government's main agency for agricultural development, the Sarawak Land Development Board (SLDB). The project now described and evaluated as a potential investment embodies the programmes for that agency during the period 1974-75 to 1980-81—the Action Programme Period. The Terms of Reference for this Study require that a detailed planned development programme should be drawn up covering approximately 50,000 acres during that period.

While development in each RDA can proceed over the years independently, certain interrelated features, particularly with respect to physical infrastructure and organisation, are inevitably designed to cater for the development programme as a whole.

The project consists of activities in two RDAs: in one development is undertaken in continuation of ongoing schemes; in the other the activities are designed to create a nucleus from which development can be expanded into the surrounding areas. SLDB is planned to develop all the land along estate-type lines to a certain stage when part of it will be handed over to selected smallholders guided and supported by a newly established Agricultural Development Unit within the Department of Agriculture. SLDB will continue management of a nucleus estate.

The area of State Land selected for development by SLDB during the period is roughly 59,325 gross acres which, after deduction of unsuitable areas and allocation of land to villages and roads, will provide an estimated net crop area of 37,855 acres. 13,690 acres would be on the public estate and 24,165 acres destined, after development, to be subdivided into smallholdings.

Oil palms, rubber, cocoa and rice are the main crops recommended for inclusion in the cropping programme, divided as follows:

Oil palm	...	...	...	...	26,065 acres
Rubber	...	...	...	...	7,975 acres
Cocoa	...	...	...	...	2,385 acres
Rice	...	...	...	...	1,430 acres

In addition there would be roughly 1,538 acres of good agricultural land allocated in one-acre homestead plots for smallholders on which would be undertaken as small-scale activities such enterprises as growing of pepper, coffee, fruit, vegetables, spices and the rearing of pigs, poultry and pond cultured fish.

The smallholdings have been designed to provide a minimum family income of \$2,500 by the sixth year, completely amortise housing, land development and crop establishment costs within 20 years at an interest rate of seven per cent per annum, and provide for a replanting fund during the life of the tree crops. For the nucleus public estate analyses of three possible financial organisation systems were shown to give satisfactory repayment capacity but differed in family incomes to the workers.

The project is expected to result in a considerable increase in agricultural production reaching about 46,000 tons of palm oil, 9,000 tons of rubber, 1,500 tons of rice and 1,700 tons of cocoa by the mid-1980's. The value of this production is estimated to be between \$22 mn and \$27 mn per year.

Economic evaluation at market prices shows that the investment period (when costs exceed revenues) would extend over nine years and the accumulated cash flow deficit would amount to \$56.3 mn. The commercial rate of return to investment, excluding duty, would be 8.5 per cent.

Economic evaluation at social prices shows that the internal rate of return would exceed the opportunity cost of capital by 4.6 per cent and indicates that the surplus earned by the development would be \$16 mn over the 25-year period.

Foreign money costs are expected to exceed earnings during the first six years and total about \$3.3 mn, but since most of the Project production will be exported the eventual direct foreign exchange inflow attributable to the development will be considerable. From 1984 onwards the net contribution to national foreign exchange reserves from the Project is estimated to be \$ 20 mn per year.

The project consists of a nucleus estate in the form of a public estate and a number of smallholdings. The nucleus estate is to be developed in the form of a public estate and the smallholdings are to be developed in the form of a public estate. The nucleus estate is to be developed in the form of a public estate and the smallholdings are to be developed in the form of a public estate. The nucleus estate is to be developed in the form of a public estate and the smallholdings are to be developed in the form of a public estate.

Oil palm, rubber, cotton and rice are the main crops recommended for inclusion in the cropping programme, divided as follows:

Oil palm	20,000 acres
Rubber	7,000 acres
Cocoa	1,382 acres
Rice	1,480 acres

In addition there would be roughly 1,238 acres of good agricultural land allocated to one-acre homestead plots for smallholders on which would be undertaken as small-scale activities such as growing of pepper, coffee, fruit vegetables, spices and the raising of pigs, poultry and good cultured fish.

CHAPTER 1

OBJECTIVES AND BACKGROUND OF THE PROJECT

1.1 OBJECTIVES

The project presented here is the development of unoccupied State Land to agriculture by the Sarawak Land Development Board (SLDB). This development has been planned to be a continuation of large-scale agricultural development already started by the SLDB in the Fourth Division of the State. That development in itself was undertaken as part of the Second Malaysia Plan the objectives of which can be summarised as follows:

- (a) the eradication of poverty;
- (b) the reconstruction of society and of economic balance.

The objectives particularly associated with agriculture are:

- to improve the farmers' livelihood and the rural amenities;
- to provide employment for the population of working age;
- to diversify agricultural production.

These are also the basic objectives of the overall agricultural plan which is an integral and major component of a comprehensive Miri-Bintulu Regional Development Plan covering an area of about 3.5 million acres—the Study Area—the location of which is shown in Figure 1.1.

An additional particular objective specified in the Scope of Work of this Study is that the Government wishes to develop the potential of the Area in order to provide employment opportunities within it primarily for migrants from certain parts of Sarawak where the rural people are unable to make a reasonable livelihood from their land.

The Scope of Work also gave guidelines for development indicating that processing of agricultural produce should, as far as possible, be undertaken in the Region and specifically that about 50,000 acres of unoccupied State Land should be developed by 1980 and a further 200,000 by 1990.

In accordance with these objectives the agricultural plan for the Study Area has been specifically aimed at:

- (a) providing farmers and farm workers with a minimum annual net income of between \$2,500 and \$3,000 a year;
- (b) opening up presently unoccupied suitable State Land to provide employment and farming opportunities for people from outside the Area;
- (c) providing opportunities for the existing population to participate in and benefit from the development;
- (d) diversifying agriculture away from the predominance in the Area of rubber and pepper.

LOCATION OF STUDY AREA

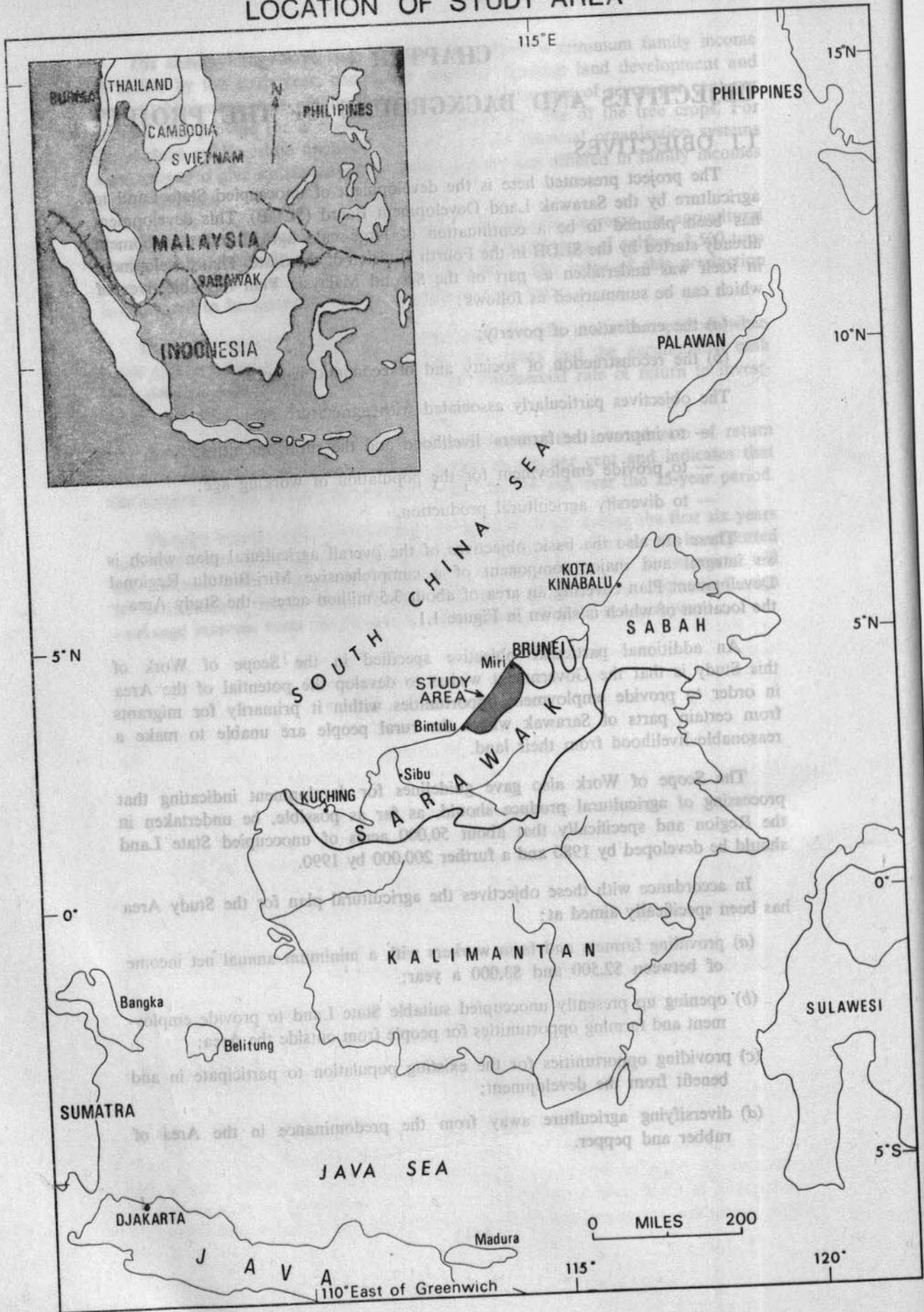


FIGURE 1

Detailed plans were drawn up for the development of about 49,500 acres of unoccupied land. The plan, covering roughly 42,000 acres, are presented here as an investible project. About 7,500 more acres were planned as a beef ranch and a Livestock Production and Animal Husbandry Training Centre. The plans for the beef ranch have also been presented as an investible project.

1.2 CHARACTER OF THE PROJECT

The Project is a vital component of the overall agricultural plan, the essence of which has been to select promising accessible areas of unoccupied land for agriculture and to concentrate into them an intensive effort, in which all the technical and social factors affecting development are integrated. These intensive development areas form the core of the plans for rural development. But although these will progressively expand and increase in number, it is implicit in such a development policy that many farmers will remain outside the intensive areas for some time to come. For them the normal Department of Agriculture extension services will continue, aimed mainly at minimising land destruction, improving food output and preparing the people for their eventual incorporation in intensive schemes by improving marketing conditions and continuing provision of existing subsidy schemes.

For development purposes the Study Area has been divided into nine Rural Development Areas (RDAs) as shown in Figure 1.2. An RDA is a composite geographical area, the size and location of which is determined by physical, organisational, management, processing and investment factors. Each RDA consists of land that can be largely developed independently as a viable undertaking based on agriculture and forestry; but development in one RDA would generally be mutually supporting with previous or subsequent development of an adjacent RDA.

In each RDA the agricultural plan aims to use either a nucleus enterprise that already exists as a basis for development or, where no nucleus exists, to create one by concentrating intensive agricultural inputs into relatively small areas. Thus in the Miri, Marudi, Lambir-Subis and Bintulu RDAs future agriculture has been orientated either towards supplying the needs of the increasing urban populations or towards reinforcing already established agricultural enterprises. In other RDAs a phased creation of nuclei has been planned.

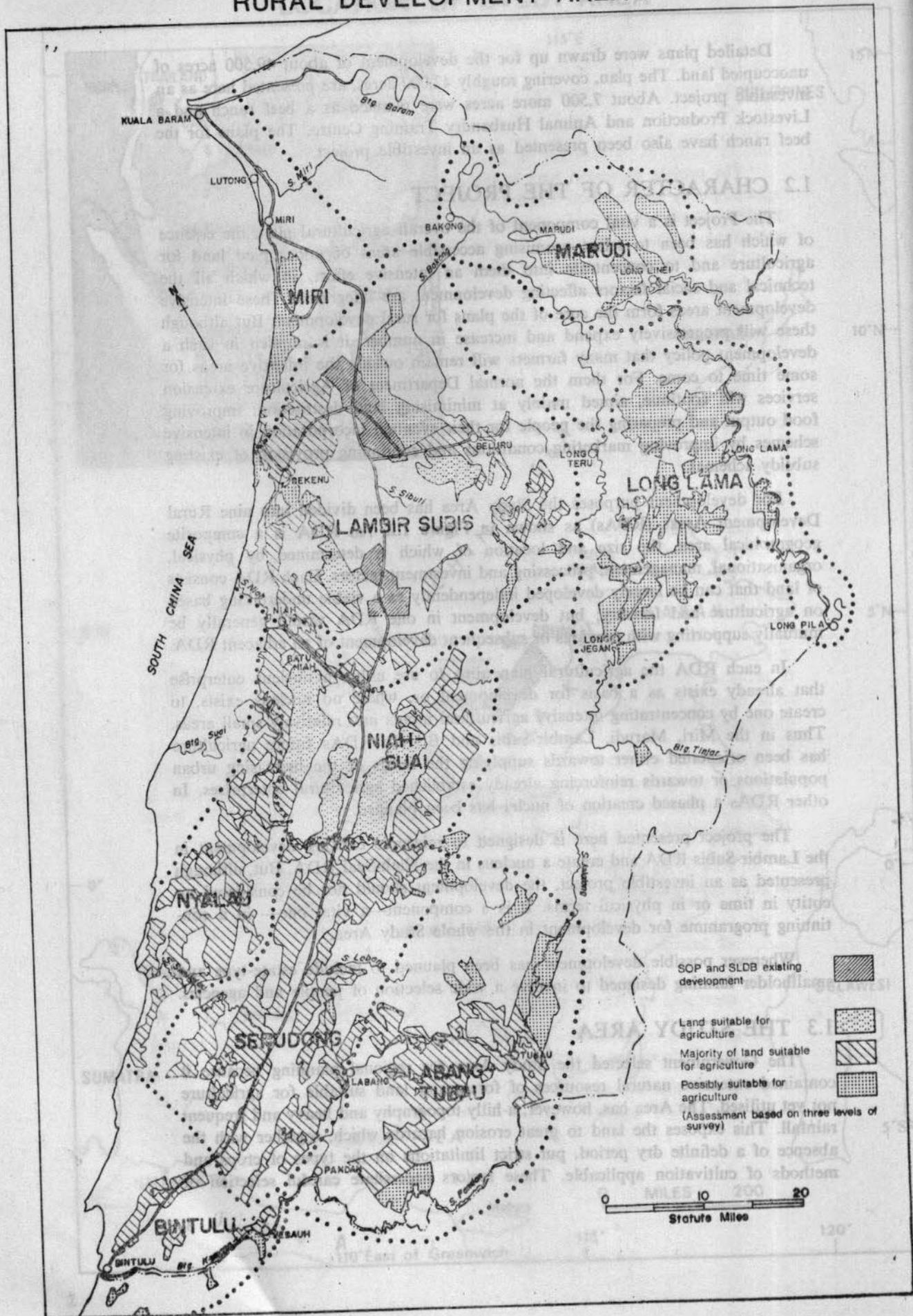
The project presented here is designed to reinforce existing development in the Lambir-Subis RDA and create a nucleus in the Niah-Suai RDA. But, although presented as an investible project, the development should not be considered an entity in time or in physical terms. It is a component—a vital one—in a continuing programme for development in the whole Study Area.

Wherever possible development has been planned to include estate-type and smallholder farming designed to involve a wide selection of people and agencies.

1.3 THE STUDY AREA

The Government selected the Study Area for regional planning because it contained extensive natural resources of forest and land suitable for agriculture not yet utilised. The Area has, however, a hilly topography and heavy and frequent rainfall. This exposes the land to great erosion hazards which, together with the absence of a definite dry period, put strict limitations on the types of crops and methods of cultivation applicable. These factors necessitate careful selection of

RURAL DEVELOPMENT AREAS



land for development. Soil and terrain classification surveys of the whole Study Area were carried out at three levels of intensity. The results are included in Figure 1.2. The blocks of State Land suitable for agriculture are widely scattered but are mainly in the western half of the Study Area and the majority a considerable distance from both Miri and Bintulu, the two main towns in the Area. Generally the suitable agricultural land is in relatively small blocks (maximum about 20,000 acres) separated by larger areas of unsuitable land. Even within the blocks of suitable land there are few large contiguous stretches with uniform cropping capabilities. Rapid changes of land capability within short distances result in numerous irregularly shaped and sized patches each with different agricultural capabilities. This is clearly shown on the land capability maps in the Map Folder which is part of the Final Report.

By far the greatest proportion of the land blocks found suitable for agriculture are at present inaccessible by road or navigable river; in the past the pattern of land settlement has been along the river banks. Most of the land between the larger rivers has been left relatively undisturbed. This pattern is shown in Figure 1.3.

The characteristics of present agriculture can be summarised as follows:

- (a) extensive river-based shifting cultivation of hill rice by longhouse communities who also have small scattered plots of rubber which are generally poorly maintained;
- (b) less extensive settled agriculture, around small townships, of Malays, Melanaus and Chinese cultivating mainly rice, pepper, vegetables and rubber;
- (c) predominantly smallholder farming;
- (d) almost complete absence of any form of on-the-farm transport or mechanical aids;
- (e) recently started large-scale, estate-type planting of oil palms in the Lambir-Subis Development Area.

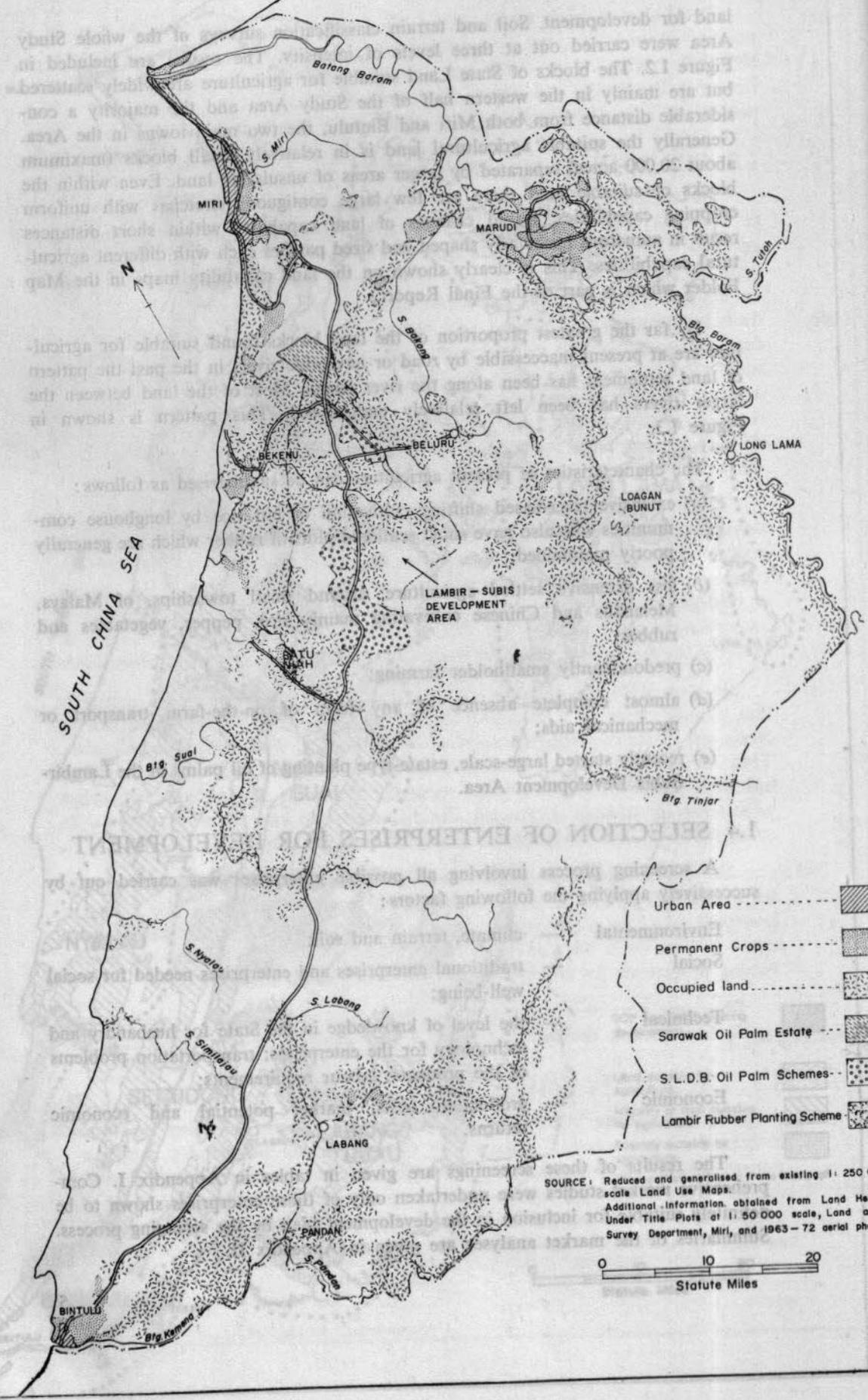
1.4 SELECTION OF ENTERPRISES FOR DEVELOPMENT

A screening process involving all possible enterprises was carried out by successively applying the following factors:

- | | | |
|---------------|---|---|
| Environmental | — | climate, terrain and soil; |
| Social | — | traditional enterprises and enterprises needed for social well-being; |
| Technical | — | the level of knowledge in the State for husbandry and technology for the enterprises; transportation problems of the products; labour requirements; |
| Economic | — | production costs, market potential and economic returns. |

The results of these screenings are given in tables in Appendix I. Comprehensive market studies were undertaken only of those enterprises shown to be definitely suitable for inclusion in the development plan by the screening process. Summaries of the market analyses are given in Appendix II.

PRESENT AGRICULTURAL SITUATION



SOURCE: Reduced and generalised from existing 1:250 000 scale Land Use Maps. Additional information obtained from Land Held Under Title Plots at 1:50 000 scale, Land and Survey Department, Miri, and 1963-72 aerial photographs.

The conclusions from the screening and the market studies were that only two enterprises, oil palm and rubber, could be included in the agricultural plan for immediate large-scale plantings, but beef rearing, cocoa and pepper growing and single cropping of rice were enterprises which could be included on a more limited scale so long as reasonable precautions were taken in selecting the land for them.

Other potentially remunerative activities that could be undertaken on a small scale include the growing of annual grain, pulses and vegetable crops, the planting of fruit trees, several spices, cashew nuts, annatto and some essential oils as well as the rearing of pigs, poultry and pond cultured fish. The choice and size of these latter enterprises would often depend upon the distance from an urban market.

Oil palms should be the main enterprise but large-scale operations are needed particularly with regard to processing. Large capacity mills are required to achieve economies of scale. Unit costs of practically all production items are generally higher in Sarawak than elsewhere and only by operating efficiently and on a large scale will it be possible to create an industry that would be competitive on the world market.

For rubber the development aim should be to maintain Sarawak's position as a rubber producer. There is a need to create sufficiently large concentrations of new high yielding rubber plantation so as to establish a firm base for setting up central processing and marketing facilities which would handle production from existing rubber plots. This would provide an incentive for better maintenance and more regular tapping of those plots.

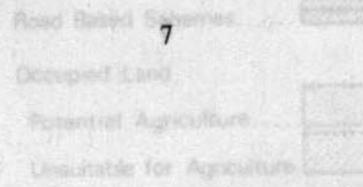
Cocoa planting should initially be restricted to the best agricultural land and should be in fairly large individual blocks in order to facilitate good management and pest control and to enable processing facilities to be located centrally. The aim should be to produce reasonably large uniform export consignments of good quality beans.

Because local knowledge and experience of cattle rearing and pasture management are limited development should first be restricted to creating a breeding herd initiated by importing beef-type cattle and keeping them under commercial ranch conditions. A project along these lines is included in the development plan but is not part of the SLDB programme.

Pepper should be grown as an important subsidiary crop for small-scale farmers because it gives good economic returns. But the risk of failure due to disease and the high capital investment required combine to make this enterprise best suited to relatively small-scale operations.

Rice should be grown mainly for satisfying local demand for food and as such would perform an essential function in the development process. Most of the land suitable for this crop is in long narrow valleys subject to flooding, but with water control, levelling and bunding the land could be very productive, especially with irrigation.

The market analyses have shown that at present the demands for palm oil, natural rubber and cocoa exceed supplies, and prices are high. But the forecasts for the next decade are that supplies will outstrip demand, and there will be a gradual decline in the prices of all three commodities. Also considerable fluctuations, both short term and long term, can be expected in the prices of almost all



the products of enterprises selected for inclusion in the agricultural plan. This necessitates that attempts must be made to provide some security, particularly to small-scale farmers, against fluctuations and falling prices of the main tree crops. These requirements have been met by planning for the adoption of a diversified farming system and the inclusion within each estate, farm or small-holding of at least two of the main tree crops.

Agricultural development should fundamentally be based on land capability classification. But the application of this criterion alone would lead to a patchwork cropping pattern, with some crops being grown on a scale too small to be easily marketed and processed, and too small to make them attractive for plantation-type management. Some aggregation will be necessary to make homogeneous blocks of manageable size. For estate-type operations the approximate minimum acreages of blocks of the main crops should be:

Oil palms and rubber	200 acres
Cocoa	100 acres
Rice	50 acres

1.5 SELECTION OF LAND FOR PRIORITY DEVELOPMENT

Criteria for the selection of land to be surveyed for identification of the 50,000 acres required by the Terms of Reference to be planned for development by 1980 were as follows:

- that most of the land was at present unoccupied;
- that good road connections existed, or could easily be created, to Miri or Bintulu;
- that harvesting of the forest on the land was underway or completed;
- that new development could be associated with development already undertaken.

These conditions could only be met in the Lambir-Subis and Niah-Suai RDAs. Consequently about 112,000 acres were soil surveyed at the semi-detailed level. It was necessary to survey this total acreage in order to identify the 50,000 acres of suitable agricultural land. The locations of the land blocks surveyed are shown in Figure 1.4. The land block named Karabungan was found to have rather shallow soils and was selected for development mainly to beef. The other areas are the ones on which the SLDB development programme is planned.

1.6 RECRUITMENT AND SELECTION OF PARTICIPANTS FOR THE PUBLIC SECTOR DEVELOPMENT SCHEMES

Sociological Studies indicated that the majority of the participants to public sector schemes are likely to come from the Malay and Iban communities in the First, Second, Third and Fifth Divisions of the State. However, the present organisation for publicity concerning opportunities for participation in development schemes is not considered adequate. Recommendations have been given in the overall Regional Plan for improving this and combining it with a State-wide recruitment and selection process of potential participants. SLDB must be closely involved in this and the recommendations are briefly described in Appendix IV.

1.7 SOCIAL REQUIREMENTS OF POTENTIAL MIGRANTS

To improve the farmers' livelihood and their rural amenities requires that in the development plan a balance must be established between physical and economic viability objectives of the development on the one hand and the well-being and aspirations of the people for whom the development is undertaken on the other.

The sociological investigations previously mentioned indicated that in addition to the need for most families to cultivate a patch of rice, the following aspects would be of particular importance in planning the agricultural development:

- (i) that a large proportion of the people willing to participate in agricultural development, whether recruited locally or from other parts of Sarawak, will come from communities presently practising shifting cultivation. The majority of these people will have attitudes and expectations not associated with large-scale development. For example they will—
 - be unused and unprepared for the social environment created in a development area;
 - have a minimal knowledge of the cultivation techniques for the most important crops and enterprises suitable for development;
 - expect to have the prospect of establishing a personal relationship with an identifiable holding of land.
- (ii) the amenities considered most important by prospective settlers are—
 - security of persons and property;
 - easy access to health and schooling services;
 - facilities for worship and religious ceremonies;
 - opportunities for a diversification of employment especially for dependants of migrants' families;
 - facilities for recreation.
- (iii) there are individuals and community groups in Sarawak with sufficient capital or credit worthiness as well as willingness to undertake agricultural development on their own account;
- (iv) there are also sections of the community who do not wish to become permanent farmers, either smallholders or private investors, but who require employment only for a relatively short period. There are others who would want agricultural employment but who prefer to be employed and directed in daily work.

To provide for the employment and land ownership aspirations requires the establishment on State Land of estate-type holdings as well as individual farm holdings. The agricultural plan provides for this in the SLDB development programme and in recommendations to allocate land to suitable private investors.

Since many of the participants in the new development areas will be unprepared for the changed social environment, organised reorientation training and social welfare activities have been provided for by recommendations to station trained community development personnel in the new settlements.

The participants need for agricultural training, guidance and support is provided for by:

- (i) arranging that all the potential smallholder farmers that are selected for participation in schemes involving publicly developed land either undergo a probation period working as a labourer on a public estate or receive a year's training at a Farmer Training Institute.
- (ii) the creation of a specialised agricultural service that would operate only in the development areas with the specific task of guiding and supporting all small-scale farmers.

1.8 PROVISION OF EFFICIENT MANAGEMENT AND ADEQUATE TECHNICAL ADVISORY STAFF

Financial returns to farmers in Sarawak and in the Study Area are at present lower than in Peninsular Malaysia. Transport and handling costs are higher, which adds to the cost of imported farm inputs and to the expense of marketing export products. Import duties are also higher on vehicles and plant; labour wage rates are higher, and labour productivity on the average is lower. Management staff salaries, in both the public and private sectors, are substantially greater and, in the Study Area, road and port facilities are poor and road construction costs are high. Finally expensive soil conservation measures are required on much of the land. In general this situation is likely to continue in the future and will necessitate that all development undertakings are efficiently managed. In addition, the need for good management is emphasised by the heavy reliance on tree crops in the development plan. Costs of establishing crops of this type are high, and no income accrues for some years. The standard of management during the years of establishment is known to have a marked influence on the later productivity of the mature plantation. There will be need for expensive processing facilities, particularly for oil palm fruits. This in turn will make demands on management, which must ensure that the production of good quality fruit is matched to the capacity of the mill. Moreover, as the oil deteriorates quickly after harvesting of the fruit bunch, it will be essential to have strict system of quality control in the field, and efficient, quick transport of the bunches to the mill.

The basic aim in the project described here is to combine efficient primary land clearing, development and permanent crop establishment with an ultimate objective—progressively achieved—of meeting the understandable wish of many farmers to identify themselves with a piece of land and to manage it. The project provides for the experience and efficiency of the SLDB to be used to develop the land for smallholdings and for public nucleus estates around which selected smallholders and others can be helped to manage their own affairs. It is planned that SLDB should provide centralised processing and marketing facilities for palm oil and wherever possible for the other enterprises too so that advantage can be taken of economies of scale. The need to provide small-scale farmers with guidance on the correct husbandry techniques and give them support in the form of credit and marketing is met in the agricultural plan by the proposal to create a special organisation within the Department of Agriculture—the Agricultural Development Unit (ADU). The establishment and operation of the ADU is summarised in Appendix III. The SLDB and ADU would work in close conjunction with each other and in co-operation with all other Government agencies involved in implementing the Plan as a whole.

1.9 SETTLEMENT PATTERN AND URBANISATION

To attract and retain persons to new development areas will require the rapid establishment of a reasonable level of the amenities they most require. This will necessitate early introduction of urbanisation, and a concentration of the people into villages and towns. The settlers and labourers associated with agricultural development will constitute virtually the only population in the development areas, therefore, they will have to provide the urban population.

The basic principle adopted for urbanisation in the new development areas is to create a central town which would be surrounded by several villages within a radius of five to ten miles. The main town and the villages would be mutually supporting and the village populations would utilise the facilities in the town. Each village would be surrounded by a cultivated area of about 5,000 acres which would support an agricultural population of approximately 2,000 people. The maximum distance from the village to any part of the developed land would be 1.5 to 2 miles (2 to 3 kilometers), which corresponds to about 30 minutes walking.

In order to establish the central town the procedure recommended is to concentrate into the chosen location the potential population of two or three villages. These people would be the main "town-creating force". The proposal is that the concentration of population should begin with the establishment of a large public sector estate under the management of SLDB. The labourers and staff serving the whole estate would live in the town, implying that a proportion of the workers would have to be transported from the town to their place of work in the fields. Manufacturing industries and commerce will probably not move into those towns until they are well established.

The villages would be connected to the town by all-weather roads and a public or concessionary bus service would be established. Thus the village populations could use the service facilities of the town frequently enough to become acquainted with a certain level of town life. In this system the service level in the villages would be kept at a basic minimum without depriving the village population of access to better facilities.

To satisfy the agricultural requirements of the participants it is recommended that sufficient suitable valley land is developed for wet rice cultivation to allow each permanent settler to be allocated one acre. In addition the new villages should be planned at a low housing density whereby the families would live on a homestead plot of about one acre on which the families should be encouraged to undertake the small-scale enterprises previously mentioned. To achieve this aim it will be essential to site the villages on good agricultural land. The general strategy recommended for these small-scale enterprises is to concentrate those requiring some processing (turmeric, ginger and essential oils for example) into selected villages, while other enterprises like the growing of pepper, coffee, annatto, cashew nuts and cardamom should be more widely scattered.

1.10 AGENCIES FOR IMPLEMENTATION OF THE PROJECT

1.10.1 The Sarawak Land Development Board (SLDB)

This Board was set up by Government in early 1971 for implementation of its large-scale agricultural development on unencumbered State Land. The specific tasks laid down by the Government for the SLDB are as follows:

- (a) to open up undeveloped land for agricultural use and settlement, with oil palm and rubber as the main crops;
- (b) to settle selected persons on land thus developed by providing economic holdings of the main crops;
- (c) to provide credit facilities, management and supervisory services to settlers;
- (d) to facilitate the processing and marketing of settlers' produce through the establishment of modern processing and marketing facilities;
- (e) to develop settler groups into viable social and economic communities.

These are wide and important roles which make the SLDB an ideal body for initiating rural development. Its State-wide organisation is shown in Figure 1.5 which traces the chain of command to the Study Area. The organisation is considered sound and no changes are recommended.

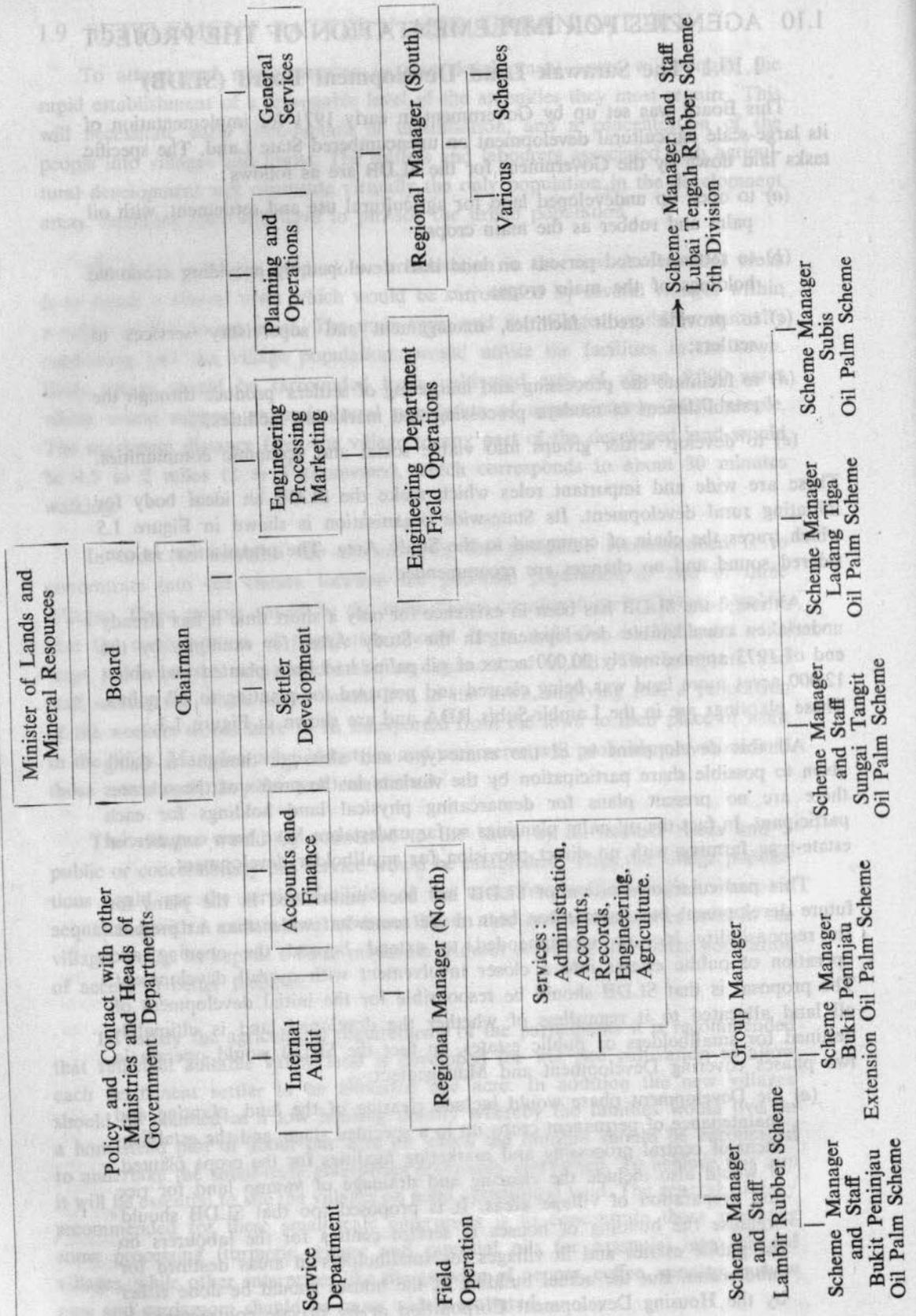
Although the SLDB has been in existence for only a short time it has already undertaken considerable development. In the Study Area, for example, by the end of 1973 approximately 20,000 acres of oil palms had been planted and about 12,000 acres more land was being cleared and prepared for planting to oil palms. These plantings are in the Lambir-Subis RDA and are shown in Figure 1.3.

All this development is of the estate-type and although thought is being given to possible share participation by the workers in the profits of the schemes there are no present plans for demarcating physical land holdings for each participant. In fact the oil palm plantings so far undertaken have been commercial estate-type farming with no direct provision for smallholder development.

This particular orientation of SLDB has been maintained in the plans for future development but its role has been made somewhat wider than at present. Its responsibility is now recommended to extend beyond the opening and operation of public estates into a closer involvement with overall development. The proposal is that SLDB should be responsible for the initial development of all land allocated to it regardless of whether the developed land is ultimately destined for smallholders or public estates. In fact the SLDB would operate in two phases covering Development and Management:—

- (a) the Development phase would include clearing of the land, planting and maintenance of permanent crops up to a specified stage, and the establishment of central processing and marketing facilities for the crops planted. It would also include the clearing and drainage of swamp land for rice and preparation of village areas. It is proposed too that SLDB should organise the building of houses in service centres for the labourers on the public estates and in villages for smallholders in areas destined for subdivision. But the actual building of the houses should be done either by the Housing Development Corporation or by private contractors.

FIGURE 1.5 PRESENT ORGANISATION OF THE SARAWAK LAND DEVELOPMENT BOARD



(b) the Management phase would begin when the main permanent crops reach maturity. At this stage responsibility for management of the developed land would split. SLDB would continue to manage areas destined for public estates which would form the nucleus for surrounding development and contain most of the processing facilities and the major town for the area. The management of the other developed areas would pass to selected smallholder families who would be guided and supported by the ADU.

These proposals are represented diagrammatically below:—

Proposed Development Procedure for Public Sector Schemes

Development Phase

Management Phase

SLDB responsibility

along estate-type lines

SLDB Public Estates

Smallholders

supported by the ADU

For much of the initial work in the development phase SLDB would employ, as they do at present, experienced contractors because of the fundamental importance of protecting the land from erosion and getting the permanent crops well established. But from this stage onwards SLDB's labour force should be composed as far as possible of potential smallholders carefully recruited with a future independence in mind. Their paid employment would be combined with a programme, lasting about nine months, and deliberately designed to give them farming experience, to test their suitability for becoming smallholders and to see if they themselves liked the prospects of a career on the land.

Two further important changes in SLDB's future operations in the Study Area are recommended. They are:—

- (a) a reduction in the rate of land development. This arises from the Governments stated intention to increase SLDB's commitments in other parts of Sarawak;
- (b) adoption of a diversified cropping pattern which would include rubber and cocoa in addition to oil palms. The reasons for this recommendation have already been explained.

1.10.2 The Agricultural Development Unit (ADU)

The importance of the role of ADU cannot be over-emphasised. Success in persuading and encouraging farm families to change from their traditional pattern of life to a settled existence and sustained hard work in an urbanised rural environment, will depend very largely indeed on the capacity and quality of ADU and the supporting social services.

ADU will not only be responsible for guiding and supporting the smallholders managing land developed by SLDB, but also those involved in Block Alienation schemes, farmers on legally occupied land and on small private holdings. ADU's services, which would include extension, credit and marketing, would be backed by the full resources of the Agricultural Department, to be called upon when required. The duties of its staff will therefore be manifold and technically diverse; but, as with all extension services, success will ultimately turn on the method and manner of approach. The education and training of ADU personnel

is therefore of greatest importance. A brief description of the ADU and its establishment is given in Appendix III. The overall development plan includes a comprehensive training and establishment programme for the ADU. It ensures that specially trained staff are available and so organised that at the appropriate time they will be able to guide and support the smallholder farmers, first on their rice and homestead plots, then later, when SLDB management ceases, on their plots of permanent crops. To make all farmers increasingly self-reliant both as individuals and collectively would be an important ADU aim. Therefore at an early stage, and before farmers become too dependent on ADU, they would be encouraged to form organisations to handle some of their own services, for example the supply of inputs or crop collection and transport.

1.10.3 Supporting Services

(a) The Research Services

Adequate back-up by the research services of the Department of Agriculture is an important component of the overall plan. The Department already has plans for considerable expansion of research in the Fourth Division and recommendations have been given in the overall plan which will ensure that investigations are orientated towards practical aspects and the particular requirements of development in the Region. This, combined with sociological research recommended in the overall plan to be undertaken at the agricultural university already planned to be built in Bintulu, and by a special research team attached to the existing Sarawak Manpower Section, will ensure these aspects are well cared for.

(b) Soil Surveys

In the areas covered by the Project semi-detailed soil surveys have been completed. Therefore no further surveys are planned in these particular areas but programmes have been drawn up for survey work to be done in land blocks where associated development is planned to be undertaken by private investors and by local inhabitants.

(c) Boundary Determination and Demarcation

Two aspects are involved:—

- (i) A social and political problem of determining the boundaries between legal and illegal occupation; this is planned to be undertaken by Administrative Officers.
- (ii) A physical problem of surveying, demarcating and mapping the boundaries. The work is planned to be divided between the Land and Survey Department and the Forest Department.

Recommended implementation programmes for both these aspects are included in the overall development plans.

(d) Harvesting of Forest Produce

It is important that the fullest possible use is made of the forests on land destined for development to agriculture. Schedules for harvesting and release of land to agriculture have been drawn up and will require the support of the Forest Department to ensure timely implementation.

1.11 ESTABLISHMENT OF SMALLHOLDER FARMERS

Those people proven suitable, during work on an SLDB estate, to become farmers (and provided they themselves wish to do so) would move into villages built for them on specific SLDB sub-schemes. Each family would be immediately allocated a swamp rice plot and a homestead plot both of which would be planted and developed with the guidance and support of the ADU. The settlers would continue to work under SLDB management as estate labour force until such time as the developed land is subdivided and allocated as smallholdings. This would take place when the tree crops attain maturity, about five years from clearing, when SLDB management would cease. ADU would be responsible for subdividing the blocks of oil palms and (where available) cocoa among the smallholders, who would thereafter be responsible for the management of the crops aided by the ADU. The rubber areas would continue to be managed as undivided blocks by ADU until ready for tapping—about seven years from clearing—when the blocks would be subdivided among the smallholders.

1.11.1 The Size and Composition of Smallholdings

Four main factors have together determined the most suitable size for a smallholding:—

- a family's work capacity, especially in periods of peak demand;
- the labour requirement of the preferred cropping pattern;
- the net target income;
- loan repayment capacity.

The main farming enterprises have to be oil palms, rubber and cocoa for which the demand and prices, as already explained, are uncertain and subject to wide variations. Therefore the agriculture on each holding is planned to be as diversified as land use criteria permit and the size of the holdings as large as can be reasonably handled by individual families.

The intention is that the rice plot and the homestead plot should be of one acre each. This would fulfil the traditional wish for adequate rice land and give productive employment for the whole family near home. These plots would provide the family's subsistence requirements of staple food, fruit, vegetables, small stock and possibly pond-cultured fish. In addition each holding is planned to have a plot of oil palms and one other plot of either rubber or cocoa.

With a diversified pattern of the main perennial crops dispersed around a village in accordance with land classification criteria, the determination of the optimum unit size of each tree crop to allot to an individual farmer is not easy. A system of 'modules' has been worked out, a module being the minimum unit size of land of a particular crop that will provide sufficient work, for most cultural operations, to justify a smallholder in making a journey to it. The disposition of modules would be such that no farmer would have to walk more than about 1.5 to 2 miles from his village.

The module sizes that have been adopted are; oil palms and rubber approximately five acres, cocoa about four acres. According to the total area of these main crops available within the village lands, a smallholder would be allotted one or more modules to give him a total holding size that corresponded approximately with his wishes and family labour capacity.

Given below are the composition of the five different holdings used in the Project. They are dependent upon the relative acreages of main crops available in the village areas and based on an average family of two manpower units.

Plot				(a)	(b)	(c)	(d)	(e)
				acres	acres	acres	acres	acres
Homestead	...	...	...	1	1	1	1	1
Rice	...	...	...	1	1	1	1	1
Oil Palm	...	...	...	9	10	11	10	9
Rubber	...	...	...	6	5	4	0	0
Cocoa	...	...	...	0	0	0	4	5
Totals	...	...	...	17	17	17	16	16

Modules, from their definition, would not be subdivided; but it is envisaged that whole modules could be negotiable assets which, with suitable controls, would allow enterprising farmers to acquire more land from those who preferred less.

The annual labour requirements of the various holdings based on detailed studies of labour requirements for the various crops are summarised in Table 1.1 which shows that on an annual basis the work load would not exceed the capacity of the average family consisting of two full time worker equivalents.

1.11.2 Target Net Income

The target net income adopted was \$2,500 to \$3,000 per family. It was derived on the basis of the earning potential of the full time workers available in an average family, assuming full time employment and current take-home wages for unskilled workers employed in agriculture. The net sale or consumption value of the rice and homestead plot enterprises is expected to amount to about \$500 out of the total income, the bulk of which would come from the tree crops. In addition there would be the accommodation value of the house.

The intention is that the rice plot and the homestead plot should be of one acre each. This would fulfil the traditional wish for adequate rice land and give productive employment for the whole family. The homestead plot would provide the family's subsistence requirements of staple food (rice, vegetables, small stock and possibly pond-cultured fish. In addition each holding is planned to include a plot of rubber and one other plot of either pepper or cocoa.

With a diversified pattern of the crop potential crops designed around a village in accordance with land classification criteria the determination of the optimum size for each module was also an aim to the individual farmer is not easy. A system of modules has been worked out, a module being the minimum unit size of land of a particular crop that will provide subsistence work for most cultural operations to justify a smallholder in making a journey to it. The disposition of modules would be such that no farmer would have to walk more than about 1.2 to 2 miles from his village.

The module sizes that have been adopted have been based on the experience of smallholders who have been shown how to manage their land. According to the findings of the study, the village smallholder would be allowed to manage his land in a way that would give him a total return of about \$2,500 to \$3,000 per year and family labour capacity will be properly

TABLE 1.1 LABOUR REQUIREMENTS FOR TREE CROP PRODUCTION ON THE PROPOSED SMALLHOLDINGS

Year of Scheme	12 and following											
	1	2	3	4	5	6	7	8	9	10	11	12 and following
Farm type (a)												
Total man days ...	375	255	272	317	289	240	344	410	404	424	428	444
Worker equivalents required ...	1.3	0.9	1.0	1.1	1.0	0.8	1.2	1.4	1.4	1.5	1.5	1.6
Farm type (b)												
Total man days ...	360	245	274	330	306	253	339	390	379	396	399	412
Worker equivalents required ...	1.3	0.9	1.0	1.2	1.1	0.9	1.2	1.4	1.3	1.4	1.4	1.5
Farm type (c)												
Total man days ...	344	234	276	343	322	265	334	369	353	367	370	380
Worker equivalents required ...	1.2	0.8	1.0	1.2	1.1	0.9	1.2	1.3	1.2	1.3	1.3	1.3
Farm type (d)												
Total man days ...	237	278	313	355	354	317	317	296	274	274	274	274
Worker equivalents required ...	0.8	1.0	1.1	1.3	1.2	1.1	1.1	1.0	1.0	1.0	1.0	1.0
Farm type (e)												
Total man days ...	231	303	325	352	352	323	323	304	284	284	284	284
Worker equivalents required ...	0.8	1.1	1.1	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0

CHAPTER 2

PHYSICAL ASPECTS OF THE PROJECT

2.1 THE EXISTING SITUATION IN THE PROJECT AREAS

2.1.1 The Lambir-Subis RDA

(a) General

All forest in this Area, except that in the Niah National Park, has been harvested but some valuable marketable timber still remains and salvage logging operations are required to be undertaken in all areas destined for agricultural development.

The central part of this Area was selected and planned in 1966/67 as the Lambir-Subis Development Area. Large-scale oil palm planting has since been undertaken by the SLDB and Sarawak Oil Palm Berhad (SOP). The Niah National Park, though not officially gazetted, has been under proposal since 1961. Much of the remaining land is already occupied, most of it for shifting cultivation of hill rice. Some of the occupation is illegal and adjudication by administrative officers will be necessary in many places before planned development can proceed. The unoccupied land is available for development to agriculture if semi-detailed soil surveys prove it suitable.

Bekenu and Beluru are small established towns, each with a bazaar and some Government offices. The Beluru bazaar, which was burned down in 1972, is being rebuilt by Government. A health centre has been built at a possible future service town site located on the Miri-Bintulu Road between the SLDB Bukit Peninjau Scheme and the SOP estate.

(b) Population

Urban (Bekenu) 700.

Rural and semi-urban in the remaining parts 21,300.

(c) Communications

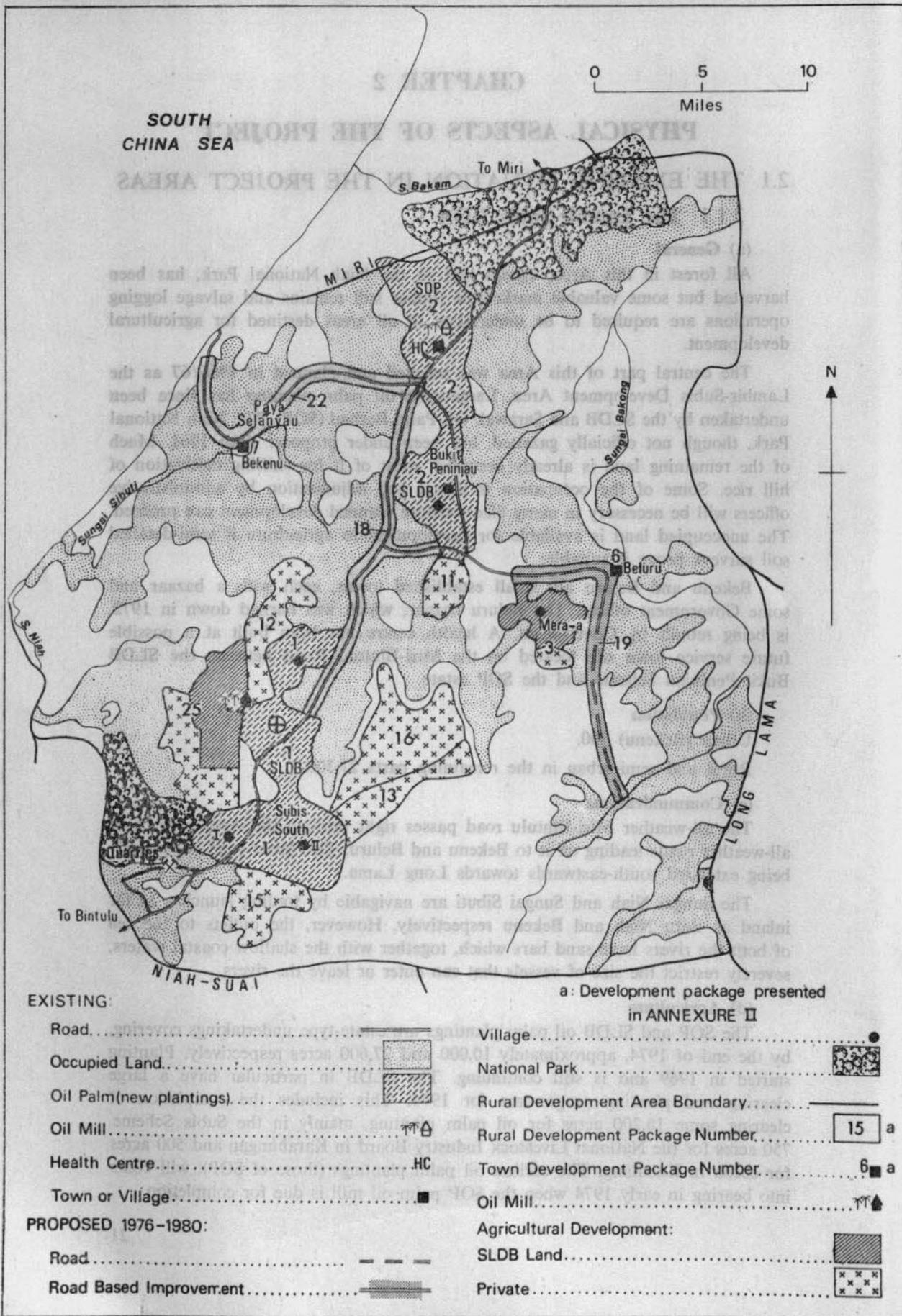
The all-weather Miri-Bintulu road passes right through the Area with other all-weather roads leading off it to Bekenu and Beluru. This latter road is currently being extended south-eastwards towards Long Lama.

The Sungai Niah and Sungai Sibuti are navigable by trading launches as far inland as Batu Niah and Bekenu respectively. However, the outlets to the sea of both the rivers have sand bars which, together with the shallow coastal waters, severely restrict the size of vessels that can enter or leave the rivers.

(d) Agriculture

The SOP and SLDB oil palm plantings are estate-type undertakings covering, by the end of 1974, approximately 10,000 and 27,600 acres respectively. Planting started in 1969 and is still continuing. The SLDB in particular have a large clearing and planting programme for 1974. This includes the completion of clearing some 16,200 acres for oil palm planting, mainly in the Subis Scheme, 750 acres for the National Livestock Industry Board in Karabungan and 500 acres for cocoa in Kabalang. The earliest oil palm plantings (those of SOP), will come into bearing in early 1974 when the SOP palm oil mill is due for completion.

PRESENT AND FUTURE DEVELOPMENT IN THE LAMBIR-SUBIS RDA



It is designed to handle about 20 tons of fresh fruit bunches (ffb) per hour, a capacity which is expected to be a little in excess of the production from the SOP plantings. The intention has been to provide processing facilities for fruit from a limited area of oil palms planted by local farmers in the vicinity.

The SLDB mill currently being planned is expected to be located on the north-western boundary of the SLDB Subis Schemes and is expected to have an ultimate capacity of 60 tons of ffb per hour. The first stage should be operational in 1975. This mill too is expected to be able to process fruit from nearby private growers. The Department of Agriculture has already initiated a road-based scheme near Pukit Peninjau to plant 300 acres of oil palms on Native Customary Land during 1973/74.

Much of the agriculture in the occupied areas is shifting cultivation of hill rice, but there are considerable areas of Mixed Zone Land around Bekenu, along the Sibuti river. This land is mostly divided into smallholdings, issued under title, where swamp rice, fruit trees and rubber are grown. Also near Bekenu, at Paya Selanyau, there is a partially completed Government rice scheme where drainage and irrigation works are in hand. The works are planned to cover eventually about 3,350 acres. A rice testing station was opened there in 1972.

The cultivation of swamp rice is also practised quite extensively in the Native Customary Land along the road to Beluru and in swamp land east of the SOP estate. There are small, privately owned rubber holdings scattered throughout the occupied land.

Agricultural research for the Fourth and Fifth Divisions is centred at the Kabuloh Research Station. This is run by a graduate Research Officer with a relatively small supporting staff. Adjacent to this Station is the Kabuloh Farmers Training Institute with accommodation for 60 students. It was opened in 1971.

The land block Mera-a, because it is favourably situated with regards to easy road access and close to previous development, is recommended as the first area to be developed by SLDB to a diversified cropping pattern for the subsequent establishment of smallholders. The proposal is that Sarawak citizens, who have proved themselves as good potential smallholders by their work with SLDB in the existing oil palm schemes and wish to become smallholders, should be selected and transferred to Mera-a for working. Here they would, by stages, eventually become smallholders in accordance with the policies and procedures already described. The development of Mera-a along these lines can be considered a trial for the system because, in the overall Plan, work here would commence two years before the next area proposed for similar development.

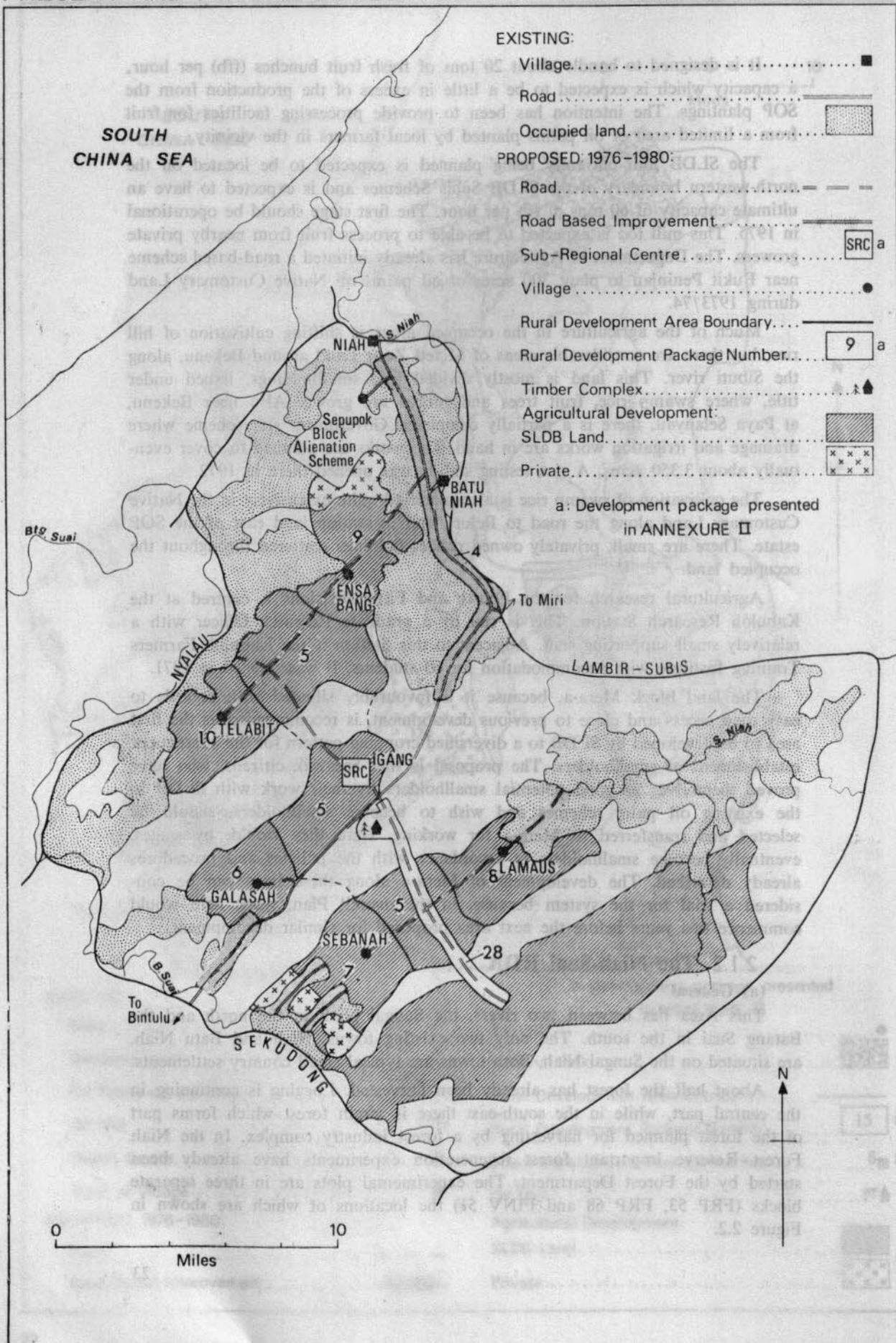
2.1.2 The Niah-Suai RDA

(a) General

This Area lies between two rivers, the Sungai Niah in the north and the Batang Suai in the south. The only two existing towns, Niah and Batu Niah, are situated on the Sungai Niah. Both towns are typical small country settlements.

About half the forest has already been harvested. Logging is continuing in the central part, while in the south-east there is virgin forest which forms part of the forest planned for harvesting by a forest industry complex. In the Niah Forest Reserve important forest regeneration experiments have already been started by the Forest Department. The experimental plots are in three separate blocks (FRP 53, FRP 68 and FINV 51) the locations of which are shown in Figure 2.2.

PRESENT AND FUTURE DEVELOPMENT IN THE NIAH-SUAI RDA



Just east of Batu Niah there are two stone quarries; one owned by Government, the other privately. These are the only easily accessible large sources of stone between Miri and Bintulu.

(b) Population

Urban (Niah and Batu Niah), 2,000

Rural and semi-urban in the remaining parts, 2,000.

(c) Communications

The all-weather Miri-Bintulu road runs right through the Area. The branch road to Batu Niah and Niah is also all-weather.

The Batang Suai is navigable by trading launches for a considerable distance inland, but no trading towns have developed on its banks. The Sungai Niah is similarly navigable to a short distance up-river of Batu Niah.

(d) Agriculture

Around Niah and Batu Niah are a cluster of Chinese smallholdings where rice, pepper, fruit, vegetables and rubber are grown. Practically all the rest of the occupied land is under shifting cultivation of hill rice with small rubber plantings scattered throughout.

During 1973 the Department of Agriculture started a block alienation settlement scheme at Sepupok. The scheme covers about 3,000 acres and has been planned to accommodate eventually 210 smallholder farmers who would develop a mixed cropping pattern based primarily on oil palms.

The land blocks included in the Project are: Igang, Galasah, Sebanah, Sawai, Lamaus, Ensabang, Jatan and Telabit. These are all reasonably close to the existing roads. The forest on all except Jatan and Telabit has been logged and now requires only salvage logging: Jatan and Telabit are still virgin forest areas but are under licence.

2.2 THE OVERALL PROGRAMME OF ACTIVITIES FOR LAND INCLUDED IN THE PROJECT

The programme is summarised in Table 2.1.

2.3 DETAILED SLDB PROGRAMME

2.3.1 Land Clearing and Crop Establishment Activities

The programme to be undertaken by the SLDB to establish the areas of crops required for the Project is shown in Table 2.2. The development activities fall into four phases:

- (a) Land clearing after salvage logging has been completed. The logging roads would form the basis of the agricultural road network. Land clearing operations include under-brushing, felling, burning, stacking, reburning, cover crop establishment.
- (b) Nursery establishment and clearing for an administrative centre at a suitable site having the necessary topographic and water supply requirements.
- (c) Planting of the seeds or seedlings into the prepared cleared areas; lining, hoeing, shade establishment, protection against rodents and other pests are part of this operation.

TABLE 2.1 THE PROPOSED DEVELOPMENT AND MANAGEMENT PROGRAMME FOR LAND ALLOCATED TO SLDB IN THE LAMBIR-SUBIS AND NIAH-SUAI RDAs

ACTIVITY	NAME OF BLOCK OF LAND									
	MEIRA-A	IGANG	GALASAH	SEBANAH	SAWAI	LAMAUS	ENSABANG	JATAN	TELABIT	KABATU
	1973*	1973*	1973*	1973*	1973*	1973*	1973*	1973*	1973*	1973*
Semi-detailed Soil Survey	Year	1974	1975	1975	1975	1976	1977	1978	1978	1978
Adjudication by Administrative Officers of boundaries of legal occupation	Year	1974	1975	1975	1975	1976	1977	1978	1978	1978
Survey of boundaries by Land and Survey Department	Miles	22	10	16	22	7	21	19	11	13
	Year	1974	1974	1975	1975	1976	1976	1977	1978	1978
Land and Survey Department	Miles	10	nil	9	11	nil	12	17	6	9
Demarcation of boundaries	Year	1974	1974	1975	1975	1976	1976	1977	1978	1978
Forest Department	Miles	12	10	7	11	7	9	2	5	4
Forest Department Licence No.			T0169	T0102	T0102	T0102	T0102	T0065 T0186	T0169	T0169
Year of Release by Forest Department		1974	1975	1976	1976	1977	1978	1978	1979	1979
Estimated Total Acreage to be released to Agriculture		4,700	6,400	5,100	7,600	6,100	8,700	7,750	7,900	5,200
Commencement of SLDB Management	Year	mid-1974	mid-1975	mid-1976	mid-1976	mid-1977	mid-1977	mid-1978	mid-1979	mid-1979
Period of Land Clearing by SLDB		mid-1974 to mid-1975	mid-1975 to mid-1976	mid-1976 to mid-1977	mid-1976 to mid-1977	mid-1977 to mid-1978	mid-1977 to mid-1979	mid-1978 to mid-1979	mid-1979 to mid-1980	mid-1979 to mid-1981
Period of Planting of Perennial Crops by SLDB		1975	1976	1977	1977	1978	1978 & 1979	1979	1980	1981 & 1982
Creation of ADU Centre		1976	None	Beginning of 1978	Beginning of 1978	None	Beginning of 1979	Beginning of 1980	None	Beginning of 1982***
Termination of SLDB Management		End of 1978	Does not Terminate	End of 1980	End of 1980	Does not Terminate	End of 1983	End of 1983	Does not Terminate	End of 1985

REMARKS AND RECOMMENDATIONS FOR AGRICULTURAL DEVELOPMENT										
	Name of Block of Land									
MEIRA-A	This area is adjacent to existing extensive SLDB development in the Lambir-Subis RDA and is proposed as the first area to be sub-divided into smallholdings. Oil palm produced in the area would be processed either at the SOP factory or the SLDB Subis facilities.									
IGANG	This is the area for which there is a conflict of interest between development needs and the Forest Department. In this programme it is planned to contain the sub-regional service centre and remain in the public estate.									
SEBANAH	Planned, after full development, to be divided into smallholdings. Road based improvement southwards to the Suai river planned to start in 1979. 1,225 acres of land south of the SLDB area allocated to private development in 1979. Recommended to be small or medium sized farms.									
LAMAUS	In order to maintain a steady SLDB work programme this sub-scheme is split in two and the development spread accordingly from mid-1977 to mid-1979. After full development the land is planned to be divided into smallholdings. Road based improvement northwards to the Niah river is planned to start in 1980.									
JATAN	Planned to be part of the public estate.									
GALASAH	Planned, after full development, to be divided into smallholdings. Road based improvement along the Miri-Bintulu road planned to start in 1979.									
SAWAI	Planned to be part of the public estate.									
ENSABANG	Planned, after full development, to be divided into smallholdings. The occupied land along the western boundary of the planned area offers the opportunity for road based improvement along roads leading westwards, 950 acres of land in the northern part are allocated to private development recommended to be of small and medium sized farms. Such development would be an extension to, and support for, the Sepupok Block Alienation Scheme which has already been started by Government.									
TELABIT	Forest harvesting here has not yet started therefore logging operations should be started as soon as possible. The development of this sub-scheme is spread from mid-1979 to mid-1982. After full development the land is planned to be divided into smallholdings. Road based improvement could be undertaken along roads extending into legally occupied land in the south-west.									
KABATU	This area is part of the FAO Unit 3 and is planned to be harvested as Phase I in that Unit. Forest harvesting is scheduled to start in 1976, which necessitates early completion of soil surveys and boundary demarcation. The development of agricultural land should be based on three villages and subsequently divided into smallholdings. The cropping pattern should be similar to that planned for the other smallholder areas.									

NOTES:
 * Completed by the Consultants.
 ** Not necessary.
 *** Not planned.
 **** Not planned, three teams would be involved.

- (d) Crop maintenance until production commences is the final phase of the establishment programme and includes weeding, fertilising, pruning and shade control.

Provision has been made in the overall plan for the recovery of the costs of all these operations during the productive life of the crops proposed for inclusion in the cropping programme.

2.3.2 The Mera-a Sub-scheme

Based on the findings of the semi-detailed soil survey the Mera-a land block has been sub-divided as shown in Figure 2.3. The acreages concerned are as follows:

- 6,550 acres allocated to Forest Reserve proposals,
 - 3,750 acres to Ulu Selepin
 - 2,800 acres to Bakas.

 - 4,575 acres allocated to development by SLDB to agriculture of which roughly 875 acres should remain as Communal Forest enclaves. About 1,240 acres have been occupied by shifting cultivation since the compiling of the 1:250,000 scale Land-use Maps, Series No. 22, and have therefore been assumed to be illegally occupied and included in the detailed planning.

 - 770 acres allocated to development by private enterprise to agriculture, of which 210 should remain as forest enclaves.

 - 430 acres considered legally occupied and therefore not included in the detailed planning.

 - 570 acres of flood-prone valley land also not included in the detailed planning.
- Total 12,895

Roughly 4,400 acres of the land allocated to agriculture is logged forest, but is still under licence. The salvage logging programme provides for the agricultural parts to be released for clearing by mid-1974. SLDB is planned to start work immediately and complete the clearing by the end of 1974 when crop establishment would start. The proposed cropping pattern is shown in the 1:50,000 scale Detailed Plan Area (Map No. 20) in the Map Folder, the acreages are given in Table 2.2. The estimated number of potential smallholders required is 194. This is based on the eventual sub-division of the area into the types and numbers of smallholdings shown in Table 2.3. The oil palm fruit bunches produced at Mera-a could be processed either at the SOP mill or at the planned SLDB mill both of which are in the Lambir-Subis RDA and within easy road transport of Mera-a.

Cocoa processing (fermentation and drying) would take place in several conveniently located Samoan-Type processing units which would accept fresh wet beans from the farmers.

NERA-A SUB SCHEME

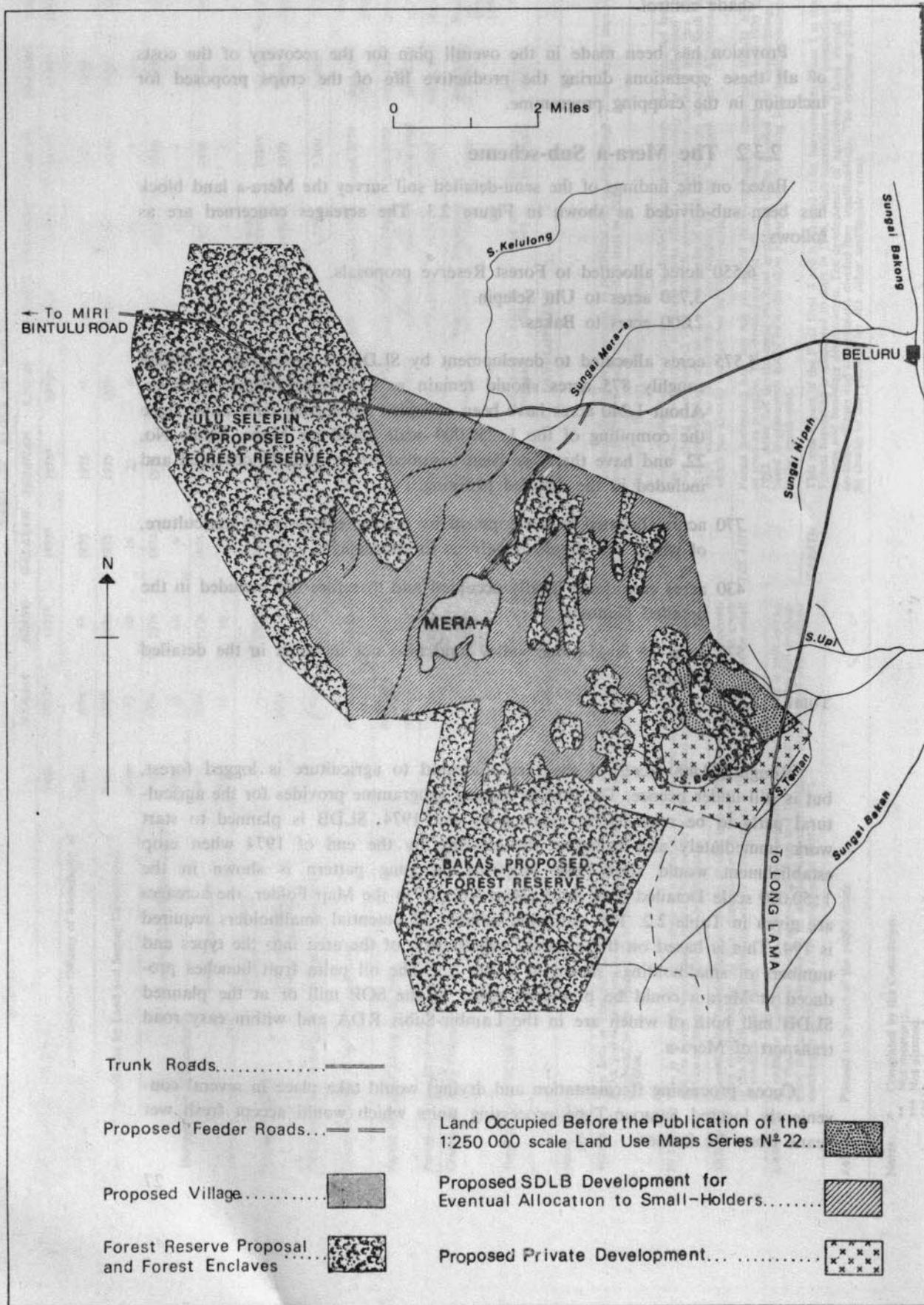


TABLE 2.2 DETAILS OF SLDB CLEARING PROGRAMME FOR CROP PLANTING⁽¹⁾

	1	2	3	4	5	6	7	8
DESCRIPTION	1974	1975	1976	1977	1978	1979	1980	1981
ESTATE AREA CLEARED								
OIL PALM SLDB ...		3,245	3,245	5,863	5,863	11,182	11,182	11,182
RUBBER SLDB ...		370	370	1,015	1,015	1,785	1,785	1,785
COCOA SLDB ...				270	270	720	720	720
		3,615	3,615	7,148	7,148	13,687	13,687	13,687
SMALLHOLDER AREA CLEARED								
OIL PALM ...	1,890	1,890	5,835	8,390	12,425	13,086	14,880	14,880
RUBBER ...	875	875	2,290	2,290	4,820	4,820	6,190	6,190
COCOA ...	120	120	995	1,505	1,505	1,505	1,665	1,665
RICE ...	195	195	620	950	1,250	1,250	1,430	1,430
HOUSE PLOT ...	195	195	620	950	1,268	1,268	1,536	1,536
ALL CROPS	3,275	3,275	10,360	14,085	21,268	21,929	25,701	25,701
TOTAL AREA CLEARED								
OIL PALM ...	1,890	5,135	9,080	14,253	18,288	24,268	26,062	26,062
RUBBER ...	875	1,245	2,660	3,305	5,835	6,605	7,975	7,975
COCOA ...	120	120	995	1,775	2,225	2,385	2,385	2,385
RICE ...	195	195	620	950	1,250	1,250	1,430	1,430
HOUSE PLOT ...	195	195	620	950	1,268	1,268	1,536	1,536
ALL CROPS	3,275	6,890	13,975	21,233	28,416	35,616	39,388	39,388

(1) Net acres are given for land to be planted the following year.

TABLE 2.3 PROPOSED CROPPING AND DEVELOPMENT PATTERN IN THE SLDB MERA-A SETTLEMENT SUB-SCHEME (acres)

	Gross ⁽¹⁾	Net
Village ⁽²⁾	285	
Cropped Area	Oil Palms	1,890
	Rubber	875
	Cocoa	120
	Rice	195
	Total	3,415
Forest Enclaves ⁽³⁾	875	
Total Sub-scheme Area	4,575	3,080

(1) Gross acreages have been measured from the 1:50,000 scale Detailed Plan Area (Map No. 20) while the net areas representing the actual planted acreages are obtained by allowing a 10 per cent wastage of land due to unsuitable patches, roads and drains.

(2) The gross acreage includes bazaar, smallholders one acre homestead plots, recreation areas, roads, etc.

(3) The forest enclaves represent areas unsuitable for agriculture and are planned to remain under forest and be gazetted as Communal Forests. Small areas of less than 50 acres have been included in the agricultural development.

TABLE 2.4 THE TYPES AND NUMBERS OF SMALLHOLDINGS PLANNED IN THE SLDB MERA-A SUB-SCHEME

Smallholding Type	Net acres of Crop					Number of Smallholdings
	Oil Palm	Rubber	Cocoa	Rice	Homestead	
a	9	6	—	1	1	50
b	10	5	—	1	1	115
d	10	—	4	1	1	29
Total:						194

2.3.3 The Sub-schemes in the Niah-Suai RDA

Roughly 78,600 acres were surveyed at the semi-detailed soil survey level, and on the results of the survey the area has been divided as follows:

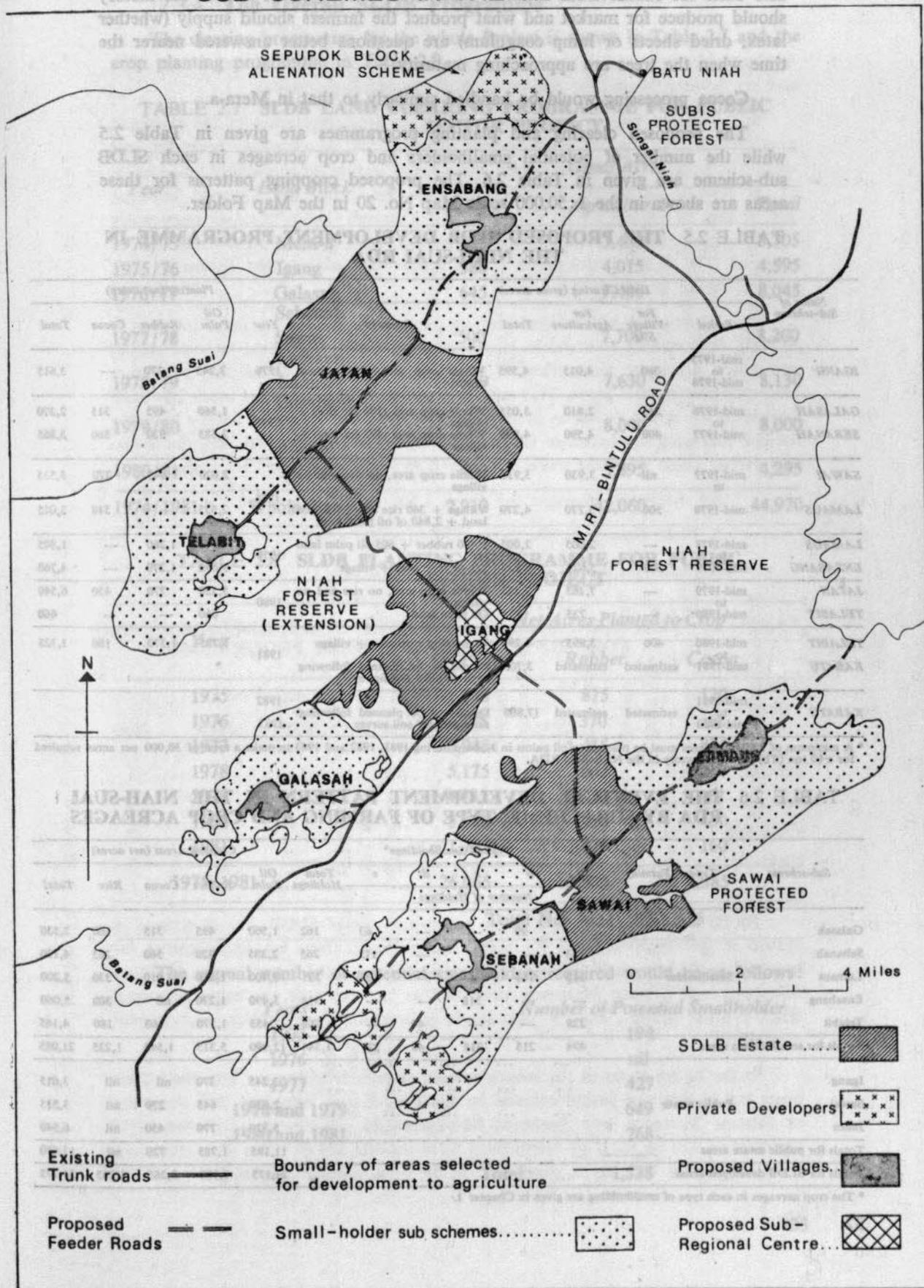
- 17,240 acres allocated to Forest Reserve;
- 54,750 acres allocated to development by SLDB to agriculture. About 3,760 acres of this land have been occupied since publication of the 1:250,000 scale Land-use Maps, Series No. 22, and have, for development purposes, been assumed to be State Land;
- 2,175 acres allocated for development by private enterprise;
- 4,430 acres assumed to be legally occupied because the areas are shown as cleared land on the Series No. 22 Maps. This land is not included in the detailed planning.

The total area for agricultural development is therefore approximately 61,360 acres but this includes forest enclaves on land unsuitable for agriculture.

The land allocated to SLDB for development has been divided into sub-schemes as shown in Figure 2.4 (and in more detail on the 1:50,000 scale Detailed Plan Area, Map 20). Roughly 20,400 acres, consisting of sub-schemes Igang, Sawai and Jatan have been proposed as a public estate which would contain and initiate the sub-regional centre (named for convenience Igang after a nearby prominent hill). The remaining 34,400 acres are planned to be developed by SLDB for subsequent sub-division into smallholdings. This part consists of five villages (Galasah, Sebanah, Lamaus, Ensabang and Telabit), each surrounded with developed land to a distance of 1.5 to 2.0 miles. The unoccupied agricultural land outside this radius has been allocated to private development. Road based improvement schemes have been planned for the areas assumed to be legally occupied.

The whole plan has been based on initial development by SLDB of all the area allocated to it. The estate would be the nucleus on which the rest of the development would depend for processing and marketing of its main products, oil palm and rubber. The oil palm plantings have been planned to reach eventually 30,000 acres, sufficient to justify the construction of a large central mill handling 60 tons of ffb per hour. This total acreage would not be achieved in the first five years of planned plantings and a continuation of similar type development would need to proceed during 1980 to 1983 into an area named Kabatu, south-east of Sawai. The rubber plantings, together with those in Mera-a, all of which have been generally planned for the steeper or less accessible lands, are sufficient to justify the establishment of a central processing factory, which could

SUB SCHEMES IN THE NIAH-SUAI RDA



also cater for rubber from a much wider area. What type of rubber the factory should produce for market and what product the farmers should supply (whether latex, dried sheets or lump coagulum) are questions better answered nearer the time when the trees are approaching maturity.

Cocoa processing would be handled similarly to that in Mera-a.

The proposed clearing and planting programmes are given in Table 2.5 while the number of potential smallholders and crop acreages in each SLDB sub-scheme are given in Table 2.6. The proposed cropping patterns for these areas are shown in the 1:50,000 scale Map No. 20 in the Map Folder.

TABLE 2.5 THE PROPOSED SLDB DEVELOPMENT PROGRAMME IN THE NIAH-SUAI RDA

Name of Sub-scheme	Land Clearing (gross acres)				Remarks	Planting (net acres)				
	Period	For Village Site	For Agriculture	Total		Year	Oil Palm	Rubber	Cocoa	Total
IGANG	mid-1975 to mid-1976	580	4,015	4,595	Whole crop area + sub-regional centre	1976	3,245	370	—	3,615
GALASAH	mid-1976 to mid-1977	245	2,810	3,055	Whole crop area (180 for rice) + village	1977	1,560	495	315	2,370
SEBANAH	mid-1977	400	4,590	4,990							Whole crop area (395 for rice) + village	2,385	920	560	3,865
SAWAI	mid-1977 to	nil	3,930	3,930	Whole crop area, no rice and no village	1978	2,620	645	270	3,535
LAMAUS	mid-1978	500	3,770	4,270	Village + 360 rice and 570 cocoa land + 2,840 of oil palm land						2,555	—	510	3,065
LAMAUS	mid-1978 to mid-1979	—	2,005	2,005	1,400 rubber + 605 oil palm land	1979	545	1,260	—	1,805
ENSABANG	mid-1979	500	5,625	6,125	Whole crop area + village						3,490	1,270	—	4,760
JATAN	mid-1979 to mid-1980	—	7,265	7,265	Whole crop area, no rice and no village	1980	5,320	770	450	6,540
TELABIT	mid-1980	—	735	735	Oil palm land						660	—	—	660
TELABIT	mid-1980 to mid-1981	400	3,895	4,295	Remaining crop area + village	1981	1,795	1,370	160	3,325
KABATU	mid-1981	estimated	estimated	3,705	Details to be planned following semi-detailed soil survey					
KABATU	mid-1981 to mid-1983	estimated	estimated	17,800	Details to be planned following semi-detailed soil survey	1982	*			
						1983	*			

* A minimum of 3,935 net acres must be planted to oil palms in Kabatu during 1981, 1982 and 1983 to make a total of 30,000 net acres required for a 60 ton (ffb) per hour factory in the Niah-Suai RDA.

TABLE 2.6 THE EVENTUAL DEVELOPMENT PATTERN IN THE NIAH-SUAI RDA BY SUB-SCHEME, TYPE OF FARMING AND CROP ACREAGES

Sub-scheme	Type of Farming	Type of Smallholdings*					Cropped Areas (net acres)					
		a	b	c	d	e	Total Holdings	Oil Palm	Rubber	Cocoa	Rice	Total
Number of Holdings												
Galasah		—	99	—	—	63	162	1,560	495	315	160	2,530
Sebanah		153	—	—	—	112	265	2,385	920	560	265	4,130
Lamaus	Smallholder	113	116	—	—	102	331	3,100	1,260	510	330	5,200
Ensabang		—	—	318	—	—	318	3,490	1,270	nil	300	5,060
Telabit		228	—	—	40	—	268	2,455	1,370	160	180	4,165
Totals for smallholders areas		494	215	318	40	277	1,344	12,990	5,315	1,545	1,235	21,085
Igang								3,245	370	nil	nil	3,615
Sawai	Public estate							2,620	645	270	nil	3,535
Jatan								5,320	770	450	nil	6,540
Totals for public estate areas								11,185	1,785	720	nil	13,690
Totals for SLDB developed areas								24,175	7,100	2,265	1,235	34,775

* The crop acreages in each type of smallholding are given in Chapter 1.

2.3.4 The Overall SLDB Programme

The clearing programme for the whole Project is shown in Table 2.7 and the crop planting programme in Table 2.8.

TABLE 2.7 SLDB LAND CLEARING PROGRAMME FOR PUBLIC SECTOR PROJECT

Year	Land Block	Gross Acres		
		Village	Agricultural	Total
1974/75	Merá-a	285	3,420	3,705
1975/76	Igang	580	4,015	4,595
1976/77	Galasah Sebanah	645	7,400	8,045
1977/78	Sawai Lamaus	500	7,700	8,200
1978/79	Lamaus Ensabang	500	7,630	8,130
1979/80	Jatan Telabit	nil	8,000	8,000
1980/81	Telabit	400	3,895	4,295
1974/1981	Whole Project	2,910	42,060	44,970

TABLE 2.8 SLDB PLANTING PROGRAMME FOR PUBLIC SECTOR PROJECT

Year	Net Acres Planted to Crop		
	Oil Palms	Rubber	Cocoa
1975	1,890	875	120
1976	3,245	370	nil
1977	3,945	1,415	875
1978	5,175	645	780
1979	4,035	2,530	nil
1980	5,980	770	450
1981	1,795	1,370	160
1975/1981	26,065	7,975	2,385

Total Net Acres : 36,425

The annual number of potential smallholders required would be as follows:

Years	Number of Potential Smallholder
1975	194
1976	nil
1977	427
1978 and 1979	649
1980 and 1981	268
Total	1,538

2.3.5 Future SLDB Organisational and Staff Requirements

At present the SLDB organisation in the Study Area is controlled by a Regional Manager with a Group Manager in the Lambir-Subis Development Area and six Scheme Managers; one on each of the existing schemes.

It is obvious that at some stage during the implementation of the proposed development the task of the Regional Manager will become too great for one man. The stage at which this occurs will depend largely on the ability and quality of the Scheme Managers; the better they are the longer the Regional Manager will be able to manage alone. But eventually a second Group Manager responsible for the physical development in the Niah-Suai Rural Development Area will be required. The SLDB organisation in the Study Area as it might appear in, say, 1978 is shown in Figure 2.5.

The adoption of a diversified cropping pattern will necessitate some increase in SLDB's field staffing rate and in its technical agricultural services because rubber and cocoa are more demanding of management than oil palms and require a relatively greater staff input. This need for greater field managerial input has been accounted for in the estimates of staff requirement given in Table 2.9, by allowing for the following approximate staffing rate in relation to planted acreage of the two crops. These rates are more intensive than for monocultural oil palm estates.

An Assistant Manager for every 1,500 to 2,000 acres

A Field Supervisor for every 750 to 1,000 acres

A Field Assistant for every 325 to 500 acres.

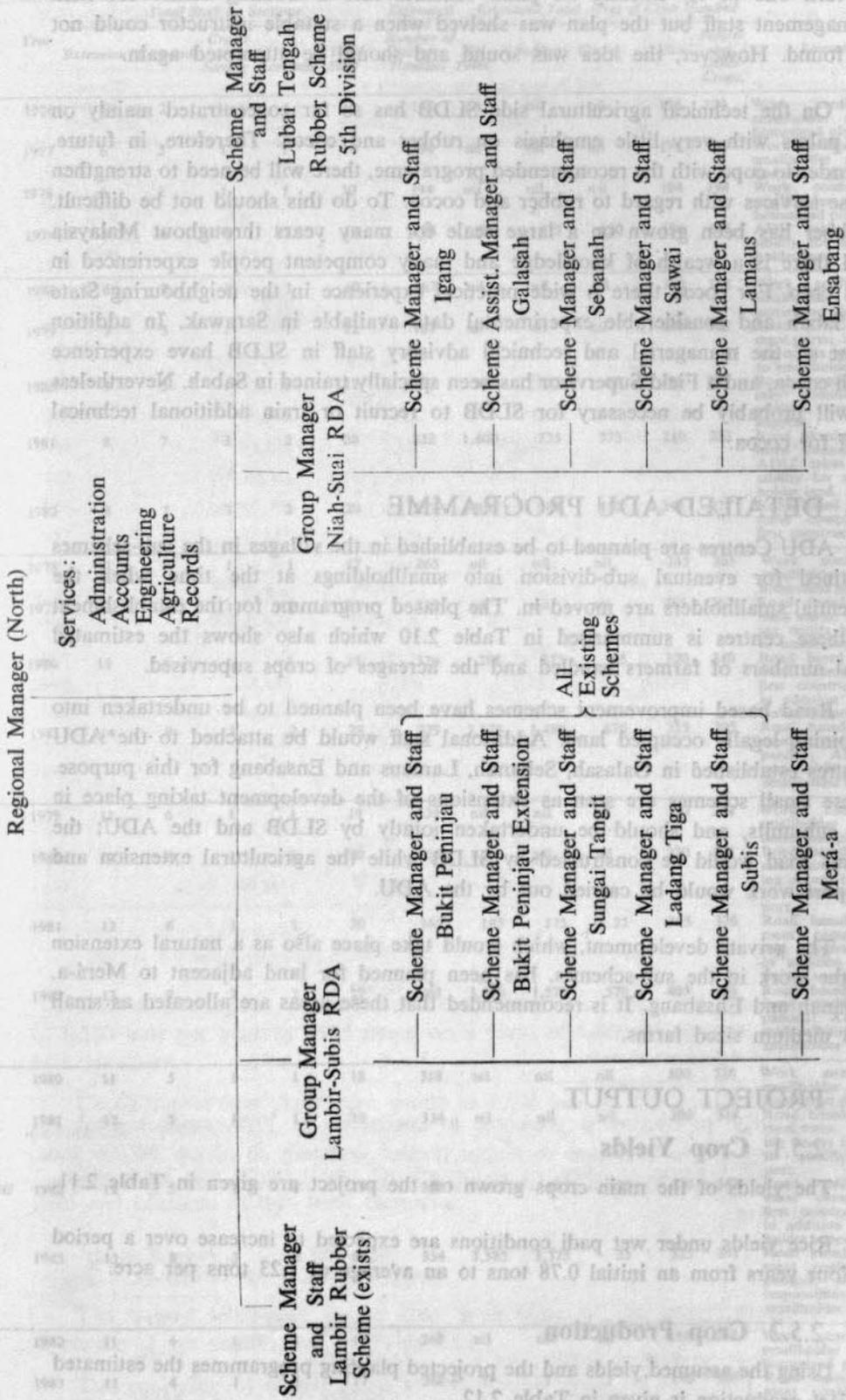
TABLE 2.9 NEW MANAGERIAL AND FIELD STAFF REQUIREMENTS FOR THE SLDB DEVELOPMENT PROGRAMME

Staff Cadre	New Staff required each Year					
	1975	1976	1977	1978	1979	1980
Scheme Manager	1	1	2	1	0	1
Assistant Manager	1	2	3	2	4	2
Field Supervisors	3	3	8	8	7	2
Field Assistant	5	6	12	10	21	3

To fill the managerial and field supervisory posts SLDB has at present a system of on-the-job training for Field Assistant and there are opportunities for promotion of these staff. Nevertheless many of the Field Supervisors, Assistant Managers and Scheme Managers have had to be, and still are being, recruited from outside SLDB. This is because it is a young organisation and is still expanding.

In the future some of the locally trained personnel will move into the higher posts but, during the period covered by the Project, it is expected that the posts of Scheme Managers and Assistant Managers and possibly some of the Field Supervisors will be filled by recruitment from outside SLDB. Thus it is important that the present training is expanded. In 1973 an attempt was made by SLDB

FIGURE 2.5 POSSIBLE FUTURE ORGANISATION OF SLDB (1978) IN THE STUDY AREA



to turn one of its existing oil palm schemes into a training centre for field management staff but the plan was shelved when a suitable instructor could not be found. However, the idea was sound and should be attempted again.

On the technical agricultural side SLDB has so far concentrated mainly on oil palms with very little emphasis on rubber and cocoa. Therefore, in future, in order to cope with the recommended programme, there will be need to strengthen these services with regard to rubber and cocoa. To do this should not be difficult. Rubber has been grown on a large scale for many years throughout Malaysia and there is a wealth of knowledge and many competent people experienced in this crop. For cocoa there is wide practical experience in the neighbouring State of Sabah and considerable experimental data available in Sarawak. In addition some of the managerial and technical advisory staff in SLDB have experience with cocoa, and a Field Supervisor has been specially trained in Sabah. Nevertheless it will probably be necessary for SLDB to recruit or train additional technical staff for cocoa.

2.4 DETAILED ADU PROGRAMME

ADU Centres are planned to be established in the villages in the sub-schemes destined for eventual sub-division into smallholdings at the time when the potential smallholders are moved in. The phased programme for the establishment of these centres is summarised in Table 2.10 which also shows the estimated total numbers of farmers handled and the acreages of crops supervised.

Road based improvement schemes have been planned to be undertaken into adjoining legally occupied land. Additional staff would be attached to the ADU Centres established in Galasah, Sebanah, Lamaus and Ensabang for this purpose. These small schemes are seen as extensions of the development taking place in the sub-units, and should be undertaken jointly by SLDB and the ADU; the access road would be constructed by SLDB while the agricultural extension and support work would be carried out by the ADU.

The private development, which would take place also as a natural extension of the work in the sub-schemes, has been planned for land adjacent to Merá-a, Sebanah and Ensabang. It is recommended that these areas are allocated as small and medium sized farms.

2.5 PROJECT OUTPUT

2.5.1 Crop Yields

The yields of the main crops grown on the project are given in Table 2.11.

Rice yields under wet padi conditions are expected to increase over a period of four years from an initial 0.78 tons to an average of 1.23 tons per acre.

2.5.2 Crop Production

Using the assumed yields and the projected planting programmes the estimated project production is given in Table 2.12.

TABLE 2.10 SUMMARIES OF STAFF BUILD-UP AND ACTIVITIES OF THE ADU CENTRES ASSOCIATED WITH SLDB — DEVELOPED SMALLHOLDER SCHEMES IN THE NIAH-SUAI RDA

Centres	Year	Total Staff by Sections				Total Staff	Estimated Total Number of Farmers Handled	Estimated Total Acres of Crop Handled					Remarks
		Extension	Economic	Credit and Saving	Accounts			Oil Palm	Rubber	Cocoa	Rice	Pepper and Other Crops	
MERA-A	1976	6	2	1	1	10	194	nil	nil	nil	194	194	Work confined to smallholder rice and homestead plots. Work confined to smallholder rice and homestead plots. Work confined to smallholder rice and homestead plots. ADU takes responsibility for all smallholder land.
	1977	6	2	1	1	10	194	nil	nil	nil	194	194	
	1978	6	2	1	1	10	194	nil	nil	nil	194	194	
	1979	8	6	3	2	19	194	1,890	875	120	194	194	
GALASAH	1978	6	2	1	1	10	162	nil	nil	nil	160	162	Work confined to smallholder rice and homestead plots. Road based improvement starts; land clearing occurs in addition to smallholder support. Road based improvement continues in addition to smallholder support. Road based improvement continues and ADU takes responsibility for all smallholder land. Road based improvement completed on first constructed road.
	1979	7	3	1	1	12	187	nil	nil	nil	160	162	
	1980	7	3	1	1	12	197	145	175	35	185	207	
	1981	8	7	3	2	20	222	1,800	775	375	210	232	
	1982	8	7	3	2	20	237	1,955	960	410	245	277	
SEBANA	1978	11	4	1	1	17	265	nil	nil	nil	265	265	Work confined to smallholder rice and homestead plots. Road based improvement starts; land clearing occurs in addition to smallholder support. Road based improvement completed on first constructed road in addition to smallholder support. Road based improvement could be expanded; ADU takes responsibility for all smallholder land.
	1979	13	6	1	1	21	315	nil	nil	nil	265	265	
	1980	13	6	1	1	21	329	285	325	65	320	340	
	1981	14	9	3	2	28	329	2,875	1,480	670	355	395	
LAMAUS	1979	11	6	1	1	19	331	nil	nil	nil	330	331	Work confined to smallholder rice and homestead plots. Road based improvement starts; land clearing occurs in addition to smallholder support. Road based improvement completed on first constructed road in addition to smallholder support. Road based improvement could be expanded; ADU takes responsibility for all smallholder land.
	1980	12	6	1	1	20	356	nil	nil	nil	330	331	
	1981	12	6	1	1	20	363	145	175	35	355	376	
	1982	13	9	3	2	27	363	3,370	1,570	570	405	456	
ENSABANG	1980	11	5	1	1	18	318	nil	nil	nil	300	318	Work confined to smallholder rice and homestead plots. Road based improvement starts; land clearing occurs in addition to smallholder support. Road based improvement completed on first constructed road in addition to smallholder support. Road based improvement could be expanded; ADU takes responsibility for all smallholder land.
	1981	12	5	1	1	19	334	nil	nil	nil	300	318	
	1982	12	5	1	1	19	334	95	105	25	325	343	
	1983	13	8	3	2	26	334	3,585	1,375	25	325	341	
TELABIT	1982	11	4	1	1	17	268	nil	nil	nil	180	268	Work confined to smallholder rice and homestead plots. Road based improvement could start on road between Telabit and Nyalau but this is not included here. ADU takes responsibility for all smallholder land.
	1983	11	4	1	1	17	268+	?	?	?	180	268	
	1984	11	4	1	1	17	268+						
	1985	12	7	3	2	24	268+						

TABLE 2.11 ASSUMED YIELDS OF PRODUCTS FROM OIL PALM, RUBBER AND COCOA ON SCHEMES DEVELOPED BY SLDB

Year from Planting	Oil Palms (tons per acre)			Rubber (drc lbs per acre)	Cocoa (dbe tons per acre)
	ffb	Oil	Kernels		
3	0.5	0.10	0.015	nil	nil
4	3.6	0.72	0.126	nil	0.22
5	6.1	1.22	0.229	nil	0.45
6	7.7	1.54	0.308	nil	0.67
7	8.5	1.70	0.340	620	0.67
8	8.8	1.76	0.352	1,010	
9	9.0	1.80	0.360	1,260	
10	9.0	1.80	0.360	1,420	
11	9.0	1.80	0.360	1,500	
12	8.9	1.78	0.356	1,600	
13	8.8	1.76	0.352	1,700	
14	8.6	1.72	0.344	1,800	
15	8.5	1.70	0.340	1,800	
16	8.3	1.66	0.332		
17	8.9	1.64	0.328		
18	8.0	1.60	0.320		
19	7.8	1.56	0.312		
20	7.8	1.56	0.312		
21	7.7	1.54	0.308		
22	7.7	1.54	0.308		
23	7.6	1.52	0.304		
24	7.6	1.52	0.304		
25	7.5	1.50	0.300		

ffb = fresh fruit bunches.
drc = dry rubber content.
dbe = dry bean equivalent.

Oil palm production is projected to commence in 1979, reach a peak of 233,000 tons ffb in 1989 and thereafter decline gradually to about 200,000 tons per year. In terms of palm oil and kernels these ffb tonnages are equivalent to the following:

	Palm Oil tons	Palm Kernels tons
Initial production (1979) ...	1,685	311
Peak production (1989) ...	46,480	9,294
Long-term production ...	40,000	8,000

TABLE 2.12 SUMMARY OF CROP PRODUCTION FROM DETAILED PLANNED PUBLICLY DEVELOPED SCHEMES (tons)

Year	Palm Oil	Palm Kernels	Rubber drc	Cocoa dbc	Rice
1975	—	—	—	—	—
1976	—	—	—	—	—
1977	—	—	—	—	152
1978	189	38	—	—	174
1979	1,685	311	—	26	540
1980	5,037	935	—	54	875
1981	10,227	1,949	—	273	1,222
1982	17,151	3,309	245	646	1,383
1983	24,732	4,822	497	1,018	1,630
1984	33,194	6,502	1,053	1,288	1,698
1985	39,781	7,848	1,576	1,427	1,730
1986	43,706	8,718	2,610	1,563	1,759
1987	45,648	9,133	3,476	1,598	1,759
1988	46,352	9,268	4,429	1,598	1,759
1989	46,480	9,294	5,060	1,598	1,759
1990	46,202	9,240	5,477	1,598	1,759
1991	45,719	9,130	5,793	1,598	1,759
1992	45,066	9,006	6,031	1,598	1,759
1993	44,347	8,847	6,226	1,598	1,759
1994	43,500	8,666	6,325	1,598	1,759
1995	42,756	8,536	6,380	1,598	1,759
1996	41,998	8,385	6,380	1,598	1,759
1997	41,373	8,275	6,380	1,598	1,759
1998	40,820	8,156	6,380	1,598	1,759
1999	40,341	8,046	6,380	1,598	1,759

drc = dry rubber content.

dbc = dry bean equivalent.

Rubber production is estimated to commence in 1982 and reach a peak of 6,380 tons per year by 1995 based on a yield of 1,800 lb. drc per acre from new plantings.

Cocoa output from the Project would be 1,598 tons by 1987, production would commence in 1979.

The total rice output from the Project is expected to reach 1,759 tons by 1986 and continue at that level thereafter.

2.5.3 Value of Crop Output

The values attributed to the crop production at the prices predicted in Appendix II are summarised in Table 2.13.

The peak annual output value at fob (social) prices of \$29.5 mn would be reached in 1988.

TABLE 2.13 PUBLIC SECTOR SETTLEMENTS OUTPUT VALUES AT FOB PRICES
(\$ Thousand)

YEAR	AT SOCIAL PRICES			AT MARKET PRICES					TOTAL PROJECT REVENUE	
	Gross Revenue fob prices	Forestry Revenue	Total Project Revenue	Gross Sales Revenue	Export Duty	Net Revenue	Forestry Revenue	Excluding Duty	Including Duty	
1974	—	356	356	—	—	—	356	356	356	
1975	—	441	441	—	—	—	441	441	441	
1976	68	772	840	68	—	68	772	840	840	
1977	175	787	962	168	8	1002	787	947	955	
1978	1,125	780	1,905	1,067	65	2,553	780	1,782	1,847	
1979	2,907	1,389	4,296	2,741	188	5,106	1,389	3,942	4,130	
1980	5,810	2,629	8,439	5,482	376	8,606	2,629	7,735	8,111	
1981	9,813	—	9,813	9,250	644	12,311	—	8,606	9,250	
1982	14,053	—	14,053	13,232	921	16,391	—	12,311	13,232	
1983	18,735	—	18,735	17,643	1,252	19,533	—	16,391	17,643	
1984	22,373	—	22,373	21,045	1,512	22,232	—	19,533	21,045	
1985	25,479	—	25,479	23,967	1,735	23,889	—	22,232	23,967	
1986	27,386	—	27,386	25,763	1,874	23,889	—	23,889	25,763	
1987	28,751	—	28,751	27,049	1,977	25,072	—	25,072	27,049	
1988	29,502	—	29,502	27,758	2,033	25,725	—	25,725	27,758	
1989	29,834	—	29,834	28,073	2,057	26,016	—	26,016	28,073	
1990	29,959	—	29,959	28,194	2,066	26,128	—	26,128	28,194	
1991	29,924	—	29,924	28,165	2,063	26,102	—	26,102	28,165	
1992	29,807	—	29,807	28,058	2,054	26,004	—	26,004	28,058	
1993	29,527	—	29,527	27,799	2,032	25,767	—	25,767	27,799	
1994	29,254	—	29,254	27,546	2,011	25,535	—	25,535	27,546	
1995	28,910	—	28,910	27,225	1,985	25,240	—	25,240	27,225	
1996	28,630	—	28,630	26,965	1,963	25,002	—	25,002	26,965	
1997	28,376	—	28,376	26,728	1,944	24,784	—	24,784	26,728	
1998	28,154	—	28,154	26,521	1,927	24,594	—	24,594	26,521	

CHAPTER 3

FARM BUDGETS AND INCOMES OF PUBLIC SECTOR DEVELOPMENT SCHEMES

3.1 SMALLHOLDER SUB-SCHEME

Farm sizes for smallholders were planned according to the following income criteria:

- (a) a minimum family income of \$2,500 per annum by the sixth or seventh year from planting.
- (b) complete amortisation of housing, land development and crop establishment costs within a period of about 20 years from planting at an interest rate of seven per cent per annum.
- (c) provision for replanting funds to be set up during the productive life of the tree crops.

The actual acreages of the five types of smallholdings adopted in the agricultural plan have been given previously.

The revenues and costs on the smallholdings have been estimated in three distinct periods:

- (a) the development or investment period (years 0-4);
- (b) the production or repayment period; and
- (c) the post repayment period.

3.1.1 The Development Period

It has been made clear that during the initial development period the SLDB would be responsible for establishing the tree crops and bringing them into production, for constructing the internal road networks and drainage works required for the crop areas of the schemes, and for organising the building of houses. The costs for the five farm types over the development period are summarised in Table 3.1. All costs would be aggregated on a scheme basis, including labour and management costs and accrued interest at seven per cent until the end of year four when the SLDB responsibility would cease and the ADU would take over.

TABLE 3.1 SMALLHOLDING DEVELOPMENT COSTS (YEARS 0-4)

\$

Item	Farm type				
	a	b	c	d	e
Land development costs ...	6,457	6,634	6,781	7,167	7,184
Crop production costs ...	9,584	10,975	11,124	11,247	11,325
Management costs ...	5,305	4,843	4,778	4,477	4,541
Sub-total ...	21,346	22,452	11,683	22,891	23,050
Net revenue from crop sales (Years 3 and 4)	2,693	2,992	3,291	3,882	3,806
Total net cost per holding (excluding interest)	18,653	19,460	19,392	19,009	19,244
Average cost per acre excluding house and homestead plot	1,165	1,216	1,212	1,267	1,283

The initial clearing, draining and levelling of the land for rice would be undertaken by the SLDB and then handed over in year 2 to the ADU for allocation to settlers when the first crop would be produced. Development costs, estimated at \$1,050 per acre, would be charged on a pro rata basis according to the actual acreage allocated to each individual.

3.1.2 Repayment Period

The repayment period has been assumed to commence in the fifth year when management of the scheme would be taken over by the ADU and settlers would be allocated plots of oil palms and cocoa. The major determinant of the repayment potential of any holding would be the net income available after all current operating costs have been recovered. A payback period longer than 20 years is unlikely to be acceptable on social grounds and, due to the large interest element in repayments, would have little effect on the settlers cash income position. On the other hand, too short a period would place an undue financial burden on the farmer.

3.1.3 Post Repayment Period

Once the full development costs of the holding have been repaid, the farmer would become virtually independent and assume 'title' to his land on whatever terms are operative at the time. During this period tree crops would require replanting and for this purpose it is proposed that replanting funds are established by means of levies on products sold.

Payment for the construction of the house would cease in year 20 and it may be necessary to rebuild the house during this period. Thus it would be important that the income is adequate to provide sufficient funds for this purpose. This and other requirements, such as improved personal livelihood, indicate the need for a fairly high income in this period.

Management costs have been charged on the basis that initially the management of the area would be under SLDB but ultimately the smallholders would be responsible with the technical advice and assistance of the ADU or a Farmers' Organisation which might develop in time. The costs of these services have been included in the budgets on the following basis:

- (a) all SLDB management costs during the development period. This departure from the current Government practice on existing schemes of not charging these costs has been considered necessary for the following reasons:
 - (i) the SLDB would be acting as a development contractor and as such the management charges would be part of the cost chargeable to each scheme.
 - (ii) the costs of managing the establishment of the schemes would be considerable and should be recovered from the individuals benefitting from them if the schemes are not to become an incumbrance on the rest of the agricultural economy.
- (b) ADU or Farmers' Organisation costs involved in providing the supply and credit services to the schemes. At present it is customary for Government to provide free technical advice to farmers but in the proposed development plan these services would be directly involved in procuring and supplying agricultural requisites and credit. There appears to be no

justification for subsidies here, especially when in time these functions should be taken over by a Farmers' Organisation or Co-operatives. In the analysis the following charges have been allowed for:

Year 5	\$200 per holding
Year 6	\$290 per holding
Year 7 and onwards ...	\$320 per holding

3.1.4 Interest

A seven per cent rate of interest has been charged on development investments. This rate is considered reasonable for long-term agricultural loans in Sarawak although the opportunity cost of capital is nearer 10 per cent. A higher rate of interest would reduce farm incomes and returns to land which would be undesirable from the socio-economic view point. It would however be necessary to keep the interest rate under review in future to ensure that it was consistent with international lending rates. Since a constant price assumption has been applied throughout all the farm budget calculations an exercise was carried out to examine the effect of inflation on real interest costs. The rate of inflation was assumed to be five per cent in which case the real interest rate would be only two per cent to the smallholder.

3.1.5 Replanting Levy

A replanting levy has been considered necessary because the tree crops are expected to have a productive life of 20 to 25 years after which replanting would be required. For budgeting purposes a sinking fund has been assumed to be considered during the productive life of the crop in the 'post repayment' period to cover the costs of replanting when it becomes necessary. Examples of the annual costs per acre of crop calculated on a sinking fund basis, with interest at seven per cent are as follows:

<i>Crop</i>	<i>Replanting Year</i>	<i>Number of years after repayment needed to create replanting fund</i>	<i>Replanting costs discounted to clearing year (\$ per acre)</i>	<i>Annual Cost (\$ per acre)</i>
Oil Palm	25	8 years	759	74
Rubber	30	13 years	1,287	64
Cocoa	30	13 years	1,230	61

3.1.6 Farm Income and Repayment Capacity

During the development period it has been assumed that the settler family would receive wages paid for work done in establishing the main tree crops. In addition there would be the net value of rice and homestead crops produced. These have been assessed as follows:

<i>Year</i>	<i>Homestead Plot</i>	<i>Rice Plot</i>
2	100	180
3	100	220
4	200	275
5	200	275
6 onwards	300	275

The estimated average earnings for smallholder farmers during the development period are given in Table 3.2. It has been assumed that the settler family would receive wages for work done in establishing the main tree crops, in addition there would be the net value of the homestead and rice crop produced. Although the earnings do not reach the desired minimum of \$2,500 per year per family, they are considered satisfactory because the accommodation value of the house, estimated at \$325, has not been included.

However, no repayment charges could be expected during this period and services such as medical and education would need to be free or heavily subsidised.

TABLE 3.2 ESTIMATED SMALLHOLDER INCOMES DURING THE FARM DEVELOPMENT PERIOD

Item	Earnings per year after clearing (\$)			
	1	2	3	4
Wage earned per worker at \$5 per day ...	775	655	730	845
Average wages per family ...	1,550	1,310	1,460	1,690
Rice and homestead plots ...	nil	280	320	475
Family income ...	1,550	1,590	1,780	2,165

(1) Work in year 1 is expected to be undertaken by contractors.

Incomes during the repayment period, from the fifth year onwards, have been calculated as the surpluses remaining after allowing the following revenues and costs:

- the gross value of farm production, taken as the value of the total production of each crop at the fob market prices presented in Appendix II, less;
- 'ex-farm' costs of processing, duty, transport, and distribution of the products sold;
- 'on-farm' costs of development and production items including road and drain maintenance, fertilisers, and other chemicals, small tools and equipment;
- the house amortisation cost of \$235 per annum;
- the management charges for the supply services.

A summary of the farm budgets showing the net farm incomes and the settlers income (after deducting loan repayment costs) are shown, for the five holding types, in Table 3.3. It is shown that gross farm incomes for holding types b, c, d and e could be sufficient in year 5 for loan repayments to commence in that year. For holding type (a) repayments could start in year 6. Possible payback periods are shown in Table 3.4. The calculations demonstrate that the estimated incomes generated by all the farm types would be sufficient for payback within 21 years from planting.

Two alternative situations were examined taking holding type (b) as an example.

- (a) a 20 per cent increase in rubber prices, the effect of which would be:
 - (i) the repayment capacity of the holding would increase and the payback period would be slightly shorter, 15 years instead of 16;
 - (ii) net farm income during the post repayment period would be increased by 16 per cent.
- (b) a reduced real interest rate from seven per cent to two per cent per year. This would reduce the payback period by 24 per cent, from 17 to 13 years.

TABLE 3.3 SUMMARY OF SMALLHOLDER FARM BUDGETS

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
FARM TYPE 'a'																					
Gross Farm Revenue ...	5,963	7,224	9,813	11,058	11,835	12,228	12,462	12,675	12,879	13,011	12,930	12,768	12,687	12,525	12,363	12,363	12,282	12,282	12,192	12,192	12,066
Total Costs ...	3,538	4,291	4,898	5,069	5,275	5,378	5,433	5,532	5,576	5,598	5,577	5,528	5,500	6,502	6,456	6,221	6,197	6,197	6,174	6,174	6,150
Net Farm Income ...	2,425	2,933	4,915	5,989	6,560	6,850	7,029	7,143	7,303	7,413	7,353	7,240	7,187	6,023	5,907	6,142	6,085	6,085	6,018	6,018	5,916
Loan Repayment ...	—	433	2,165	3,239	2,560	3,850	3,529	3,643	3,803	3,913	3,853	3,740	3,43	—	—	—	—	—	—	—	—
Settler Income ...	2,425	2,500	2,750	2,750	3,000	3,000	3,500	3,500	3,500	3,500	3,500	3,500	6,844	6,023	5,907	6,142	6,085	6,085	6,018	6,018	5,916
FARM TYPE 'b'																					
Gross Farm Revenue ...	6,560	7,950	10,320	11,385	12,045	12,350	12,545	12,700	12,845	12,910	12,820	12,640	12,550	12,370	12,190	12,190	12,100	12,100	12,000	12,000	11,860
Total Costs ...	3,791	4,527	5,089	5,252	5,428	5,513	5,559	5,635	5,665	5,670	5,647	5,592	6,477	6,424	6,371	6,136	6,111	6,111	6,084	6,084	6,058
Net Farm Income ...	2,769	3,423	5,231	6,133	6,617	6,837	6,986	7,065	7,180	7,240	7,173	7,048	6,073	5,946	5,819	6,054	5,989	5,989	5,916	5,916	5,802
Loan Repayment ...	269	923	2,481	3,383	3,617	3,837	3,486	3,565	3,680	3,740	3,673	2,508	—	—	—	—	—	—	—	—	—
Settler Income ...	2,800	2,500	2,750	2,750	3,000	3,000	3,500	3,500	3,500	3,500	3,500	4,540	6,073	5,946	5,819	6,054	5,989	5,989	5,916	5,916	5,802
FARM TYPE 'c'																					
Gross Farm Revenue ...	7,157	8,676	10,827	11,712	12,255	12,472	12,628	12,725	12,811	12,809	12,710	12,512	12,413	12,215	12,017	12,017	11,918	11,918	11,808	11,808	11,654
Total Costs ...	4,043	4,762	5,279	5,428	5,581	5,648	5,684	5,738	5,755	5,742	5,717	5,657	6,544	6,486	6,427	6,192	6,165	6,165	6,135	6,135	6,107
Net Farm Income ...	3,114	3,914	5,548	6,284	6,674	6,824	6,944	6,987	7,056	7,067	6,993	6,855	5,869	5,729	5,590	5,825	5,753	5,753	5,673	5,673	5,547
Loan Repayment ...	614	1,414	2,798	3,534	3,674	3,824	3,444	3,487	3,556	3,567	3,493	2,372	—	—	—	—	—	—	—	—	—
Settler Income ...	2,500	2,500	2,750	2,750	3,000	3,000	3,500	3,500	3,500	3,500	3,500	4,483	5,869	5,729	5,590	5,825	5,753	5,753	5,673	5,673	5,547
FARM TYPE 'd'																					
Gross Farm Revenue ...	8,560	10,950	11,800	11,910	11,960	11,870	11,870	11,870	11,680	11,500	11,410	11,230	11,140	10,960	10,780	10,780	10,690	10,690	10,590	10,590	10,450
Total Costs ...	4,331	4,984	5,220	5,282	5,364	5,316	5,316	5,291	5,264	5,212	5,845	5,790	5,802	5,707	5,654	5,419	5,394	5,394	5,367	5,367	5,341
Net Farm Income ...	4,329	5,966	6,580	6,628	6,596	6,554	6,554	6,489	6,416	6,288	5,565	5,440	5,338	5,253	5,126	5,361	5,296	5,296	5,223	5,223	5,109
Loan Repayment ...	1,829	3,466	3,830	3,878	3,596	3,554	3,054	2,989	2,916	2,189	—	—	—	—	—	—	—	—	—	—	—
Settler Income ...	2,500	2,500	2,750	2,750	3,000	3,000	3,500	3,500	3,500	4,099	5,565	5,440	5,338	5,253	5,126	5,361	5,296	5,296	5,223	5,223	5,109
FARM TYPE 'e'																					
Gross Farm Revenue ...	8,463	10,974	11,739	11,838	11,883	11,802	11,802	11,721	11,631	11,469	11,388	11,226	11,145	10,983	10,821	10,821	10,740	10,740	10,650	10,650	10,524
Total Costs ...	4,227	4,890	5,106	5,161	5,250	5,192	5,192	5,170	5,146	5,099	5,730	5,681	5,657	5,657	5,559	5,324	5,300	5,300	5,277	5,277	5,253
Net Farm Income ...	4,236	6,084	6,633	6,677	6,633	6,610	6,610	6,551	6,485	6,370	5,659	5,545	5,488	5,326	5,262	5,497	5,440	5,440	5,373	5,373	5,271
Loan Repayment ...	1,736	3,584	3,883	3,927	3,633	3,610	3,110	3,051	2,985	2,183	—	—	—	—	—	—	—	—	—	—	—
Settler Income ...	2,500	2,500	2,750	2,750	3,000	3,000	3,500	3,500	3,500	4,187	5,658	5,545	5,488	5,326	5,262	5,497	5,440	5,440	5,373	5,373	5,271

TABLE 3.4 REPAYMENT CAPACITY OF SMALLHOLDINGS

Holding Type	Accumulated Capital Sum ⁽¹⁾ at Start of Repayment	Payback Period in Years:	
		From Clearing	From Holding Allocation
	\$		
a	24,560	17	12
b	24,267	16	11
c	24,173	16	11
d	23,641	14	9
e	23,925	14	9

(1) Including funded interest at 7 per cent.

3.2 SLDB NUCLEUS ESTATE

The three sub-schemes making up the nucleus estate have the following cropping patterns:

Sub-scheme	Net acres of crops planted			
	Oil Palm	Rubber	Cocoa	Total
Igang	3,245	370	Nil	3,615
Sawai	2,620	645	270	3,535
Jatan	5,320	770	450	6,540
Total	11,185	1,785	720	13,690
Per cent of total area ...	82	13	5	100

Analyses were made aimed at showing:

- (a) the incomes workers would receive from wage employment on the estate;
- (b) the potential incomes of workers if the schemes were organised on a group participation basis;
- (c) the capacity of the schemes to pay back the development costs involved in their establishment under normal wage employment and if profit sharing were introduced.

3.2.1 Number of Workers

The plan provides for the workers to be accommodated in the central town, Igang, with the maximum distance of about 6.5 miles to any part of the estate. The number of workers/settlers employed would be related to the labour requirements of the crops planted which would vary according to the stage of each crop. For planning purposes they have been taken as follows:

oil palms	1 worker per 11 acres
rubber	1 worker per 6 acres
cocoa	1 worker per 10 acres

Allowance has also been made for part time employment. On these assumptions the estimated numbers of workers and families associated with the schemes would be:

<i>Sub-scheme</i>	<i>Number of workers required</i>	<i>Number of families accommodated</i>
Igang	356	220
Sawai	372	222
Jatan	657	403
Total	1,385	845

3.2.2 Workers Incomes on Daily Pay

Workers have been assumed to receive \$5.00 per day and that the employment created by the crops on the schemes would be equally available to all workers. The actual numbers employed at any time would vary with the work load on the schemes. There are likely to be seasonal labour peaks in oil palm largely due to the seasonal fruiting. Similar labour peaks occur in rubber production. Therefore some workers would be seasonally employed as indicated previously.

The average earnings per family, calculated from the annual expenditures on labour wages for crop production, are given in Table 3.5.

The average level of earnings would not reach the desired minimum of \$2,500 per year. There appears little chance of decreasing the number of families on each sub-scheme, thereby increasing earnings per family, due to the limitation of physical capacity of workers to deal with more than the indicated acres of crops.

3.2.3 Workers Incomes on a Profit Sharing System

The possibility of increasing incomes by a profit sharing system was investigated. SLDB at present operates a scheme whereby workers receive a \$1.00 per day bonus if they work more than 20 days per month. If a similar bonus were applied to the earnings shown in Table 3.5 the average family income would increase to about \$2,160. If the value of housing, which would be provided at no cost, is taken into account, the average income would be \$2,485. In addition water and other services could be provided free and this would raise incomes to a satisfactory level.

3.2.4 Workers Incomes on a Group Participation Basis

The effect of the schemes being organised on a group participation basis was examined. The possible arrangement envisaged was:

- Settlers to participate in groups with 20 to 30 members.
- Scheme crop areas to be divided amongst groups according to the number of participants.
- Overall management to be retained by SLDB.
- House ownership provided on an individual or group basis.
- Groups formed in fifth year of the scheme.
- Development costs including labour and management up to the formation of the groups to be recovered by a consolidated charge calculated on a per acre basis aimed at recovering those costs together with funded interest within 20 years.
- Settler to receive an income of \$2,500 to \$3,000 per family.

TABLE 3.5 WAGE EMPLOYMENT INCOMES ON THE SLDB NUCLEUS ESTATE

Item	Scheme Year after Clearing									
	2	3	4	5	6	7	8	9	10-16	17 onwards
<i>Igang Sub-scheme</i>										
Total Wage Payment \$000	...	339	452	433	357	389	382	351	363	403
Average per Family \$	1,140	1,540	2,050	1,960	1,620	1,760	1,730	1,590	1,650	1,830
<i>Sawai Sub-scheme</i>										
Total Wage Payment \$006	293	344	319	400	339	395	414	392	413	449
Average per Family \$	1,310	1,540	1,430	1,800	1,520	1,770	1,860	1,760	1,860	2,020
<i>Jatan Sub-scheme</i>										
Total Wage Payment \$000	516	639	804	774	653	720	719	669	695	762
Average per Family \$	1,280	1,580	1,990	1,920	1,620	1,780	1,780	1,660	1,720	1,890

The Jatan sub-scheme was analysed as an example. It was shown that the participants would receive an increase of between \$1 and \$2 per day which would make their annual income satisfactory.

3.2.5 Repayment Capacity

Calculations were also made to examine the payback period of the sub-schemes under the three wage-payment systems. The results are summarised in Table 3.6. If wages only were to be paid to workers at \$5 per day the payback period of all three sub-schemes would be close to, or less than the 20 years considered desirable. Under a profit sharing system the payback period would be longer but still within the productive life of the tree crops. Under the group participation scheme the payback period would be longer but still acceptable.

TABLE 3.6 REPAYMENT CAPACITIES OF SLDB SUB-SCHEMES UNDER DIFFERENT WAGE PAYMENT SYSTEMS

Wage payment system	Sub-scheme	Accumulated deficit including interest \$ mn	Payback period from clearing year (years)
<i>Paid Labour</i>			
at \$5 per day	Igang	7.6	17
	Sawai	7.5	20
	Jatan	13.7	19
<i>Profit Sharing</i>			
(a) Bonus of \$1 per day	Jatan	14.5	21
(b) Bonus of \$2 per day	Jatan	15.5	25+
<i>Group Participation</i>			
(a) Including housing	Jatan	15.7	25+
(b) Excluding housing	Jatan	11.9	22

(c) Labour costs, which throughout the analysis have been assumed to have an opportunity cost of \$3 per day. However, a sensitivity analysis is also carried out on a \$5 per day costing. In the financial analysis wages on the estate have been costed at \$5 per man day, but on smallholder areas labour costs have been assessed on a family income basis as follows:—

Year	Income Allowance Excluding House-Plot
Clearing year	zero
1	1,300
2	1,500
3	1,750
4	2,000
5 onwards	2,500

CHAPTER 4

BENEFITS AND ECONOMIC JUSTIFICATION

4.1 GENERAL

In estimating the value of this project to the regional economy all costs have been based on their assumed market values, as given in Appendix II, financing would be available at a rate which corresponds to the international development lending rate. This rate is about three per cent below the ten per cent rate which has been estimated as the opportunity cost of capital in Sarawak. Since Sarawak traditionally maintains a considerable surplus on the State balance of foreign payments, and since Malaysia as a whole is in a similar economic situation, it has not been considered necessary to introduce any shadow rates of foreign exchange in the economic evaluation.

While the economy as a whole will benefit directly or indirectly from the income created by the Project, the State and Federal Governments will benefit directly through increased tax revenues. Export duties and income taxes accrue to the Federal Government and land taxation revenues pass to the State Government. In addition to these direct revenues, income derived from taxes on vehicles, fuels and other dutiable products the use of which will increase with the development will contribute to the Government benefit. Because of the infinite ramifications involved no attempt has been made to estimate these Government revenues.

4.2 COSTS

The main costs of land development, crop maintenance, housing, management and processing are summarised in Table 4.1 from details given in the Final Report. The components of these costs are as follows:—

- (a) Land development, which includes land clearing, drainage and stream clearing and construction of the road network required to serve the area.
- (b) Crop production costs, which cover all materials and labour inputs concerned with planting, establishing, maintaining and harvesting the crops.
- (c) Labour costs, which throughout the analysis have been assumed to have an opportunity cost of \$3 per day. However, a sensitivity analysis is also carried out on a \$5 per day costing. In the financial analysis wages on the estate have been costed at \$5 per man day, but on smallholder areas labour costs have been assessed on a family income basis as follows:—

Year	Income Allowed Excluding House-Plot
	\$
Clearing year	zero
1	1,300
2	1,500
3	1,750
4	2,000
5 onwards	2,500

TABLE 4.1 SUMMARY OF PUBLIC SECTOR DEVELOPMENT SCHEMES COSTS
(\$ Thousand)

Year	Farm Costs (Materials)			Labour Costs		Village and Housing	Project Costs			Total Costs	
	Land Development	Crop Production		Labour at \$3 per man day	Labour at \$5 per man day		Management	Processing	With Labour at \$3	With Labour at \$5	
1974	204	—	63	104	91	94	—	452	493		
1975	712	314	347	577	962	333	—	2,668	2,898		
1976	999	635	608	1,013	717	650	—	3,609	4,014		
1977	1,813	1,160	1,757	1,757	2,379	1,250	—	7,656	8,359		
1978	2,174	1,832	1,552	2,585	2,054	1,588	5,989	15,189	16,222		
1979	2,322	2,652	2,124	3,539	1,868	2,124	1,071	12,161	13,576		
1980	2,423	3,509	2,421	4,034	1,077	2,204	1,255	12,889	14,502		
1981	1,508	4,090	2,121	3,814	1,999	2,234	2,357	14,598	16,124		
1982	1,466	4,568	2,889	4,813	1,999	1,974	5,347	16,443	18,367		
1983	969	5,214	2,383	4,303	1,999	1,747	2,635	13,347	15,067		
1984	876	5,628	2,570	4,283	1,999	1,733	2,768	13,774	15,487		
1985	794	5,971	2,584	4,307	1,999	1,577	2,841	13,966	15,689		
1986	832	6,071	2,670	4,307	1,999	1,577	3,331	14,681	16,451		
1987	764	6,184	2,739	4,450	1,999	1,580	3,012	14,478	16,303		
1988	764	6,205	2,792	4,564	1,999	1,575	3,040	14,575	16,437		
1989	764	6,217	2,624	4,375	1,999	1,578	3,060	14,442	14,193		
1990	764	6,237	2,853	4,375	1,999	1,578	3,073	14,704	16,605		
1991	764	6,230	2,880	4,754	1,999	1,579	3,078	14,730	16,651		
1992	764	6,224	2,880	4,801	1,999	1,579	3,079	14,774	16,721		
1993	764	6,202	2,923	4,870	1,999	1,585	3,071	14,776	16,746		
1994	764	6,173	2,955	4,925	1,999	1,585	3,071	14,776	16,746		
1995	764	6,132	2,995	4,991	1,999	1,589	3,063	14,783	16,779		
1996	764	6,109	3,023	5,038	1,999	1,589	3,054	14,761	16,776		
1997	764	6,109	3,064	5,107	1,999	1,596	3,046	14,778	16,821		
1998	764	6,083	3,077	5,128	1,999	1,596	3,042	14,761	16,812		
1998	764	6,061	3,077	5,129	1,999	1,596	3,035	14,732	16,784		

(d) Transport and distribution costs, which include loading and transport of the crop from farm gate to processing centre, and thereafter the distribution and port handling costs of the processed products. Throughout the analysis Bintulu is assumed to be the port of shipment.

(e) Process costs: The following costs for processing have been assumed on the analysis:—

Oil Palm: The estimated capital, operating and management costs of the Igang Oil Palm mill have been used for the Niah-Suai area while a cost of \$12 per ton ffb has been included for smallholder production from the Mera-a sub-scheme.

Rubber: Latex has been assumed to be processed in the crumb rubber factory at Igang to produce high grade SMR. For the Niah-Suai RDA the actual estimated capital and operating costs of this factory have been included. For Mera-a processing costs have been calculated at 6.25 cents per pound of rubber produced.

Cocoa: Fermentation and drying have been assumed to be carried out in Samoan type units operated on a group user basis at a cost of 3.5 cents per pound of dried bean equivalent (dbe).

(f) Management costs, which cover the SLDB and ADU organisations including the capital and recurrent costs of buildings, salaries, vehicles and general administration. Worker transport costs have been included at \$0.60 per man day of labour input on the SLDB estate on which workers would be transported daily to their place of work.

(g) Housing costs, which cover the capital and maintenance costs of housing for the estimated number of settler or worker families accommodated on a scheme at \$4,500 per housing unit. Land clearing costs of the village areas have been assumed at \$250 per acre.

4.3 REVENUES

In the analysis the revenue from the proposed development schemes are made up of the value of the crops produced at their projected fob market prices less the appropriate selling commission and export duty; and net revenue derived from the forestry operation. Summaries of crop production and revenue are given in Tables 2.12 and 2.13. The agricultural revenue stream was calculated directly from the build-up of crop production which in turn depends on the phasing of planting. Forestry revenues are assessed on the basis of estimated yields less extraction costs. On smallholder sub-scheme areas homestead plot production, most of which would be consumed by the family, is assessed on the basis of the estimated net production values mentioned in Chapter 2.

Once all the tree crops are in full production, around 1991, the gross revenue of the development would be about \$28 mn, export duty would account for \$2 mn of this total.

4.4 ECONOMIC AND FINANCIAL ANALYSES

4.4.1 Economic Evaluation at Market Prices

The net cash flow of the Project is shown in Table 4.2 and depicted in Figure 4.1. The table shows that the investment period, that is when costs exceed revenues, would extend over nine years (up to 1982) and the accumulated cash

flow deficits would amount to \$56.3 mn. The annual cash surplus would rise to \$11.2 mn in 1990 and 1991 but would decline to \$9.6 mn by 1998 due to decreasing oil palm yields and prices towards the end of the plan period. In Appendix V net cash flows are computed to show the effect of higher palm oil and rubber prices and of including and excluding export duties.

The commercial rate of return to investment in the Project at basic prices and excluding duty would be 8.5 per cent; while if rubber and palm oil prices rise 20 per cent a return of 13.2 per cent would be achieved. The probable return to the scheme lies between these two rates. If export duty were not payable the returns would be 11.1 and 15.1 per cent respectively at basic prices. These returns are regarded as satisfactory for commercial investment where a real interest rate of seven to eight per cent net of inflation might be expected.

TABLE 4.2 PUBLIC SECTOR DEVELOPMENT CASH FLOW AT MARKET PRICES (\$ Thousand)

Year	Revenue		Costs Labour at \$5 per man day	Net Cash Flow	
	Crops Excluding Duty	Forestry Net Revenue		Including Forestry	Excluding Forestry
1974	—	356	750	— 394	— 750
1975	—	441	2,840	— 2,399	— 2,840
1976	68	772	5,052	— 4,212	— 4,984
1977	168	787	7,963	— 7,008	— 7,795
1978	1,067	780	16,728	— 14,881	— 15,661
1979	2,741	1,389	12,745	— 8,615	— 10,004
1980	5,482	2,629	14,957	— 6,846	— 9,475
1981	9,254	—	16,168	— 6,914	— 6,914
1982	13,232	—	18,246	— 5,014	— 5,014
1983	17,643	—	15,674	+ 1,969	+ 1,969
1984	21,045	—	16,100	+ 4,945	+ 4,945
1985	23,967	—	16,510	+ 7,457	+ 7,457
1986	25,763	—	17,043	+ 8,720	+ 8,720
1987	27,049	—	16,850	+ 10,199	+ 10,199
1988	27,758	—	16,847	+ 10,911	+ 10,911
1989	28,073	—	16,906	+ 11,167	+ 11,167
1990	28,194	—	16,943	+ 11,251	+ 11,251
1991	28,165	—	16,956	+ 11,209	+ 11,209
1992	28,058	—	16,995	+ 11,063	+ 11,063
1993	27,799	—	16,970	+ 10,829	+ 10,829
1994	27,546	—	16,967	+ 10,579	+ 10,579
1995	27,225	—	16,917	+ 10,308	+ 10,308
1996	26,965	—	16,955	+ 10,010	+ 10,010
1997	26,728	—	16,925	+ 9,803	+ 9,803
1998	26,521	—	16,896	+ 9,625	+ 9,625

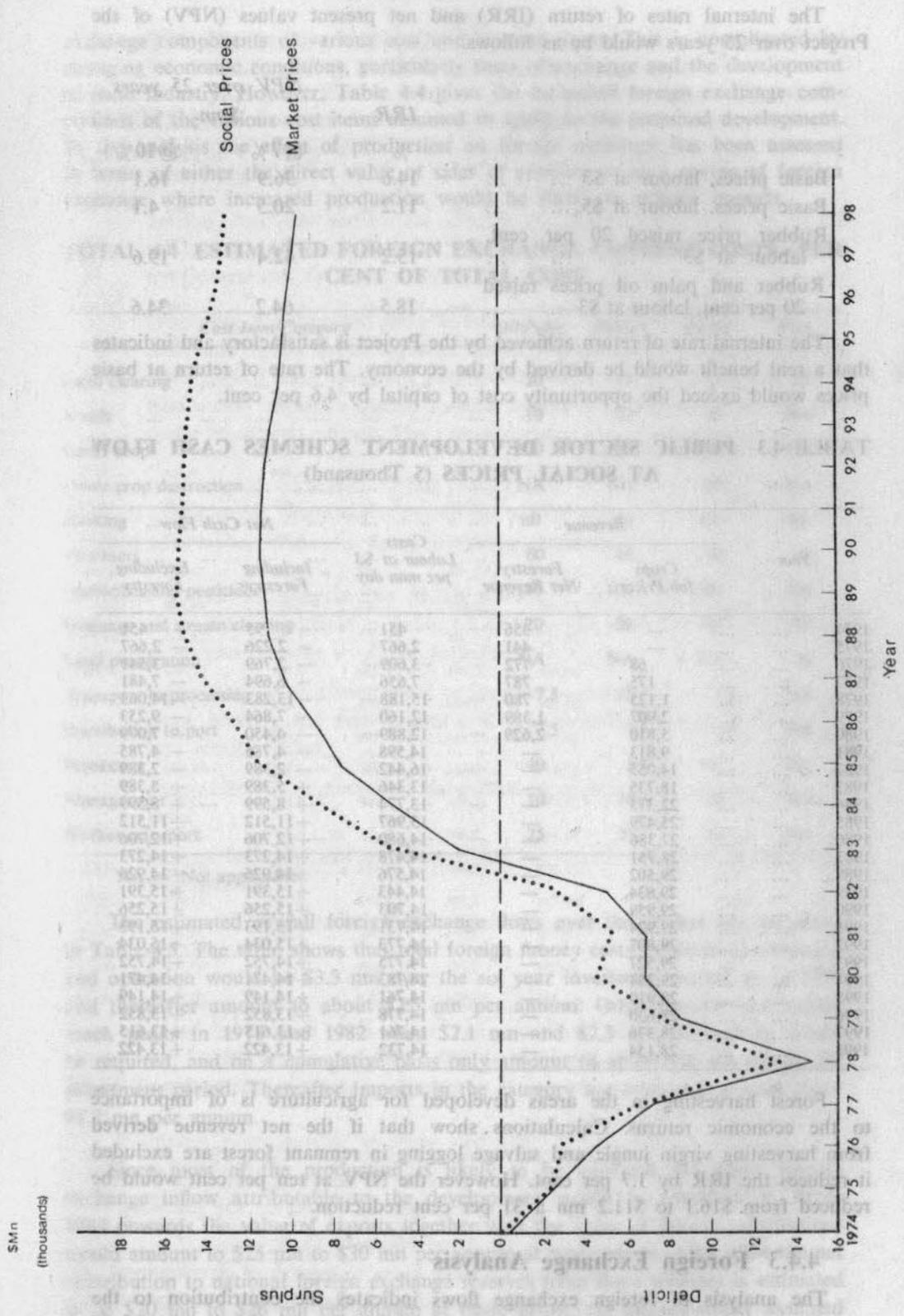
4.4.2 Economic Evaluation at Social Prices

The net cash flows at social prices are summarised in Table 4.3. Details are given in Appendix VI. Briefly the main items of costs and returns which differ from the market price evaluation are:—

Labour costs which are valued at the shadow wage of \$3 per man day to reflect productivity in traditional agricultural employment.

Production costs which are valued at fob prices for exported crops and net retail value for products consumed or sold locally.

FIGURE 4-1



PUBLIC SECTOR DEVELOPMENTS CASH FLOW

The internal rates of return (IRR) and net present values (NPV) of the Project over 25 years would be as follows:

	IRR	NPV over 25 years	
		\$mn	
	%	@7%	@10%
Basic prices, labour at \$3	14.6	36.9	16.1
Basic prices, labour at \$5	11.2	20.5	4.1
Rubber price raised 20 per cent, labour at \$3	15.2	42.4	19.6
Rubber and palm oil prices raised 20 per cent, labour at \$3	18.5	64.2	34.6

The internal rate of return achieved by the Project is satisfactory and indicates that a real benefit would be derived by the economy. The rate of return at basic prices would exceed the opportunity cost of capital by 4.6 per cent.

TABLE 4.3 PUBLIC SECTOR DEVELOPMENT SCHEMES CASH FLOW AT SOCIAL PRICES (\$ Thousand)

Year	Revenue		Costs Labour at \$3 per man day	Net Cash Flow	
	Crops fob Prices	Forestry Net Revenue		Including Forestry	Excluding Forestry
1974	—	356	451	- 95	- 451
1975	—	441	2,667	- 2,226	- 2,667
1976	68	772	3,609	- 2,769	- 3,541
1977	175	787	7,656	- 6,694	- 7,481
1978	1,125	780	15,188	- 13,283	- 14,063
1979	2,907	1,389	12,160	- 7,864	- 9,253
1980	5,810	2,629	12,889	- 4,450	- 7,079
1981	9,813	—	14,598	- 4,785	- 4,785
1982	14,053	—	16,442	- 2,389	- 2,389
1983	18,735	—	13,346	+ 5,389	+ 5,389
1984	22,373	—	13,774	+ 8,599	+ 8,599
1985	25,479	—	13,967	+ 11,512	+ 11,512
1986	27,386	—	14,680	+ 12,706	+ 12,706
1987	28,751	—	14,478	+ 14,273	+ 14,273
1988	29,502	—	14,576	+ 14,926	+ 14,926
1989	29,834	—	14,443	+ 15,391	+ 15,391
1990	29,959	—	14,703	+ 15,256	+ 15,256
1991	29,924	—	14,731	+ 15,193	+ 15,193
1992	29,807	—	14,773	+ 15,034	+ 15,034
1993	29,527	—	14,775	+ 14,752	+ 14,752
1994	29,254	—	14,783	+ 14,471	+ 14,471
1995	28,910	—	14,761	+ 14,149	+ 14,149
1996	28,630	—	14,778	+ 13,852	+ 13,852
1997	28,376	—	14,761	+ 13,615	+ 13,615
1998	28,154	—	14,732	+ 13,422	+ 13,422

Forest harvesting in the areas developed for agriculture is of importance to the economic returns. Calculations show that if the net revenue derived from harvesting virgin jungle and salvage logging in remnant forest are excluded it reduces the IRR by 1.7 per cent. However the NPV at ten per cent would be reduced from \$16.1 to \$11.2 mn a 31 per cent reduction.

4.4.3 Foreign Exchange Analysis

The analysis of foreign exchange flows indicates the contribution to the nation's foreign exchange reserves that would result from the proposed development. In order to carry out the analysis it is necessary to estimate the foreign

exchange components of various cost and revenue items. This is complicated by changing economic conditions, particularly rates of exchange and the development of local industry. However, Table 4.4 gives the estimated foreign exchange components of the various cost items assumed to apply to the proposed development. In the analysis the effect of production on foreign exchange has been assessed in terms of either the direct value of sales of produce or as a saving of foreign exchange where increased production would be likely to replace imports.

TOTAL 4.4 ESTIMATED FOREIGN EXCHANGE CONTENT COSTS—PER CENT OF TOTAL COST

<i>Cost Item/Category</i>	<i>Oil Palm</i>	<i>Rubber</i>	<i>Cocoa</i>	<i>Rice</i>
Land clearing	20	15	15	25
Roads	10	10	10	NA
Cover crop	100	100	100	NA
Cover crop destruction	NA	NA	60	NA
Planting	nil	10	nil	nil
Fertilisers	60	60	40	40
Herbicides and pesticides	100	100	100	100
Drainage and stream clearing	20	20	20	25
Land preparation	NA	NA	NA	25
Transport to processing	7.5	15	7.5	NA
Distribution to port	7.5	7.5	7.5	NA
Processing	40	2.5	nil	NA
Management	10	10	10	NA
Worker transport	25	25	25	NA

NA = Not applicable.

The estimated overall foreign exchange flows over the project life are given in Table 4.5. The table shows that total foreign money costs for farm development and operation would be \$3.3 mn over the six year investment period up to 1979 and thereafter amount to about \$2.5 mn per annum. Other project costs would reach peaks in 1978 and 1982 when \$2.1 mn and \$2.3 mn respectively would be required, and on a cumulative basis only amount to about \$25 mn during the investment period. Thereafter imports in the category are estimated to cost about \$1.2 mn per annum.

Since most of the production is likely to be exported the direct foreign exchange inflow attributable to the development would be considerable. From 1984 onwards the value of exports together with the value of import substitutions would amount to \$25 mn to \$30 mn per annum at basic prices. After 1984 the net contribution to national foreign exchange reserves from these schemes is estimated to be \$20 mn to \$26 mn per annum at basic prices. At the previously assumed raised palm oil and rubber prices net annual earnings would be increased to about \$30 mn.

**TABLE 4.5 PUBLIC SECTOR DEVELOPMENT SCHEMES OVERALL
FOREIGN EXCHANGE FLOWS (\$ Thousand)**

Year	Inflow derived from			Outflow to			Net Contribution to Foreign Exchange Reserves	
	Crops Revenue	Forestry Revenue	Sub-total	Farm Costs	Other Project Costs	Sub-Total	Including Forestry	Excluding Forestry
1974	—	356	356	88	28	116	+ 240	- 116
1975	—	441	441	251	70	321	+ 120	- 321
1976	48	772	820	600	102	702	+ 118	- 654
1977	157	787	944	980	165	1,145	- 201	- 988
1978	1,060	780	1,840	1,376	2,130	3,506	- 1,666	- 2,446
1979	2,844	1,389	4,233	1,766	771	2,537	1,696	347
1980	5,705	2,629	8,334	2,290	862	3,152	5,182	2,553
1981	9,729	—	9,729	2,351	967	3,318	6,411	6,411
1982	13,938	—	13,938	2,539	2,265	4,804	9,134	9,134
1983	18,665	—	18,665	2,528	1,301	3,829	14,836	14,836
1984	22,304	—	22,304	2,645	1,281	3,926	18,378	18,378
1985	25,447	—	25,447	2,591	1,274	3,865	21,582	21,582
1986	27,345	—	27,345	2,628	1,267	3,395	23,450	23,450
1987	28,717	—	28,717	2,587	1,197	3,784	24,933	24,933
1988	29,469	—	29,469	2,601	1,200	3,801	25,688	25,688
1989	29,798	—	29,798	2,603	1,199	3,802	25,996	25,996
1990	29,918	—	29,918	2,614	1,196	3,810	26,108	26,108
1991	29,878	—	29,878	2,613	1,193	3,806	26,072	26,072
1992	29,754	—	29,764	2,615	1,190	3,805	25,949	25,949
1993	29,466	—	29,466	2,609	1,178	3,787	25,679	25,679
1994	29,187	—	29,187	2,601	1,174	3,775	25,412	25,412
1995	28,835	—	28,835	2,596	1,169	3,765	25,070	25,070
1996	28,550	—	28,550	2,594	1,169	3,763	24,787	24,787
1997	28,291	—	28,291	2,592	1,164	3,756	24,535	24,535
1998	28,064	—	28,064	2,590	1,160	3,750	24,314	24,314

4.4.4 Financial Analysis

The purpose of this Section is to examine the financial position of SLDB during the life of the Project.

The expenditure by the SLDB on the proposed development are derived from the costs given in the economic analysis at market prices, (see Table 4.1). The main components of the Board's expenditure would be the following:—

- land development for all the areas allocated to it;
- crop production costs on all these areas to year 5 of development; and subsequently for areas retained under its control. The smallholder sub-schemes would become the responsibility of ADU in year 6. It is assumed that for these areas annual subventions from Government would be made to cover these costs so that SLDB would carry no financial burden;

- management costs of staff and administration for all the areas during the initial development period and subsequently for the areas retained under its control. Worker transport for the SLDB estate areas is included under this heading. On the smallholder schemes it is assumed similar subvention arrangements would apply to these costs as for the crop production costs.
- housing costs for settlers on smallholder areas and workers on SLDB estate areas. Smallholder settler housing costs are assumed to be reimbursed by Government or another financing agency;
- processing facilities set up to handle oil palm and rubber for the whole area, and cocoa in those areas which remain under its direct control. Both capital and operating costs would have to be met by the Board who would impose a charge for the service to all users outside the area under its direct control. The assumed rates have been given previously.

A summary of estimated SLDB expenditure is given in Table 4.6. The greatest expenditures would occur during the period 1978 to 1987 when the palm oil mill and rubber factory in Igang would be established.

The income accruing to the SLDB would be derived from a number of sources which are summarised in Table 4.7 from details given in the Final Report. The main revenue sources would be as follows:—

- subventions from Government or financing agencies to cover the development, housing and management costs of the areas destined to be divided into smallholdings;
- charges levied for processing and marketing of crops delivered to processing units;
- receipts from the sale of commodities produced on the area under SLDB management;
- receipts from replanting fund levies set up to cover replanting costs of the tree crops.

The estimated financial flow of SLDB is shown in Table 4.8 which shows that allowing for income from crops, the replanting fund levies and assuming workers in SLDB schemes receive \$5.00 per day, the accumulated cash deficit of the Board would be \$36.8 mn by 1982.

If interest were payable at seven per cent the accumulated deficit or debt would be \$49.7 mn by 1984 and the payback period of the SLDB programme would be 24 years. The financial rate of return calculated over 25 years for this operation is 7.4 per cent. If the replanting fund revenue is excluded the rate of return falls to 6.9 per cent.

The above analysis indicates that considerable care would have to be exercised in the management of SLDB operations and a possible means of providing development loans at interest rates below seven per cent should be explored.

TABLE 4.6 ESTIMATED SLDB EXPENDITURE (\$ Thousand)

Year	Nucleus Estate				Smallholder Sub-Schemes				Factory Costs	Total Expenditure		
	Land Development	Farm Production Costs	Housing and Village Clearing	Management	Sub-Total	Land Development	Farm Production Costs	Housing and Village Clearing			Management	Sub-Total
1974	—	—	—	—	—	292	16	91	94	493	—	493
1975	338	28	186	103	655	589	689	776	230	2,284	—	2,939
1976	607	804	495	250	2,156	718	514	222	400	1,854	—	4,010
1977	358	531	495	391	1,775	1,933	1,907	1,884	859	6,583	—	8,358
1978	1,041	1,412	520	708	3,681	1,673	2,436	1,534	831	6,474	5,978	16,133
1979	709	1,477	520	716	3,422	2,101	3,317	1,332	1,330	8,080	989	12,491
1980	1,595	3,038	947	1,120	6,700	1,160	3,465	213	890	5,728	1,117	13,545
1981	209	2,744	947	970	4,870	1,288	2,852	1,123	924	6,187	2,182	13,239
1982	919	3,103	76	1,191	5,289	284	2,102	46	291	2,723	5,120	13,132
1983	311	3,486	76	911	4,784	315	752	21	280	1,368	2,380	8,532
1984	278	3,747	76	909	5,010	82	745	21	185	1,033	2,495	8,538
1985	322	3,708	76	898	5,004	—	—	—	—	—	2,559	7,563
1986	283	3,848	76	903	5,110	—	—	—	—	—	3,045	8,155
1987	283	3,862	76	905	5,126	—	—	—	—	—	2,722	7,848
1988	283	3,830	76	900	5,089	—	—	—	—	—	2,747	7,836
1989	283	3,853	76	903	5,115	—	—	—	—	—	2,767	7,882
1990	283	3,856	76	903	5,118	—	—	—	—	—	2,782	7,900
1991	283	3,866	76	904	5,129	—	—	—	—	—	2,792	7,921
1992	283	3,898	76	910	5,167	—	—	—	—	—	2,796	7,963
1993	283	3,885	76	910	5,154	—	—	—	—	—	2,788	7,968
1994	283	3,907	76	914	5,180	—	—	—	—	—	2,779	7,942
1995	283	3,890	76	914	5,163	—	—	—	—	—	2,773	7,996
1996	283	3,943	76	921	5,223	—	—	—	—	—	2,769	7,979
1997	283	3,930	76	921	5,210	—	—	—	—	—	2,765	7,961
1998	283	3,916	76	921	5,196	—	—	—	—	—	—	4,275

TABLE 4.7 SUMMARY OF CROP REVENUES FROM PUBLIC SECTOR SETTLEMENTS (\$ Thousand)

Year	At Social Prices				At Market Prices				
	Gross Job Revenue	Forestry Revenue	Total Project Revenue	Gross Sales Revenue	Export Duty	Net Revenue	Forestry Revenue	Total Project Revenue	
								Excluding Duty	Including Duty
1974	—	356	356	—	—	—	356	356	356
1975	—	441	441	—	—	—	441	441	441
1976	68	840	840	68	8	160	772	840	840
1977	175	787	962	168	—	—	787	947	955
1978	1,125	780	1,905	1,067	65	1,002	780	1,782	1,847
1979	2,907	1,389	4,296	2,741	188	2,553	1,389	3,942	4,130
1980	5,810	2,629	8,439	5,482	376	5,106	2,629	7,735	8,111
1981	9,813	—	9,813	9,250	644	8,606	—	8,606	9,250
1982	14,053	—	14,053	13,232	921	12,311	—	12,311	13,232
1983	18,735	—	18,735	17,643	1,252	16,391	—	16,391	17,643
1984	22,373	—	22,373	21,045	1,512	19,533	—	19,533	21,045
1985	25,479	—	25,479	23,967	1,735	22,232	—	22,232	23,967
1986	27,386	—	27,386	25,763	1,874	23,889	—	23,889	25,763
1987	28,751	—	28,751	27,049	1,977	25,072	—	25,072	27,049
1988	29,502	—	29,502	27,758	2,033	25,725	—	25,725	27,758
1989	29,834	—	29,834	28,073	2,057	26,016	—	26,016	28,073
1990	29,959	—	29,959	28,194	2,066	26,128	—	26,128	28,194
1991	29,924	—	29,924	28,165	2,063	26,102	—	26,102	28,165
1992	29,807	—	29,807	28,058	2,054	26,004	—	26,004	28,058
1993	29,527	—	29,527	27,799	2,032	25,767	—	25,767	27,799
1994	29,254	—	29,254	27,546	2,011	25,535	—	25,535	27,546
1995	28,910	—	28,910	27,225	1,985	25,240	—	25,240	27,225
1996	28,630	—	28,630	26,965	1,963	25,002	—	25,002	26,965
1997	28,376	—	28,376	26,728	1,944	24,784	—	24,784	26,728
1998	28,154	—	28,154	26,521	1,927	24,594	—	24,594	26,521

TABLE 4.8 ESTIMATED SLDB FINANCIAL FLOW

Year	Revenue										Expenditure			Overall Net Cash flow Excluding Replanting Fund Levy		
	Cost of Smallholder Schemes Re-imbursed by Government		Crop Sales (Excluding Duty)							Replanting Fund Levy Receipt	Total Revenue	Payments to Smallholders for Produce	Crop Production and Project Expenditure		Overall Net Cash flow	
	Total Costs	Credit Net Revenue from Crop Sales(1)	Palm Oil	Palm Kernels	Rubber	Cocoa	Sub-Total									
1974	493	—	493	—	—	—	—	—	—	—	—	493	—	—	—	—
1975	2,284	—	2,284	—	—	—	—	—	—	—	—	2,284	—	—	2,939	655
1976	1,854	—	1,854	—	—	—	—	—	—	—	—	1,854	—	—	4,010	2,156
1977	6,583	34	6,549	84	13	—	—	—	—	97	—	6,646	112	112	8,358	1,824
1978	6,474	72	6,402	724	102	30	—	—	—	856	—	7,258	602	602	16,133	9,477
1979	8,080	99	7,981	2,050	298	—	—	—	—	2,348	—	10,329	1,091	1,091	12,491	3,253
1980	5,728	1,382	4,346	4,070	602	330	—	—	—	5,002	55	9,403	3,521	3,521	13,545	7,718
1981	6,187	946	5,241	6,706	1,006	353	254	—	—	8,319	55	13,615	4,725	4,725	13,239	4,404
1982	2,723	1,088	1,635	9,522	1,442	405	515	—	—	11,884	106	13,625	7,922	7,922	13,132	7,535
1983	1,368	151	1,217	12,514	1,912	540	1,092	—	—	16,058	120	17,395	7,436	7,436	8,532	1,307
1984	1,033	467	566	14,759	2,268	580	1,634	—	—	19,241	222	20,029	8,994	8,994	8,538	2,497
1985	—	—	—	16,040	2,476	540	2,707	—	—	21,763	246	22,009	9,811	9,811	7,563	4,389
1986	—	—	—	16,753	2,594	540	3,605	—	—	23,492	246	23,738	10,615	10,615	8,155	4,722
1987	—	—	—	17,011	2,632	540	4,593	—	—	24,776	275	25,051	11,384	11,384	7,848	5,544
1988	—	—	—	17,058	2,640	540	5,247	—	—	25,485	275	25,760	11,804	11,804	7,836	5,845
1989	—	—	—	16,956	2,624	5680	5,680	—	—	25,800	—	26,075	12,041	12,041	7,882	5,877
1990	—	—	—	16,779	2,593	6,007	6,007	—	—	25,919	—	26,194	12,140	12,140	7,900	5,879
1991	—	—	—	16,539	2,558	6,254	6,254	—	—	25,891	—	26,166	12,181	12,181	7,921	5,789
1992	—	—	—	16,275	2,513	6,456	6,456	—	—	25,784	—	26,059	12,157	12,157	7,963	5,664
1993	—	—	—	16,965	2,461	6,539	6,539	—	—	26,525	—	26,800	13,084	13,084	7,946	5,495
1994	—	—	—	15,092	2,424	6,616	6,616	—	—	25,272	—	25,547	11,980	11,980	7,968	5,324
1995	—	—	—	15,413	2,381	6,616	6,616	—	—	24,950	—	25,225	11,841	11,841	7,942	5,167
1996	—	—	—	15,184	2,350	6,616	6,616	—	—	24,690	—	24,965	11,726	11,726	7,996	4,968
1997	—	—	—	14,981	2,316	6,616	6,616	—	—	24,453	—	24,728	11,618	11,618	7,979	4,856
1998	—	—	—	14,805	2,285	6,616	6,616	—	—	24,246	—	24,521	11,572	11,572	7,961	4,713

NOTE: (1) Net Sales value of crop produced in years 3 and 4 before hand over to small-holders.

APPENDIX I
RESULTS OF SCREENING FOR SELECTION OF ENTERPRISES
TABLE II GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO
COMMERCIAL POTENTIALITY

Group Description	Enterprise
<p>Group I Enterprises known to be commercially viable for immediate development on a large scale.</p>	<p>Rubber, palm</p>
<p>Group II Enterprises known to be commercially viable and suitable for immediate development but on a restricted scale or only for local market.</p>	<p>Mango, cocoa, rubber, rubber (single crop), vegetables for fresh use, annatto, essential oils, turpentine, medicinal pepper, rice, coconuts, tropical fruits for fresh markets, sugar, breeding and fattening for fresh use, pigs for fresh meat, poultry, broilers and hatching eggs, swine, cattle and water buffalo</p>
<p>Group III Enterprises with promising commercial prospects but requiring an initial period of trial or heavy research prior to recommendation for development on a large scale.</p>	<p>Dates, swamp rice (suitable for export), lignite for chips or fuel, "oil" (suitable for vegetable and various uses), groundnut, for grading or export, local production of rice, rubber, coconut, sugar, medicinal, local (oil, latex, seed), water buffalo, sheep, poultry, local (oil, latex, seed)</p>
<p>Group IV Enterprises possibly suited to local development but requiring considerable research and field trial before they might be considered as commercial plants.</p>	<p>Lignite (local), groundnut, oilseed, soybean, etc., maize and wheat, for grain, bananas for export, papaya for pulp, sugar (partly direct sales, primarily sugar cane), sugar cane (milled sugar) for processed sugar (refined) plantations.</p>

* Enterprises which are listed here are shown and are given which follow.

APPENDIX I

RESULTS OF SCREENING FOR SELECTION OF ENTERPRISES

TABLE I.1 GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO COMMERCIAL POTENTIALITY

Group Description	Enterprise
<p>Group I Enterprises known to be commercially viable for immediate development on a large scale.</p>	Rubber, oil palms.
<p>Group II Enterprises known to be commercially viable and suitable for immediate development but on a restricted scale or only for local market.</p>	<p>Maize for green cobs; swamp rice (single crop); vegetables for fresh markets; annatto, essential oils (lemon grass, patchouli), pepper, coffee*, cocoa, coconuts, tropical fruits for fresh markets, sago, beef breeding and fattening for fresh meat*, pigs for fresh meat, poultry (eggs, broilers and hatching eggs), aquaculture (fish and fresh water prawns).</p>
<p>Group III Enterprises with promising commercial prospects but requiring an initial period of trial or limited research prior to recommendation for development on a large scale.</p>	<p>Dried chillies, swamp rice (double cropping); tapioca for chips or feed, cashew nuts*, essential oils (citronella and vertiver grass) grasses and legumes for grazing or cutting, (beef production), spices (cardamom, turmeric, cloves, nutmegs), lowland tea, aquaculture (brackish water crustacia, turtles).</p>
<p>Group IV Enterprises possibly suited to local environment but requiring considerable research and field trial before they might be considered for commercial planting.</p>	<p>Legumes (beans, groundnuts, cowpea, soya beans, etc.), maize and sorghum for grain, bananas for export, papaya for papain, spices (vanilla, ginger, cassia, cinnamon), sugar cane (unrefined sugar), fruits for processing, sago (cultivated plantation).</p>

* Enterprises which are border-line between the group in which they are shown and the group which follows.

TABLE I.2 GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO ACCESSIBILITY AND TRANSPORT FACTORS

Group Description	Enterprise
<p>Group I</p> <p>Enterprises whose inputs and end-products would be easily transported and for which no special processing facilities would be envisaged. These activities were regarded as suitable for development in remote areas served by minor waterways or tracks.</p>	<p>Dried chillies, swamp rice (single crop)*, annatto, coffee (robusta), spice (cardamom), cashew nuts.</p>
<p>Group II</p> <p>Enterprises whose input requirements are high and whose end-products would be bulky but reasonably durable or could be processed on the farm, requiring simple means of transport on large rivers or rural roads. These activities were considered suitable for semi-remote areas.</p>	<p>Legumes (beans, groundnuts, cowpeas, soya beans, etc.), maize and sorghum for grain, papaya for papain, pepper, spices (turmeric, vanilla, ginger, cassia, cinnamon, cloves, nutmeg), sugar cane (unrefined sugar), cocoa, coconuts (copra), rubber.</p>
<p>Group III</p> <p>Enterprises which due to the bulkiness or perishability of their product or need for specialised large-scale processing of their products require good roads or waterways. These activities were considered suitable only where proximity to an all weather road network, navigable waterway, processing plant or urban market was satisfied.</p>	<p>Maize for green cobs, swamp rice (double cropping), tapioca for chips, vegetables for fresh market, fruits for fresh market or processing, essential oil crops, grasses and legumes for grazing or cutting (i.e. beef cattle rearing), oil palms, sago, tea (lowland), pigs for market, poultry for market, aquaculture schemes.</p>

* Cropping for home consumption only. If rice is grown for market it should be considered only in Group III.

TABLE 1.3 ECONOMIC ACHIEVEMENTS OF SELECTED AGRICULTURE ACTIVITIES

ACTIVITY	Returns to Resources		Internal Rate of Return (Social Prices) per cent	Commercial Rate of Return (Market Prices) per cent	Employment Generated		Investment Required	
	Labour \$/man day	Land \$ per acre/ annum			Full time Workers per 100 acres	Maturity	Cumulative Undiscounted Deficit Cash Flows \$ per acre	Cumulative Deficit Cash Flow Including Interest at 7 per cent \$ per acre
Oil Palm								
Estate based on 60 ton per hour mill	14.1	148	23	14	6.5	1,356	1,713	
Smallholder farmer	10.0	155	23	15	6.7	1,147	1,430	
Rubber								
Estate based on 10 ton per day factory:								
Large lumps field material) without	2.3	Negative	9	3	18.6	2,213	3,291	
Latex field material) stimulation	3.6	20	11	6	18.1	2,195	3,056	
Latex field material with stimulation	4.2	45	12	8	21.1	2,201	3,063	
Smallholder delivering to central factory:								
Large lumps material) without	3.3	11	11	3	18.1	1,650	2,492	
Latex field material) stimulation	4.5	55	14	8	17.7	1,635	2,331	
Pepper								
Smallholder farmer:								
Average yield situation	7.6	925	38	23	82.5	4,127	4,666	
Low yield situation	5.6	463	26	11	73.7	4,127	4,666	
Cocoa								
Smallholder farmer	9.6	201	25	20	9.3	1,167	1,450	
Rice								
Smallholder farmer	3.7	35	14	3	15.4	1,098	1,316	
Beef								
Ranch (5,000 acres)								
Initial breeding scheme	11.0	40	12	9	1.1	1,630	2,202	
Expansion scheme	10.1	35	13	12	1.1	1,062	1,434	
Smallholder farmer growing-out steers	9.6	46	18	15	2.1	559	717	
Aquaculture schemes: smallholder farmer								
1 acre Chinese carp	33.2	1,795	>50	>50	18.0	4,431	4,741	
1/2 acre Chinese carp	17.8	1,182	45	38	24.0	4,380	4,686	
1/10 acre Local fish	9.6	792	42	31	24.0	3,710	3,970	
1/2 acre prawns and local fish	18.0	1,151	46	39	24.0	4,310	4,612	
Turtles (11/10 acre)	5.0	869	37	13	140.0	4,327	4,864	

TABLE 1.4 GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO SUITABILITY FOR DIFFERENT SLOPE RANGES AND STEEPNESS OF LAND

Slope Range (degrees)	Enterprises			Remarks
	Annual Crops	Semi-perennial	Perennial	
0 - 2	Swamp rice			Aquaculture
0 - 6	Vegetables, pulses, maize, spices			If terraced, small patches could be grown on steeper land. Erosion control measures would be necessary on slopes above four degrees.
0 - 12		Essential oil crops papaya, pineapples	Bananas	
0 - 20			Oil palms, cardamom, coconuts, pasture, annatto, coffee, cocoa, fruit trees	The tree and bush crops would need to be contour planted on slopes between 4 and 12 degrees. Terraces or platforms would be required on slopes above 12 degrees and complete ground cover necessary during establishment.
0 - 25		Rubber, pepper, cloves, nutmeg, cashew nut	Pigs, poultry, cattle rearing	Terraces or platforms would be required above 12 degrees. Between 4 and 12 degrees contour planting would be necessary and complete ground cover necessary during establishment.

TABLE 1.3 ECONOMIC VEHICLE WEIGHTS OF RECYCLED VEHICLE TIRE RUBBERS

APPENDIX II

SUMMARY OF MARKET ANALYSIS

Comprehensive market studies were not carried out. However, the studies were shown to be definitely suitable for the purpose of a preliminary screening process indicated. The objective of the studies was to determine the extent to which the selected crops are likely to be produced in the Study Area, the orientation that the development of these crops would have on the world market of future prices. These studies are given in detail in Appendices III, IV and V, and are summarised in the following paragraphs.

1. OIL PALMS

At present the world demand for palm oil exceeds supply. However, the future market for palm oil and palm kernels will be determined in the context of the overall world market for all vegetable oils.

The long-term trends in the market for competing products such as soyabean oil, sunflower oil, etc. may favour or disfavour palm oil. The increasing possibilities for substitution between the various oils and economic factors, make it likely that there will be differences between particular types of oils and fats.

The Food and Agricultural Organisation's Indicative World Plan for Malaysia were to plant an average of 20,000 acres of oil palm per year in the period 1970 to 1975 and 35,000 to 50,000 acres per year from 1975 to 1985 when the Federation's production would be at least 1.5 million tons. These are targets likely to be equalled or exceeded by Malaysia. Production would amount to about 40 per cent of projected world production of 3.7 to 4.0 million tons by 1985. This total world production would grow at a rate of 5.5 per cent per annum over the period 1970 to 1985.

Projected growth in demand for fats and oils is about 3.5 per cent per annum. By 1985 supplies are likely to outstrip demand and result in a fall in the price for oil palm products.

Within the overall Malaysian planting programme it is estimated that 125,000 acres could be planted in the Study Area by 1985, depending on the projected world market situation.

The projected prices of palm oil and palm kernels are given in the following table:

Year	Price per ton (US Dollars)	
	Palm Oil	Palm Kernels
1975	520	180
1980	475	170
1985	390	150
1990	360	140
1995	330	130

APPENDIX II

SUMMARY OF MARKETING ANALYSIS

Comprehensive market studies were undertaken only of those enterprises which were shown to be definitely suitable for inclusion in the development plan by the screening process indicated. The objectives of the market analyses were to estimate the extent to which the selected enterprises could be developed in the Study Area, the orientation that the development should have, and the likely trend of future prices. These studies are given in detail in Supporting Report 2, Parts IV and V, and are summarised in the following paragraphs.

II.1 OIL PALMS

At present the world demand for palm oil exceeds supply and prices are high. However, the future market for palm oil and palm kernels has to be viewed in the context of the overall world market for all vegetable and animal fats and oils.

The long-term predictions for this market are complex due to the wide range of competing products as well as technical, natural, economic and political factors which may favour or operate against particular products. Over the whole range the increasing possibilities for substitution between the various oils, in conjunction with economic factors, make it likely that there will be a decrease in price differences between particular types of oils and fats.

The Food and Agricultural Organisation's Indicative World Plan shows that if Malaysia were to plant an average of 30,000 acres of oil palms per year during the period 1970 to 1975 and 35,000 to 50,000 acres per year between 1975 and 1985 then the Federation's production would be at least 1.5 mn tons in 1985. These are targets likely to be equalled or exceeded by Malaysia as a whole, and production would amount to about 40 per cent of projected world palm oil production of 3.7 to 4.0 mn tons by 1985. This total world output represents a growth rate of 5.5 per cent per annum over the period 1970 to 1985. The predicted growth in demand for fats and oils is about 3.5 per cent per annum. Thus by 1985 supplies are likely to outstrip demand and result in a predicted gradual decline in the price for oil palm products.

Within the overall Malaysian planting programme it is considered that up to 155,000 acres could be planted in the Study Area by 1990 without noticeably prejudicing the projected world market situation.

The projected prices of palm oil and palm kernels over the next 20 years are as follows:

Year	Price per ton fob Sarawak (\$)	
	Palm Oil	Palm Kernels
1975	520	365
1980	422	315
1985	398	290
1990	398	290
1995	398	290

II.2 RUBBER

In the last decade the world market prospects for natural rubber have been overshadowed by competition from synthetic rubber. However, the very recent change in the marketing of crude oil supplies and the unprecedented increase in its price are reasons to adopt a more optimistic view with regard to demand for natural rubber. The present position is one where demand is greater than supply and prices are higher than for many years.

Since the increases in the price of crude oil considerable uncertainty has been attached to the FAO Indicative World Plan predictions which suggested that natural rubber might command 24 per cent of the elastomer market in 1985. Under the present changed conditions the market share of natural rubber could increase or decrease depending on a number of factors of which the more important are:

- the demand for oil supplies for other uses combined with high crude oil prices; this could induce caution in the rate of investment in synthetic rubber installations and act favourably for increased demand for natural rubber;
- increased refined fuel oil prices; this could cause a decline in the demand for vehicle tyres and therefore a drop in demand for natural rubber;
- improved primary processing techniques for natural rubber aimed at specialised forms catering for specific user needs; this could accelerate the expansion of uses for natural rubber.

A range of figures considered reasonable for natural rubber's share of the world market by 1985 is as follows:

	<i>Market share of natural rubber</i> (per cent)	<i>Equivalent quantity demand on world market</i> (mn tons)
High	32	5.95
Low	17	3.13
Average	24	4.45

These estimates, compared to present demand for natural rubber (about 2.4 mn tons), show that there should be an increased demand for it if it is available at a competitive price.

Projections of future production are extremely difficult to make because production has been so affected by changing prices. For this reason existing statistics are unreliable in gauging future production, but a review by the Rubber Research Institute of Malaysia (1970) estimated Malaysian production would reach 2.1 mn tons by 1980. In addition the widespread use of ethylene based stimulants could increase the figure by 100,000 tons. Continuing these possible production growths to 1985, Malaysian output might reach 2.6 to 2.8 mn tons, or about 60 per cent of world usage projected by FAO.

From available information it appears that the period from 1980 onwards will be a critical time for natural rubber on the world market. By then supplies from Malaysia are likely to have built-up and similar increases can be expected from other major producing countries. Therefore, some degree of caution is recommended in rubber planting plans aimed at filling the present shortfall in supplies. Future production should be orientated to provide high yields and an

ensured supply of a uniform, good quality product. New and replacement plantings totalling about 90,000 acres by 1990 would appear a reasonable target for the Study Area. An important respect in this connection is that any new planting of rubber trees will not come into production for seven years by which time market conditions may have changed again.

In view of the uncertainty of the rubber market situation a basic price of 57 cents per fob Singapore was used in calculating the returns to rubber. This price would be equivalent to 47 cents fob Sarawak. For a sensitivity analysis a price 20 per cent higher was used.

II.3 COCOA

During the period from the late 1950's to the mid-1960's cocoa production increased more rapidly than demand with the result that prices declined considerably by the mid-1960's. Since then production has increased slowly with virtually no changes over the past three years and prices have generally recovered, indicating that a balance is being reached between supply and demand. But a general feature of the cocoa market is its price instability with rapid changes from month to month and year to year. This has led to the present concerted efforts by major producers and consumers to negotiate an International Cocoa Agreement. Although reactions to this have been favourable final ratification has yet to be achieved.

The FAO commodity projections (1967 and 1971) suggest that supply and demand would be more or less in balance by 1985. However, if the potential which exists for increasing production in a number of countries is utilised there could be an overproduction by that time. Also past experience indicates that due to the relatively low price elasticity of demand in the main importing countries any tendency towards continuously high prices could result in curtailed consumption. Conversely, consumption is stimulated by periods of low prices and, in general, consumption is rising in developing countries at a faster rate than in the traditional consuming countries of the United States and Western Europe (4.0 per cent per annum compared to 3.5 per cent). For example chocolate is already manufactured in Peninsular Malaysia providing a ready market for the good quality cocoa produced in Sabah. Another encouraging feature of the cocoa market in recent years has been the increase in Soviet Union imports and this country was ranked third of world importers in 1971.

The conclusion of the market analysis was that the production from up to about 6,000 acres of cocoa in the Study Area by 1990 could be safely absorbed. Production should at first be aimed at the export of a high standard quality of dried beans. Sophisticated processing should not be undertaken but the manufacture of cocoa butter and powder could possibly be undertaken in Sarawak when local production of dried beans has reached sufficient quantities.

The prices forecast which has been used in the economic evaluations were as follows:

Year	U.S. Future Price	fob Price Sarawak
	U.S. (\$) per lb.	Malaysian (\$) per lb.
1975	31	60
1980	29	55
1985	27	50
1990	27	50
1995	27	50

II.4 PEPPER

A feature of the world pepper trade is that production occurs only in a limited number of countries from which it is exported throughout the world. Variations in supply tend to cause fluctuating prices and contribute to competition between the exporting countries. Also the demand for pepper is very inelastic, thus prices respond to any change in the supply situation and wide fluctuations have tended to occur in the past. International measures to derive a buffer-stock operation to reduce price fluctuations are currently being examined but little progress has been made so far in the face of upward price trends.

Most pepper is consumed in its raw state, and in the producing countries little progress has been made up to now in discovering new uses or developing processing facilities. However, in the world market there is considerable increase in the use of oleoresin extraction of piperine from black pepper.

At present Sarawak pepper is mainly sold through brokers and agents in Singapore who provide credit, storage, clearing, grading and packing facilities as well as contact with overseas buyers. Marketing channels are, however, currently under review and a Pepper Marketing Board, aimed at promoting direct sales to consuming countries and securing a larger share of the world market for the Malaysian product, was established in 1973. The intention is to introduce a compulsory grading of all pepper exported from Sarawak. This will offer an opportunity (of which the Director of the Pepper Marketing Board is fully aware) for Sarawak to sell a grade of light berries directly to the oleoresin extraction firms thus gaining an opening in this expanding market.

Over the period 1968 to 1970 Sarawak on average accounted for 29 per cent of world exports. The world demand for pepper is projected to increase at the rate of two per cent per year (FAO, 1970). Sarawak's possible share of this demand is shown below on the basis of two assumptions—either retaining a constant share, or obtaining an increasing share of one per cent of the annual increase per year.

Year	World Demand Assuming a 2 per cent Annual Increase (Thousand tons)	Sarawak's Share			
		Assuming Constant Share		Assuming Share Increases	
		Quantity (Thousand tons)	% of World Demand	Quantity (Thousand tons)	% of World Demand
1970	85.0	24.5	29	24.5	29
1975	93.8	27.2	29	27.6	29.5
1980	103.6	30.0	29	32.0	31
1985	114.4	33.2	29	37.9	33
1990	126.3	36.6	29	45.7	36

The figures show that there are opportunities for increasing production of pepper in Sarawak and it is recommended that the crop is included in the cropping pattern for the Study Area. It should be considered an important supplementary crop to be grown by most farmers.

The prices used in the economic evaluations were the 1964 averages:

\$125 per picul for white pepper

\$100 per picul for black pepper

II.5 RICE

Sarawak is an importer of rice. Overall consumption in the State has increased with population growth and local production has generally kept pace with, but has not equalled, the increased demand. Thus while imports have been necessary to supply total demand, the proportion of imports has tended to fall over the last decade from around 50 per cent in the early 1960's to under 40 per cent in the early 1970's. The most significant contribution to increasing local supplies is attributed to swamp rice production which has grown by about 70 per cent over the last decade. Overall production increased by 50 per cent over the same period.

Available statistics indicate that total local consumption of rice rose from about 120,000 tons in 1961 to about 159,000 tons in 1971. The per capita consumption has however shown no specific trend, averaging around 340 pounds of milled rice equivalent per year in Sarawak as a whole to 310 pounds in the Study Area. In poor crop years subsistence farmers go short of rice; imports do not balance the deficit because farmers in remote areas do not usually buy additional supplies in the market. Thus demand for rice in Sarawak is largely a function of population growth and, to a much lesser extent, income changes. For the purpose of projecting possible future local demand for rice the population of Sarawak has been assumed to grow at 2.8 per cent per annum, and per capita income at three per cent per annum. The income elasticity of demand for rice at that income growth rate is likely to be zero or negative (i.e. minus 0.2). On the basis of these assumptions two possible levels of per capita consumption of rice over the next 20 years have been calculated as shown:

Year	Average consumption per capita at two demand levels of income elasticity	
	A	B
	0	-0.2
Basic level	340	340
1975	340	330
1980	340	320
1985	340	310
1990	340	301

Using these consumption figures the following estimated future demands were calculated.

Year	Population '000	Projected Demand at per capita level 'A' ('000 tons rice)	Projected Demand at per capita level 'B' ('000 tons rice)
1975	1,120.5	170.1	165.1
1980	1,286.3	195.2	183.8
1985	1,476.8	224.2	204.4
1990	1,695.5	257.4	227.8

The simple scope for Sarawak to enter the export trade. But initial development

Possible future rice production in Sarawak up to 1990 is shown in Table II.1 and has been calculated on the following assumptions:

- the total area of swamp rice would increase on average by 3,400 acres per annum or about 52,000 acres over the 20 year period;
- the total areas of hill rice would remain static at about 186,000 acres;
- average yields of swamp rice would increase to 2,265 pounds padi by 1990 while hill rice yields would remain static at 640 pounds padi per acre.

On the basis of these estimates local production would be unlikely to supply the total Sarawak demand for rice by 1990, but the country would be 74 per cent self-sufficient.

Two alternative possibilities were examined for the 1990 situation:

Alternative I: assumes there would be a slight increase in the area under hill rice, and yields would increase to 2,750 and 800 pounds padi per acre for swamp and hill rice respectively. Under these assumptions the country would still not be self-sufficient.

Alternative II: assumes the area of swamp rice would increase by 6,800 acres per annum, and yields increase to the levels proposed for Alternative I. Total production would then possibly meet local demand.

Calculations similar to those above were carried out for the Study Area but applicable to a population growth of 4.0 per cent per annum which allows for in-migration. Future demand for rice was shown to reach almost 33,600 tons by 1990. It was found that if the yields from existing areas of rice cultivation were to remain at their present levels and there was no increase in the area under hill rice then to supply the demand would require the opening up of about 37,600 acres of new swamp rice land assuming present yields. But if yields on the new areas was 2,750 pounds per acre then roughly 22,000 new acres of swamp rice would suffice. If yields on existing swamp rice areas also increased to the higher level then only about 15,000 acres of new swamp rice land would be required.

TABLE II.1 PROJECTED SARAWAK RICE PRODUCTION 1975-1990

Year	Acreages			Yields of Padi		Total Production		
	Swamp Rice	Hill Rice	Total	Swamp Rice	Hill Rice	Swamp(I) Rice	Hill(I) Rice	Total
	Thousand acres			lbs per acre		Thousand tons rice		
1975	158	186	344	1,625	640	72.2	36.1	108.3
1980	175	186	361	1,840	640	90.6	36.1	126.7
1985	192	186	378	2,052	640	110.8	36.1	146.9
1990	209	186	395	2,265	640	133.1	36.1	169.2
1990 Alternative I	209	200	409	2,750	800	161.6	48.6	210.2
1990 Alternative II	260	186	446	2,750	800	201.1	48.6	249.7

NOTE (1) Conversion rates of padi to milled rice equivalent were on the following basis:

Swamp rice, 63 per cent.

Hill rice, 68 per cent.

These calculations show that, to meet the Government's target of at least self-sufficiency in rice, the development programme for the Study Area must include the opening up of sufficient new swamp land to supply the local population. This must be a minimum target.

The price for rice used in the economic calculation, was a farm-gate value of \$317 per ton of padi.

II.6 BEEF

Livestock production is of limited importance in Sarawak at present. Domestic production of pigs and poultry adequately supply the demand for these products. However, there has been no apparent change in the population of cattle and buffaloes over the past decade and about \$1.3 mn worth of beef is currently being imported either as live animals for slaughter or as frozen meat. There is thus an established local market for beef. On a worldwide basis FAO predictions indicate that future demands are likely to exceed supplies. This situation will undoubtedly lead to a hardening of beef prices and would enable a local beef industry to enter export markets.

The possible effect in Sarawak of an increase in local supplies of beef would be a decrease in retail prices which, if brought to the levels prevailing in Peninsular Malaysia of \$1.6 per pound, would increase annual consumption from the present 1.33 pounds per capita to about 4.3 pounds. Future rises in living standards would increase this consumption rate to about 9.0 pounds by 1995. Using these assumptions, projections of quantities of beef, carcasses and animals required in Sarawak are given in Table II.2.

TABLE II.2 **PROJECTED BEEF CONSUMPTION IN SARAWAK 1975-1995 AT PRICES EQUIVALENT TO THOSE IN PENINSULAR MALAYSIA**

Year	Beef Consumption		Equivalent Number of Carcasses at 400 lb each	Equivalent Number of Animals required in the National Herd
	Per Capita lb	Total ('000 lb)		
1975 ...	5.0	5,480	13,700	63,125
1980 ...	5.8	7,192	17,940	89,875
1985 ...	6.7	9,400	23,500	117,500
1990 ...	7.8	12,386	37,212	150,500
1995 ...	9.0	16,164	40,412	208,250

The main external markets to which Sarawak beef might be exported are Hong Kong, Japan, Brunei and Singapore. All these are already supplied with live animals and/or meat by large-scale, well established organisations in Australia, New Zealand, China, Thailand and Indonesia. To compete with these traditional suppliers will require efficient production methods and high veterinary standards. On the other hand demand in the potential markets will rise considerably. For example, the Singapore market is currently estimated to require 12,000 live animals and seven million pounds of frozen beef annually, and by 1990 demand, even at a conservative growth rate, is expected to treble. So there should be ample scope for Sarawak to enter the export trade. But initial developments

in Sarawak should aim at supplying the local market. When this has been achieved the first exports should be live animals because the production of chilled or frozen meat will require costly slaughterhouses and refrigeration plant, which would not be worth establishing for an output of less than 25,000 head per annum.

The prices used in the economic evaluation were:

- for weaners and steers, between 50 and 60 cents per lb liveweight;
- breeding heifers were valued in relation to future production potential assessed on the basis of seven calves, worth \$540 each, produced over eight years;
- for cull cows \$450 each.

II.7 FRESHWATER FISH AND PRAWNS

Fish is by far the greatest source of protein in the human diet in Sarawak and production of pond cultured fish should be aimed for the foreseeable future at satisfying local demand. The market for freshwater fish is in two main categories:—

- (i) rural domestic demand for fresh fish, mainly smaller sized and locally bred;
- (ii) the speciality urban fish market linked to the restaurant and special occasion (such as Chinese New Year) trade.

Probably the greatest need is in the rural areas where the supply of fresh fish from marine sources is usually not available. Freshwater culture of fish in these areas will be appropriate because most rural people are already familiar with freshwater fish and there is no sales resistance to this commodity.

II.8 TAIWAN TURTLES

These can be sent to market alive and, provided they are occasionally moistened with water and kept in the shade, they can survive for a number of days out of the pond. Therefore, easily reached markets anywhere in Sarawak can be considered.

There is already a good demand for the local soft-shelled turtle in the Kuching and Sibul restaurants, but generally most of the local turtles are too large for an average family. The Taiwan turtle, which is ideal for market at about two pounds, would have an initial novelty value and would appeal to the housewife.

Once local demand is satisfied the export markets could be exploited. Kuala Lumpur, Singapore, Hong Kong and Japan are all potential markets where the price could be expected to be double that in Sarawak. In Hong Kong and Japan turtles are not only a source of food, but medicine is made from the blood and bile.

II.9 OTHER CROPS

II.9.1 Robusta Coffee

In Sarawak local production does not satisfy demand. In 1972 imports of coffee, in one form or another, amounted to about \$1.46 mn. Recent market estimates made for Peninsular Malaysia (FAMA, 1973) indicated that there is an immediate market for about 2,500 tons of coffee beans per year.

II.9.2 Annatto (*Bixa orellana*)

The seed of this small tree is covered by a red substance which has a value as a colouring agent in foods and cosmetics. World market demand has risen recently due to increased restrictions in the United States, Western Europe and Japan on the use of synthetic colourings. A ready market exists for the dried seeds in Singapore.

II.9.3 Cashew Nuts

The export market consists of three products; unshelled cashew nuts, cashew kernels and cashew nut shell liquid. The last product need not be considered at this stage because supply already exceeds demand and future demand is not likely to increase faster than the present large-scale producers could easily match. But the potential markets for unshelled nuts and kernels are good.

India is the main purchaser of unshelled nuts; it imports between 150,000 and 200,000 tons of nuts a year to supply its processing factories which re-export the extracted kernels. However, the present main supply of unshelled nuts (East Africa) is already diminishing as an increasingly large proportion of the crop is diverted to the extraction plants recently introduced into those countries. Despite efforts by India to increase its domestic supply of nuts it seems likely that it will create a strong demand for unshelled nuts in the foreseeable future.

A possible further market for unshelled nuts from Sarawak is Peninsular Malaysia where cashew plantations and processing facilities are being established with Government support.

The market situation for cashew kernels has been extremely favourable over the last ten years. Both demand and prices have followed an upward trend. The prospects for further growth in demand in North America, Western Europe, Japan and Australia are good. It is expected that the market will be able to absorb all presently planned increases.

Thus, from the market point of view the planting of cashew nuts could be confidently undertaken in Sarawak and in the Study Area. Production should at first be aimed at the export of unshelled nuts because a total raw nut production of about 650 tons a year is required before it is worth installing a nut decorticating plant.

II.9.4 Spices

In most cases the aim in planting spice crops would be production for sale to the oleoresin extraction industry.

Prepared oleoresins are the residues isolated by evaporation of solvent extracts of plant material. They are mostly used as food flavouring and colouring and can come from almost any spice or herb.

Prepared oleoresins are normally sold to the food industry in the form of dispersed spice extracts, i.e. spread on a variety of dry sterile bases. In this form the products can be blended easily with other ingredients. The food industry is content to pay premia for the oleoresins which compete commercially with the dry spices because in the form of a dispersed extract it is sold weight for weight equivalent in strength to the dry spice. The advantages are:—

- it avoids the high bacterial load carried by most major spices;
- it is standardised in strength and quality to a greater extent than the dry spices.

Dispersed spice extracts have made, and continue to make, a large impact on the industrial market for spices. In the United States they have replaced about 70 per cent of this market, in the United Kingdom about 50 per cent and in Western Europe about 15 per cent, but the percentage is rising.

The prospective demand for oleoresins is, therefore, great and their extraction would appear a profitable business for the major spice producing countries to enter. However, there are many technical and marketing problems which would demand caution in starting such an undertaking. The solution for Sarawak would be to sell the dried spice to an established nearby oleoresin extraction firm, in Singapore for example. The distance to Singapore is not great and freight charges would not be high. An established firm would have the technical know-how and the markets. Reasonably large, regular supplies of a standard dried product would be necessary.

Turmeric (*Curcuma longa*)

The present world demand for turmeric for oleoresin extraction is greater than 5,000 tons, which was the 1968 demand. It is used for both colouring and flavouring. For oleoresin extraction the rhizomes, after washing, can be chipped and then sun dried.

Ginger (*Zingiber officinale*)

There is a limited local market for undried ginger. For the oleoresin market the growing and preparation of ginger is the same as for turmeric.

Sweet and Hot Chillies (*Capsicum* spp.)

This group is the most important for oleoresin extraction. There is a large and expanding market for it. Paprika (*C. annum*) is valued for its flavour and its red colouring but is not likely to be of great promise in the Study Area because of the difficulty of drying the very fleshy fruits. But the small, very hot chilli *C. minimum* should not present this problem. The drying of locally collected samples presented no problem but evaluation for capsaicin content proved that the local variety is lacking in this ingredient and is not of commercial value. It will be necessary to introduce a sufficiently "hot" variety. Seed of a commercial variety was obtained and passed to the Department of Agriculture in the Fourth Division. Other seed samples could be obtained from processing firms.

Nutmeg and Mace (*Myristica fragrans*)

Nutmeg is the seed of this tree crop and mace the covering which surrounds the shell containing the nutmeg. There is a limited market for these products.

Cloves (*Eugenia caryophyllata*)

There is a reasonable market for this crop in the world trade, but an interesting possibility would be to supply Indonesia. Although that country grows cloves itself the oil content of the variety is too high for inclusion in the cigarettes that are so popular there. Indonesia imports large quantities of cloves from Zanzibar for the cigarettes. Cloves of the correct variety, grown in Sarawak, would be in a good geographical position to supply that market.

Cardamom (*Ellettaria cardamomum*)

There is a limited but expanding market for this spice.

II.9.5 Essential Oil Crops

Generally it is difficult for a new producer to enter the essential oil market which is dominated by well established trading houses who have their traditional suppliers. Also quality standards of the refined oils are extremely stringent. Nevertheless there are possibilities of entering the market for the more widely used, and easily produced oils. The least possible processing should be undertaken locally.

There is a ready market in Singapore for the dried leaves and young stems of patchouli (*Pogostemon cablin*). The harvested material requires merely drying and bailing.

Citronella grass (*Cymbopogon nardus*) and Lemon grass (*C. citratus*) are crops which also produce oils in this category, but there would be need for simple distillation plants if these crops are to be included in the development.

APPENDIX III



APPENDIX III

THE AGRICULTURAL DEVELOPMENT UNIT (ADU)

This Appendix gives a brief description of the proposed establishment and working of the ADU which is fully described in *Suggestion Report 2, Part III*.

III.1 THE NEED FOR AND OBJECTIVES OF THE ADU

A specialised organisation is required to guide and support small-scale farmers—no matter what their origin or land tenure status—in a new development which will be created in and around new intensive development areas. The existing extension services of the Department of Agriculture is unable to undertake this work for two reasons:

- (a) at present it has insufficient staff to provide any large-scale guidance to the intensive development areas without seriously reducing the level of services supplied to the farmers outside these areas;
- (b) it is neither **APPENDIX III** guidance and support that is needed in the planned development areas where a new agricultural environment will be created.

Thus the objective of the ADU will be to supply this need for a new type of agricultural service set up to operate in planned development areas supporting and guiding newly created smallholder and small-scale independent farmers to establish themselves, manage their holdings and form Farmers' Organisations.

III.2 ESTABLISHMENT OF THE ADU

The ADU is envisaged as an integral part of the Department of Agriculture and is proposed as a specialised unit formed under the Farmers' Organisation Section. It would operate only within the intensive development areas.

The State headquarters of the Unit would be in Kuching with Divisional organisations established in those Divisions where large-scale planned development is undertaken. The present proposal is that a Divisional ADU should be started in the Fourth Division where it would be an integral part of the organisation implementing the development planned for the Sande Area.

It is planned that the Fourth Division ADU headquarters should be established during 1974 at the Kuching Farmers Training Centre. The present Centre would be taken over and expanded into a place that would be capable of housing ADU staff for the whole State. The staff required during 1974 are:

1. an experienced Agricultural Officer to be in charge of the whole Fourth Division ADU and direct the main agricultural activities;
2. a specialist in agricultural extension training to guide the curriculum to suit the needs of the ADU (The person for this post will probably have to be recruited outside Malaysia).

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- (a) at present it has insufficient staff to permit any large-scale transfer to the intensive development areas without seriously reducing the level of services supplied to the farmers outside these areas;
- (b) it is neither trained nor organised to provide the intensive guidance and support that will be required by the small-scale farmers in and around the planned development areas where a new agricultural environment will be created.

Thus the objective of the ADU will be to supply this need for a new type of agricultural service set up to operate in planned development areas supporting and guiding newly created smallholder and small-scale independent farmers to establish themselves, manage their holdings and form Farmers' Organisations.

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It is planned that the Fourth Division ADU headquarters should be established during 1974 at the Kabuloh Farmers Training Centre. The present Centre would be taken over and expanded into a place that would be capable of training ADU staff for the whole State. The staff required during 1974 are:

- an experienced Agricultural Officer to be in charge of the whole Fourth Division ADU, and direct the main agricultural activities;
- a specialist in agricultural extension training to guide the curriculum to suit the needs of the ADU. (The person for this post will probably have to be recruited outside Malaysia);

- an executive officer to relieve the Agricultural Officer of direct involvement in administrative details such as organising the building of houses, stores and offices, arranging purchase of vehicles, equipment and supplies.

The proposal is that the ADU headquarters should be fully functional by the end of 1974 so that a full complement of trainees can be handled during 1975, using the existing training staff and facilities of the Institute.

Physically the Divisional ADU would consist of several centres (that is offices and buildings) situated in villages associated with the development; organisationally it would be made up of groups of specially trained staff stationed in the centres carrying out various functions.

Although training of staff can only start in 1975 two ADU centres are required in that year to work among the farmers in the block alienation scheme already started at Sepupok near Batu Niah, and in the road based improvement scheme started in Native Customary Land near the first SLDB oil palm plantings in the Lambir-Subis RDA. It is proposed that these two centres be established by secondment of staff from the existing extension service of the Agricultural Department; but from 1976 onwards all ADU staff would be supplied through the Kabuloh Training Centre. The proposed rate of establishment of ADU centres and their immediate purpose are given in Table III.1

Each ADU centre would be staffed with a team of trained personnel consisting of four sections each covering different aspects of the work as follows:

- agricultural extension, including home economics and, where appropriate, advice on silvicultural operations in communal forests;
- agricultural economics, concerned with the supply of farming requirements, marketing of produce and farm mechanisation;
- credit and saving, handling cash and credit payments to farmers and providing saving facilities.
- accounts, concerned with keeping records of all transactions with every participant farmer.

This arrangement is a replica of the administrative system established in the farmers' organisations already formed in other parts of Sarawak. Thus the emergence of farmers' organisations from the work of the ADU centres is expected to be a natural and easy process.

At first the number of staff at each centre would be the minimum required to start and undertake a limited amount of work, but gradually, as the activities expanded covering a greater area and more farmers, the staff would be correspondingly increased. But eventually as the farmers became experienced the heavy concentration of ADU staff, necessary at the beginning, could be progressively reduced and gradually diverted to other new development schemes. The numbers of staff required for the proposed ADU programme are given in Table III.2.

TABLE III.1 THE PROPOSED PROGRAMME FOR ESTABLISHMENT OF ADU CENTRES AND THEIR IMMEDIATE PURPOSE

<i>Year</i>	<i>Rural Development Area</i>	<i>Location of Centre</i>	<i>Main Purpose</i>
1975	Lambir-Subis Niah-Suai	Bukit Peninjau Batu Niah	Support and extend the road based improvement started close to first SLDB oil palm plantings. Support of Sepupok Block Alienation Scheme.
1976	Lambir-Subis Lambir-Subis Lambir-Subis Bintulu	Marudi Bekenu Mera-a Beluru 10th Mile	Start road based improvement along the new road to Long Linei. Start road based improvement close to the CDC oil palm mill. Support of smallholder farmers in the SLDB Sub-scheme. Start road based improvement along the new road extending towards Long Lama. Start road based improvement along the Miri-Bintulu road.
1977	Niah-Suai Long Lama Labang-Tubau	Batu Niah Long Lama Labang	Strong reinforcement of the previously formed centre to start road based improvement along existing roads. Start road based improvement along the new road to Long Lama. Start road based improvement along the new road connection to the Miri-Bintulu road.
1978	Niah-Suai Niah-Suai Labang-Tubau	Galasah Sebanah Tubau	Support of smallholder farmers in the SLDB Sub-scheme. Support of smallholder farmers in the SLDB Sub-scheme. Start road based improvement along the new connection to Labang.
1979	Niah-Suai	Lamaus	Support of smallholder farmers in the SLDB Sub-scheme.
1980	Niah-Suai	Ensabang	Support of smallholder farmers in the SLDB Sub-scheme.
1982	Niah-Suai	Telabit	Support of smallholder farmers in the SLDB Sub-scheme.

TABLE III.2 ESTIMATED ADU STAFF REQUIREMENTS FOR THE PLANNED PROGRAMME

Year	Staff build-up (cumulative numbers)				
	Extension Section	Economic Section	Credit and Saving Section	Accounts Section	Total ⁽¹⁾ Staff
1975	10	4	4	2	20 ⁽²⁾
1976	37	14	9	7	67
1977	52	23	11	10	96
1978	78	41	14	14	147
1979	105	68	17	18	208
1980	125	90	18	22	255
1981	147	107	22	26	302
1982	159	114	25	28	326

(1) Staff in the State and Fourth Division Headquarters are not included.

(2) These personnel need to be seconded from the Agricultural Department extension service.

The work of the staff would vary with local circumstances, but in general there would be three main types of centre:

- (a) those associated with SLDB smallholder sub-schemes;
- (b) those working on road based improvement within easy reach of oil palm mills;
- (c) those working on road based improvement in areas more than about 20 miles from an oil palm mill.

Under the circumstances of (a) the work would first be concerned with the rice and homestead plots of the smallholders; later, upon withdrawal of SLDB management, the ADU would take over responsibility for support of the main crops (oil palm, rubber and cocoa). In the case of (b) the enterprises encouraged and supported would be the same as on an SLDB smallholder sub-scheme. However, for conditions under (c) rubber would be the main crop but cocoa, rice and other selected crops would be grown. Oil palms would not be planted. A common strategy in all the road based improvement schemes in Native Customary Land could be the use of the taungya system in which the permanent crops are interplanted with a crop of hill rice which, after harvesting would be replaced by a leguminous cover crop.

APPENDIX IV

SUMMARY OF RECOMMENDATIONS FOR RECRUITMENT AND SELECTION OF PARTICIPANTS IN PUBLIC SECTOR DEVELOPMENT PROJECTS

THE ROLE OF THE STATE MANPOWER OFFICE

The Government is aware of the importance of its manpower and recruitment system and has recently created a Manpower Office in Training in the Federal Department of Labour, 183, St. James' Road, Accra. The Director of Labour and the Terms of Reference Committee have agreed to work as well for the task it has to perform. The Manpower Office is to be a leading a sound labour recruitment organization. It should be able to ensure that the new section is made sufficient to carry out the following responsibilities:

- (a) To provide a supply of labour—skilled, semi-skilled and unskilled in service trades, manufacturing and other activities.
- (b) To identify, through a Research and Planning Unit, the needs of a Sociologist and two or three sociologically trained staff, the needs and areas of current unemployment, or potential unemployment.
- (c) To provide Welfare Officers with training in order to operate a welfare scheme to advise on, and organize, activities for the unemployed and to help the development activities to adjust the unemployed to the labour market.

The main task of the Section should be to coordinate a Manpower Office in various Registry Offices where parental workers and the unemployed are recruited. The functions of screening and selection should be done by the Manpower Office or agency. The Ministry of Labour should also be responsible for ensuring compliance with labour legislation and for the recruitment of staff and supervisory staff employed on unskilled work.

THE SLDB

It is important that the SLDB is given the necessary support and resources for its recruitment scheme. It is essential that the Manpower Office and selection of people to participate in the scheme should be done by the Manpower Office or agency. The Ministry of Labour should also be responsible for ensuring compliance with labour legislation and for the recruitment of staff and supervisory staff employed on unskilled work.

To Publicize the Fact that Recruitment is Open to Every One

It will be necessary, at least in the early stages, to coordinate the Manpower Office's recruitment efforts with the Manpower Office and to ensure that the information included in this programme should be made known to the public and information sessions by Manpower Office officials and officials of the Manpower Office through the Manpower Office. The Research Unit of the

APPENDIX IV

SUMMARY OF RECOMMENDATIONS FOR RECRUITMENT AND SELECTION OF PARTICIPANTS IN PUBLIC SECTOR DEVELOPMENT SCHEMES

IV.1 ROLE OF THE STATE MANPOWER SECTION

The Government is aware of the deficiencies of the present publicity and recruitment system and has recently created a Manpower Section in Kuching within the Federal Department of Labour. The Section is headed by an Assistant Director of Labour and the Terms of Reference for the Section appear to orientate it well for the task it has to perform. But in view of the importance of creating a sound labour recruitment organisation in Sarawak, Government must ensure that the new section is made sufficiently large to be able to undertake the following responsibilities:

- (a) To provide a State-wide labour exchange and registry for all types of labour—skilled and unskilled—and all types of employment such as service trades, manufacturing and agriculture.
- (b) To identify, through a Research and Planning Team consisting of a Sociologist and two or three sociologically trained assistants, future labour needs and areas of current unemployment or under-employment.
- (c) To provide Welfare Officers with training in sociology for each major scheme to advise on, and organise, arrangements for assisting participants on the development schemes to adjust themselves to their new surroundings.

The main task of the Section should be to establish a State-wide network of Labour Registry Offices where potential workers can be matched with available jobs. The functions of screening and selection would remain with the receiving employer or agency. The Ministry of Labour would continue its present role of ensuring compliance with labour legislation including that which applies to workers and supervisory staff employed on agricultural estates.

IV.2 THE SLDB

It is important that the SLDB is intimately involved in the selection of participants for its settlement schemes. It is proposed that the actual screening and selection of people to participate in SLDB schemes should be undertaken by the Settler Development Division of SLDB. It should have the following responsibilities:

- (a) **To Publicise the Fact that Recruitment of Settlers is Taking Place**

It will be necessary, at least in the foreseeable future, to supplement the Labour Ministry's recruitment efforts with a State-wide programme of publicity and information. Included in this programme should be scheduled visits, screening and information sessions by Settler Development Officers with potential recruits at Labour Registry Offices throughout the State. Here the Research Team of the

Manpower Section can assist by identifying areas within the State where qualified recruits are most likely to be found. In addition, visits to development areas should be arranged for village leaders, headmen and others who exert an influence on local public opinion.

(b) To Formulate and Review Selection Criteria by Means of Questionnaires, Interviews, Selection Boards and other Screening Procedures to Ensure the Selection of a Suitable Settler Population

Publicity programmes can only create initial interest and must be followed up with systematic screening of candidates according to appropriate criteria of suitability. These criteria and the procedures to be used in selecting settlers are discussed in the sub-section below.

(c) To Ensure that Recruits are Fully Aware of the Conditions under which they are Recruited and the Positions for which they are Selected

This is a critical task and must be done properly if candidates are to make an informed choice as to whether to join a scheme or remain where they are. This necessitates the organisation of thorough information sessions for selected candidates with Settler Development Officers. Great assistance in this aspect could be given by film shows of conditions on actual schemes and, as already mentioned, by visits by community leaders. It is important that doubts and long-term prospects, as well as the overall objectives of the scheme, should be discussed realistically with prospective participants. It is desirable in this connection, that Settler Development Officers have some detailed knowledge of the sociology of the groups they are dealing with, and that, in addition to the schemes, selected candidates be shown training and ADU Centres and be allowed to gain a personal impression of the total development organisation in which they will participate. It is also important that the time between selection and entry into the scheme be kept as short as possible.

(d) To Arrange for Orderly Transport and Physical Settling in of Participants

These arrangements should include transportation of the participant, his family and belongings from his original home to the settlement scheme. Of particular importance would be the reception at the scheme; the new arrivals must be given the feeling that they are expected and welcomed. Immediate accommodation should be available.

The selection of people to become smallholder farmers must be done through a simple and well publicised procedure. The criteria for eligibility, which should be as objective as possible, should be fully understood by all participants prior to entry into the scheme. It is suggested that the main, but not only, channel for selection of smallholder farmers on State Land should be from within the labour/settler force of SLDB. The minimum qualification for such candidates should be satisfactory completion of a term of service as a labourer with SLDB, and, in effect, the potential smallholder should select himself by his performance. The final selection for smallholder status is certain to be regarded as a matter of utmost concern by most participants because it directly relates to their basic motives for entering the scheme; namely security, independence and property ownership. Therefore, it is important that the Settler Development Division in SLDB should make every effort to select potentially suitable candidates from the outset. The other main source of smallholders should be people who have undergone a course at the Farmers' Training Institutes.

At present young people completing these courses are expected to either return to their homes to farm or to join Youth Settlement Schemes. However, it is recommended that youths so trained and wishing to join a scheme should be given priority selection for smallholder status on the SLDB developed schemes. This recommendation follows a sociological study of an ongoing Youth Settlement Scheme near Miri. An account of the Study is given in Supporting Report 4.

There should be an appeal procedure by which selection decisions and assignment of farming land can be reviewed. Possibly the Welfare Officer could act as the final arbiter.

IV.3 SELECTION POLICY

The aim of the selection policy should be to ensure that those people who wish to work in agriculture either as labourers or smallholders are found and given the opportunity to do so. Present selection policy aims at persons who are rural, landless or near landless and/or subsistence farmers who have little access to modern amenities.

At present SLDB candidates are screened by a selection board and score points according to age, family size, current economic circumstances, skills, physical fitness and prior farming experience. The scale of points can be adjusted at any time to reflect changing priorities or experience. In Sarawak, for example, less importance is assigned to non-farming skills and more to landlessness, family size and previous farming background than in the FELDA point system used in Peninsular Malaysia. It is recommended that the present point evaluation system be continued with the provision that it be periodically reviewed to ensure that it adequately defines the people's desires. A second recommendation is that provision be made for block recruitment of groups of people who wish to settle as a group or as an entire longhouse or village-community.

TABLE V.1 ECONOMIC ANALYSIS OF PUBLIC SECTOR SCHEMES AT MARKET PRICES

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
Gross sales revenue \$'000																										
At basic prices																										
Rubber price up 20 per cent	68	168	1067	2741	5482	9250	13232	17643	21045	23967	25763	27049	27758	28073	28194	28165	28058	27799	27546	27225	26965	26728	26521			
Palm oil and rubber price up 20 per cent	68	168	1067	2741	5482	9301	13335	17662	21372	24509	26484	27968	28608	29210	29396	29417	29351	29112	28871	28550	28289	28052	27845			
								10621	15195	20325	24292	27717	29635	31370	32220	32601	32752	32725	32606	32305	32009	31632	31326	31048	30806	
Farm costs \$'000																										
Total excluding small-holder labour	565	1293	3393	3439	5768	5563	8054	6361	7611	7665	7905	8264	8306	8430	8404	8440	8464	8471	8503	8486	8487	8446	8485	8459	8437	
Small-holder family income		252	292	895	1309	2119	2367	3091	3115	3426	3495	3629	3629													
Net farm revenue \$'000																										
At basic price	-565	-1545	-3617	-4166	-6030	-4941	-4939	-202	+2506	6550	9645	12074	13828	14900	15725	16004	16101	16065	15926	15684	15430	15150	14851	14640	14455	
Rubber price up 20 per cent	-565	-1545	-3617	-4166	-6030	-4941	-4939	-151	+2609	6769	9972	12616	14549	15909	16775	17141	17303	17317	17219	16997	16755	16475	16175	15964	15779	
Palm oil and rubber price up 20 per cent	-565	-1545	-3617	-4150	-5893	-4541	-4141	+1169	+4469	9232	12892	15824	17900	19311	20187	20532	20659	20625	20474	20190	19893	19557	19212	18960	18740	
Total project costs																										
Village development	91	962	717	2379	2054	1868	1077	2121	199	199	199															
Processing	94	333	650	1250	1588	2124	2204	2234	1974	1747	1733	1577	1578	1580	1575	1578	1578	1578	1578	1578	1578	1578	1578	1578	1578	
Management cost	356	441	772	787	760	1389	2629																			
Credit forest revenue	+171	-854	-595	-2842	-8851	-3674	-1907	-6712	-7520	-4581	-4700	-4617	-5108	-4791	-4841	-4837	-4850	-4856	-4863	-4855	-4851	-4842	-4841	-4837	-4830	
Net project cost																										
Export duties																										
Export duties at basic prices				8	65	188	376	644	921	1252	1512	1735	1874	1977	2033	2057	2066	2063	2054	2032	2011	1985	1963	1944	1927	
Export duties at raised prices (20 per cent)				9	77	226	452	773	1105	1503	1814	2082	2249	2372	2439	2469	2480	2476	2465	2439	2414	2382	2356	2333	2312	
Net cash flow																										
Excluding duty	-394	-2399	-4212	-7008	-14881	-8615	-6846	-6914	-5014	+1969	4945	7457	8720	10199	10911	11167	11251	11209	11063	10829	10579	10308	10010	9803	9625	
Including duty	-394	-2399	-4212	-6992	-11744	-8215	-6048	-5543	-3051	+4651	8192	11207	12792	14520	15373	15695	15809	15769	15611	15335	15042	14715	14371	14123	13910	
Including duty	-394	-2399	-4212	-6999	-14804	-8389	-6394	-6141	-3909	+3472	6759	9539	10969	12571	13350	13636	13731	13685	13528	13268	12993	12690	12366	12136	11937	
Ditto with raised prices	-394	-2399	-4212	-6983	-14667	-8289	-6296	-6154	-4770	-1946	46154	9996	13289	15041	16892	17812	18164	18289	18245	18076	17774	17456	17097	16727	16456	

TABLE VI.1 ECONOMIC ANALYSIS OF PUBLIC SECTOR SCHEMES AT SOCIAL PRICES

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999			
Gross revenue \$'000																													
At basic prices																													
Rubber price up 20 per cent			68	175	1125	2907	5810	9813	14053	18735	22373	25479	27386	28751	29502	29834	29959	29924	29807	29527	29254	28910	28630	28376	28154				
Palm oil and rubber price up			68	175	1125	2907	5810	9667	14163	18967	22719	26052	23149	29724	30613	31037	31231	31249	31174	30916	30655	30311	30031	29777	29555				
20 per cent			68	193	1273	3341	6673	11298	16181	21635	25885	29531	31783	33414	34313	34714	34870	34896	34704	34379	34059	33654	33324	33026	32766				
Farm costs \$'000																													
Sarawak Land Development Board Schemes																													
Land development		235	497	248	897	516	1359	193	862	310	276	320	283	283															
Materials plus distribution and transport		438	287	701	689	1605	1454	1677	1964	2330	2287	2380	2380	2380	2395	2394	2393	2389	2382	2365	2356	2339	2331	2318	2304				
Development labour at \$3		62	66	66	86	116	142	10	35	1		1																	
Production labour at \$3		17	219	164	427	473	860	774	856	913	910	853	881	890	861	875	878	886	910	912	930	930	930	967	967				
Total with labour at \$3		313	1221	735	2111	1793	3966	2431	3429	3188	3419	3462	3543	3552	3539	3552	3553	3558	3574	3559	3569	3552	3581	3568	3554				
Total with labour at \$5		365	1411	889	2453	2186	4633	2954	4022	3797	4025	4031	4130	4145	4113	4136	4139	4149	4180	4168	4189	4172	4226	4213	4199				
Small-holder Settlement Schemes																													
Land development	204	477	502	1565	1277	1806	1064	1315	604	659	598	474	549	481	481														
Materials plus distribution and transport		314	197	903	1131	1963	1904	2636	2891	3250	3398	3684	3691	3604	3810	3823	3844	3841	3842	3827	3817	3793	3778	3765	3757				
Development labour at \$3	53	67	132	222	239	210	121	100	23	12	5	2																	
Production labour at \$3	10	201	191	602	800	1325	1298	1404	1975	1657	1655	1730	1787	1849	1931	1749	1975	1994	2013	2043	2065	2093	2097	2110	2110				
Total with labour at \$3	266	1059	1021	3292	3446	5304	4387	5455	5493	5577	5655	5888	6029	6135	6223	6054	6300	6317	6336	6361	6363	6367	6356	6356	6348				
Total with labour at \$5	308	1238	1236	3841	4138	6327	5333	6458	6825	6689	6762	7041	7223	7367	7510	7220	7616	7646	7678	7723	7739	7762	7754	7762	7755				
Total farm costs at \$3	266	1372	2242	4027	5557	7097	8353	7886	8922	8765	9074	9350	9572	9687	9762	9606	9853	9875	9910	9920	9932	9919	9937	9924	9902				
Total farm costs at \$5	308	1603	2647	4730	6591	8513	9966	9412	10847	10886	10787	11072	11353	11512	11623	11356	11755	11795	11858	11891	11928	11934	11960	11975	11954				
Net farm revenue																													
Basic prices labour at \$3	-266	-1372	-2174	-3852	-4432	-4190	-2543	1927	5131	9970	13299	16129	17814	19064	19740	20228	20106	20049	19897	19607	19322	18991	18693	18452	18252				
Rubber price up labour at \$3	-266	-1372	-2174	-3852	-4432	-4190	-2543	1981	5241	10202	13645	16702	18577	20037	20851	21431	21378	21374	21264	20996	20723	20392	20094	19853	19653				
Rubber and palm oil price up labour at \$3	-266	-1372	-2174	-3834	-4284	-3756	-1680	3412	7259	12870	16811	20181	22211	23727	24551	25108	25017	24961	24794	24459	24127	23735	23387	23101	22864				
Basic prices labour at \$5	-308	-1603	-2579	-4555	-5466	-4156	4401	3206	8249	11586	14407	16033	17239	17879	18478	18204	18129	17949	17636	17326	16976	16650	16401	16200					

TABLE VI.1—(CONT.)

TABLE VI.1—(contd.)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
Project costs \$'000																										
Village development costs																										
SLDB schemes																										
Housing maintenance					20	20	40	40	76	76																
Village clearing		186																								
Housing			495	495	500	500	907	907																		
Total development cost		186	495	495	520	520	947	947	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Small-holder settlement schemes																										
Housing maintenance			16	16	50	76	102	102	123	123																
Village clearing	91		206	160	160	128																				
Housing		76	1706	1324	1272	1072																				
Total development cost	91	76	222	1884	1534	1348	130	1174	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123
Processing costs																										
Oil palm factory fixed					5978	912	912	967	4500	1590	1590	1590	1590	1621	1621											
Oil palm factory var						77	205	343	526	597	759	891	972	1011	1026	1026	1026	1010	995	997	960	942	927	914	902	
Rubber factory var							10	55	99	196	277	329	373	408	436	456	473	481	486	486						
Mera-a oil palm processing					11	82	138	175	193	200	204	204	204	204	202	200	195	193	188	185	181	177	177	175	172	
Mera-a rubber processing							34	55	69	78	82	88	93	98	98											
Credit Kabatu processing							12	103	268	392	465	499	514	521	521	519	519	513	505	496	487	487	478	470		
Net processing cost					5989	1071	1295	2357	5347	2635	2768	2841	3331	3012	3040	3060	3073	3078	3079	3071	3063	3054	3046	3042	3035	
Management costs																										
SLDB area																										
SLDB cost to small-holder	99	206	358	622	622	948	827	1019	727	727																
SLDB transport cost	94	230	400	859	831	1330	890	924	291	280	185															
ADU costs		4	44	33	86	94	172	143	172	184	182	171	176	173	176	173	176	177	183	183	187	187	194	194	194	
Total management costs	94	333	650	1250	1588	2124	2204	2234	1974	1747	1733	1577	1576	1580	1575	1578	1578	1579	1585	1585	1589	1589	1596	1596	1596	
Village development																										
Processing	91	962	747	2379	2054	1868	1077	2121	199	199																
Management	94	333	650	1250	1588	2124	2204	2234	1974	1747	1733	1577	1576	1580	1575	1578	1578	1579	1585	1585	1589	1589	1596	1596	1596	
Credit forest revenue	356	441	772	767	760	1389	2629																			
Net project cost	+171	-854	-595	-2842	-8651	-3674	-1907	-6712	-7520	-4581	-4700	-4617	-5108	-4791	-4814	-4837	-4850	-4856	-4863	-4855	-4851	-4842	-4841	-4837	-4830	
Net cash flow																										
Basic price labour at \$3	-95	-2226	-2769	-6694	-13282	-7864	-4450	-4785	-2389	+5389	+8599	+11512	+12706	+14273	14926	15391	15256	15193	15034	14752	14471	14119	13852	13615	13422	
Rubber price up 20% labour at \$3	-95	-2226	-2769	-6644	-13283	-7864	-4450	-4731	-2279	+5621	+8945	+12085	+13469	+15246	16037	16594	16528	16518	16401	16141	15672	15550	15253	15016	14823	
Oil palm and rubber price up labour at \$3	-95	-2226	-2769	-6676	-13135	-7430	-3587	-3300	-261	+8289	+12111	+15564	+17103	+18936	19737	20271	20167	20105	19931	19604	19276	18893	18546	18264	18034	
Basic prices labour at \$5	-137	-2457	-3174	-7397	-14317	-9280	-6063	-6311	-4314	+3668	+6886	+9790	+10925	+12448	13065	13641	13354	13273	13086	12781	12475	12134	11809	11564	11370	

ROAD BASED IMPROVEMENT OF AGRICULTURE IN LEGALLY OCCUPIED LAND

INTRODUCTION

The Terms of Reference for this study were set out in the National Land Development Plan to be known as the Sarawak Land Development Plan.

A Regional Plan for the area is being developed which will deal with settlement and development programmes. The main emphasis for development is on State Land, in particular the Third Divisions of Sarawak where the traditional system of agriculture has suffered serious land deterioration.

An agricultural and forestry action programme for about 50,000 acres of State Land.

A related action programme up to 1990 for the other sectors of the

PART TWO

In the course of the Study it became clear that the occupation of State Land by existing cultivators was a major obstacle to the successful implementation of any development programme. It was therefore considered that the occupation was to be curtailed, then development would be possible. The areas most likely to be affected, and assistance must be given to the farmers to enable them to continue the farming on the land they already legally occupy. This Annexure is a part of the National Land Development Plan eventually drawn up and presented. This Annexure is a part of the programme and it is here that there are programmes for:

- (a) The Sarawak Land Development Board (SLDB) to develop a Livestock Corporation to develop between 10,000 and 20,000 acres of State Land during the period 1975 to 1980.
- (b) Outline plans recommending the allocation of a further 25,000 acres of State Land to private development which would be intensively developed.
- (c) Outline plans covering recommendations for financial support to be given to the local farmers to enable them to continue the farming on the land they already legally occupy.

It is these last plans which are presented here.

The need to include the existing population of the area in the development requires that the activities should be carried out in a way which will benefit the physical problems associated with the existing population. The existing legally occupied areas suffer such a variety of problems that they are very poor, their communications poor, and the people are from different areas and have widely differing backgrounds.

ROAD BASED IMPROVEMENT OF AGRICULTURE IN LEGALLY OCCUPIED LAND

INTRODUCTION

The Terms of Reference for this Study called for a comprehensive and integrated Development Plan to be drawn up for the Miri-Bintulu Area. It should consist of:

- (a) A Regional Plan for the next 20 years which should include a land settlement and development programme covering about 250,000 acres. The main emphasis for development was to be agriculture and forestry and settlement, on State Land, of people from the First, Second and Third Divisions of Sarawak where rapidly rising populations and continuation of the traditional system of shifting agriculture were causing serious land deterioration.
- (b) An agricultural and forestry action programme for the early development of about 50,000 acres of State Land.
- (c) A related action programme up to 1980 for the development of the other sectors of the economy.

In the course of the Study it became clear that the continuing and widespread illegal occupation of State Land by shifting cultivators would seriously jeopardise the successful implementation of any development plans for that land. Also, if illegal occupation was to be curtailed, then development plans must be made for all land likely to be affected, and assistance must be given to the local farmers to improve the farming on the land they already legally occupy. Consequently, the Development Plan eventually drawn up and presented in the Final Report, of which this Annexure is part, consists of programmes covering all these aspects. Specifically there are programmes for:

- (a) The Sarawak Land Development Board (SLDB) and the National Livestock Corporation to develop between them about 50,000 acres of State Land during the period 1975 to 1980.
- (b) Outline plans recommending the allocation, during the same period, of a further 55,000 acres of State Land to private investors for agricultural development which would be intimately associated with the SLDB development.
- (c) Outline plans covering recommendations for intensive guidance and support to be given to the local farmers on as large a scale as possible.

It is these last plans which are presented here as an investible project.

The need to include the existing population of the Study Area in the new development requires that the activities should be spread throughout the Area. However, the physical problems associated with agricultural extension work in the existing legally occupied areas makes such a strategy impractical. The areas are huge, their communications poor, many of the lands are very remote and scattered, the people are from different ethnic groups, speak different languages and have widely differing backgrounds. Nevertheless a considerable spread of

development has been achieved in the Development Plan by undertaking concentrated development in each of nine Rural Development Areas into which the Study Area has been divided for planning purposes.

In most cases the keys to the successful improvement of farming in the legally occupied lands will be the road network and the agricultural and social infrastructures established during planned development of State Land. Access roads, either existing or planned, passing from schemes on State Land into legally occupied areas, will provide the opportunity for the people there to participate in new farming activities and take advantage of the facilities provided. Thus it is recommended that development in legally occupied areas should initially be either as narrow bands along the roads connecting the areas with development on State Land (so-called road based improvement), or as a compact area development if the location of the land is particularly favourable in relation to State Land development.

It is these last plans which are presented here as an indivisible project. The need to include the existing population of the Study Area in the new development requires that the activities should be spread throughout the Area. However, the physical problems associated with agricultural extension work in the existing legally occupied areas make such a strategy impractical. The areas are huge, their communications poor, many of the lands are very remote and scattered, the people are from different ethnic groups, speak different languages and have widely differing backgrounds. Nevertheless a considerable spread of

(a) Outline plans covering recommendations for intensive guidance and support to be given to the local farmers on as large a scale as possible.

(b) Outline plans recommending the allocation during the same period of a further 25,000 acres of State Land to private investors for agricultural development which would be intimately associated with the SLDB development.

(c) Outline plans recommending the allocation during the same period of a further 25,000 acres of State Land to private investors for agricultural development which would be intimately associated with the SLDB development.

(d) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(e) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(f) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(g) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(h) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(i) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(j) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(k) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(l) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(m) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(n) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(o) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(p) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(q) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(r) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(s) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(t) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(u) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(v) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(w) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(x) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(y) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

(z) The Sarawak Land Development Board (SLDB) and the National Lands Corporation to be formed during the period 1975 to 1980.

SUMMARY

During the period 1975 to 1981 road based improvement of agriculture in legally occupied land is proposed involving an estimated 47,000 acres of crops, about 180 miles of existing or already planned roads and roughly 2,500 farmers.

The main crops selected for inclusion in the programme are oil palm, rubber, cocoa and rice. A range of possible other crops may be grown on small plots including pepper, spices, fruits, vegetables and essential oils.

Two diversified cropping patterns are recommended; one based mainly on oil palms for areas within easy reach of oil palm processing facilities; the other excluding oil palms and based mainly on high yielding rubber for areas remote from oil palm mills.

The areas of crops developed are related to the estimated length of road traversing land suitable for agricultural development and the distance on either side which might be cropped. A width of 500 yards is proposed and the net usable area per mile of road is estimated as 255 acres allowing for a loss of about 30 per cent.

The organisation proposed to handle the programme is the Agricultural Development Unit (ADU) which would be a new unit formed within the Department of Agriculture. It would be formed as a considerable expansion of the existing Farmers' Organisation Section and would eventually have State-wide functions but would operate only in intensive development areas. The State headquarters would be in Kuching with appropriate Divisional headquarters. The project presented here includes the establishment of the first Divisional headquarters and a special training centre for ADU staff.

The training centre would turn out specialist staff in a number of disciplines to man the ADU Sections which would be Extension, Economics (supply and marketing), Credit and Accounting.

A gradual increase in the number of farmers handled by each extension agent under the programme results in a steadily increasing number of farmers and area of crops covered in each year of the programme.

The total technical staff requirements of the ADU over the Action Programme period are estimated as follows:—

Headquarters	...	...	...	...	...	...	3
Extension Section	...	...	...	...	...	...	159
Economics Section	...	...	...	...	...	...	114
Credit and Accounts Section	...	...	...	...	...	...	59

A full complement of vehicles and equipment will be essential for the successful implementation of the programme, the following numbers are estimated:—

- 10 Four-wheel drive vehicles
- 192 Motorcycles
- 15 Lorries

18 Tractors with ancillary equipment

59 Power tillers

45 Power knapsack sprayers

45 Powered rice threshers.

In addition numerous hand tools would be required.

Provisions are proposed for marketing of all major crop products through the ADU organisation and the ultimate formation of Farmers' Organisations to take over the marketing and supply functions is considered an important aspect of the ADU work.

Credit requirements of participants would, it is proposed, be handled by the ADU with funds provided to it by the Bank Pertanian which should set up an office in Sarawak. The total requirement might amount to \$14.8 mn over the first nine years of development.

The project as proposed would, at maturity, result in considerable increases in the annual output of major crops; estimated at:—

78,000 tons of oil palm fresh fruit bunches

16,200 tons of rubber

2,200 tons of cocoa

4,100 tons of rice.

The market value of the project output is estimated to rise to \$30 mn per annum by 1990. The commercial rate of return at market prices is estimated as 15.9 per cent, and the internal rate of return is 17.7 per cent at social prices.

The training centre would train out specialist staff in a number of disciplines to man the ADU Sections which would be Extension, Economics (supply and marketing), Credit and Accounting.

A gradual increase in the number of farmers handled by each extension agent under the programme results in a steadily increasing number of farmers and area of crops covered in each year of the programme.

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3	Headquarters
159	Extension Section
114	Economics Section
29	Credit and Account Section

A full complement of vehicles and equipment will be essential for the successful implementation of the programme. The following numbers are estimated:—

10	Four-wheel drive vehicles
192	Motorcycles
12	Tractors

CHAPTER 1

OBJECTIVES AND BACKGROUND OF THE PROJECT

1.1 OBJECTIVES

The road based improvement schemes proposed here and which together comprise the Project, are planned as important components of an overall development programme for the Study Area which covers roughly 3.5 mn acres of the Fourth Division of Sarawak. The schemes are designed specifically to provide opportunities for existing farmers in the Area to participate in and benefit from the major agricultural effort which is directed towards opening up presently unoccupied State Land.

At present local farmers, particularly those from longhouse communities, are continuing to extend their cultivation illegally into State Land. Their reason is that they believe they are short of farming land. To some extent this is true if it is accepted that the land is to accommodate an increasing population under the present extensive shifting cultivation system. Under these conditions the proposals for utilising the available unoccupied land mainly for immigrants to the Area can only raise discontent among the local farmers. It is quite clear that a harmonious co-existence between the existing population and the people from other Divisions settled onto State Land would be prejudiced if comparable assistance is withheld from the existing population in the legally occupied areas.

The basic objectives of the overall agricultural development are:—

- to improve the farmers livelihood and the rural amenities;
- to provide employment for the population of working age;
- to diversify agricultural production.

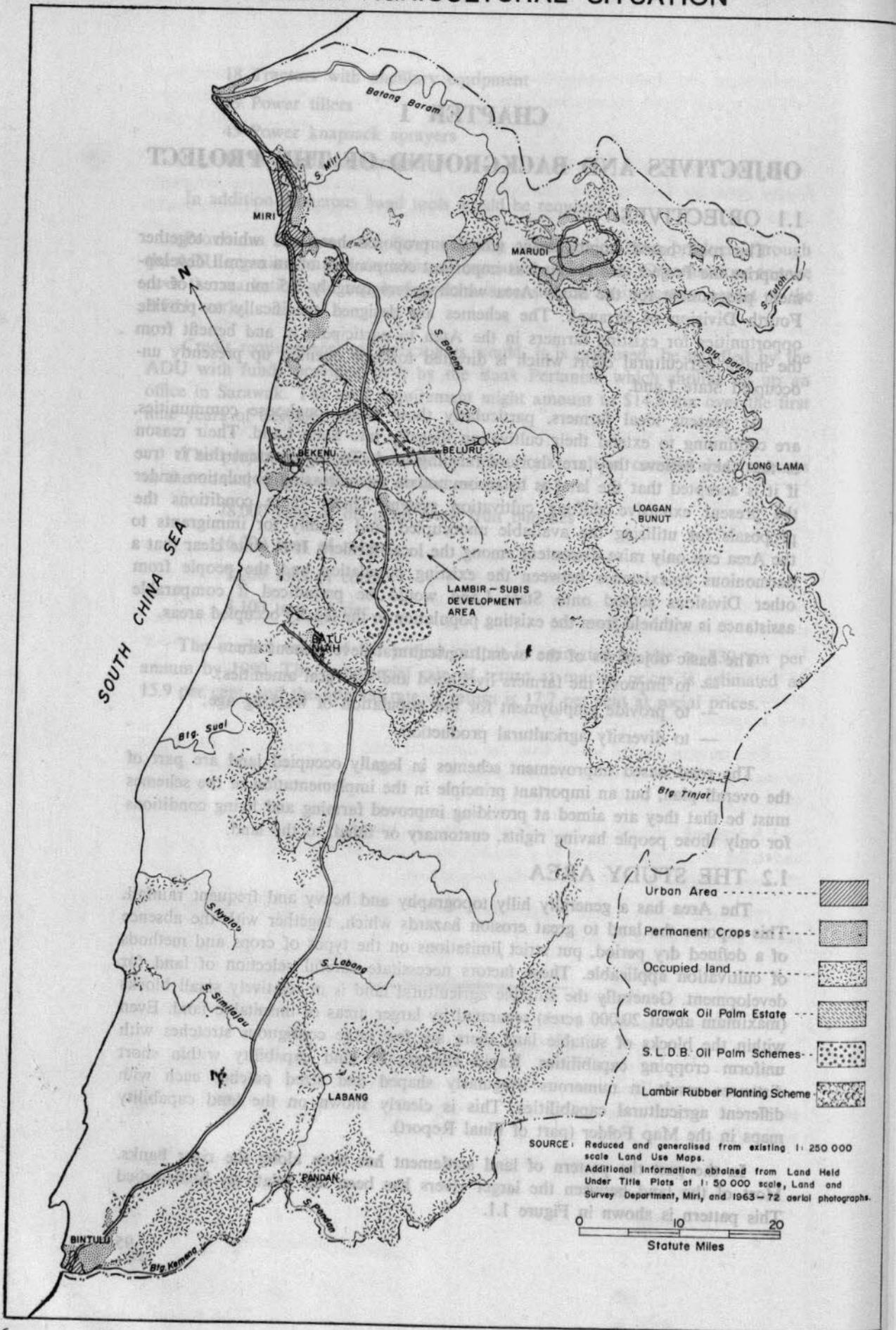
The road based improvement schemes in legally occupied land are part of the overall plan, but an important principle in the implementation of the schemes must be that they are aimed at providing improved farming and living conditions for only those people having rights, customary or titled, to the land.

1.2 THE STUDY AREA

The Area has a generally hilly topography and heavy and frequent rainfall. This exposes the land to great erosion hazards which, together with the absence of a defined dry period, put strict limitations on the types of crops and methods of cultivation applicable. These factors necessitate careful selection of land for development. Generally the suitable agricultural land is in relatively small blocks (maximum about 20,000 acres) separated by larger areas of unsuitable land. Even within the blocks of suitable land there are few large contiguous stretches with uniform cropping capabilities. Rapid changes of land capability within short distances result in numerous irregularly shaped and sized patches each with different agricultural capabilities. This is clearly shown on the land capability maps in the Map Folder (part of Final Report).

In the past the pattern of land settlement has been along the river banks. Most of the land between the larger rivers has been left relatively undisturbed. This pattern is shown in Figure 1.1.

PRESENT AGRICULTURAL SITUATION



The characteristics of present agriculture can be summarised as follows:—

- (a) Extensive river based shifting cultivation of hill rice by longhouse communities who also have small scattered plots of rubber which are generally poorly maintained and only tapped when rubber prices are high.
- (b) Less extensive settled agriculture, around small townships, of Malays, Melanau and Chinese cultivating mainly rice, pepper, vegetables and rubber.
- (c) Predominantly smallholder farming.
- (d) Almost complete absence of any form of on-the-farm transport or mechanical aids.
- (e) Recently started large-scale, estate-type planting of oil palms in the Lambir-Subis Development Area.
- (f) A continuing and widespread illegal occupation of State Land by shifting cultivators especially along newly constructed roads.

In the majority of the areas of shifting cultivation the main lines of communication are still the rivers, and the main means of transportation the long-boat and human carriers. Very often the rivers do not lead directly to service centres where facilities such as schools, hospitals, markets and administration exist. The desire on the part of the people to avail themselves of better communications is widely evident in the way cultivation follows so closely behind the construction of almost any road. This is evident even on timber extraction roads if they open the way to a service centre; but the evidence is far more apparent on the trunk road between Miri and Bintulu.

1.3 SELECTION OF ENTERPRISES FOR DEVELOPMENT

A screening process involving all possible enterprises was carried out by successively applying the following factors:—

Environmental—climate, terrain and soil;

Social—traditional enterprises and enterprises needed for social well-being;

Technical—the level of knowledge in the State for husbandry and technology for the enterprises; transportation problems of the products; labour requirements;

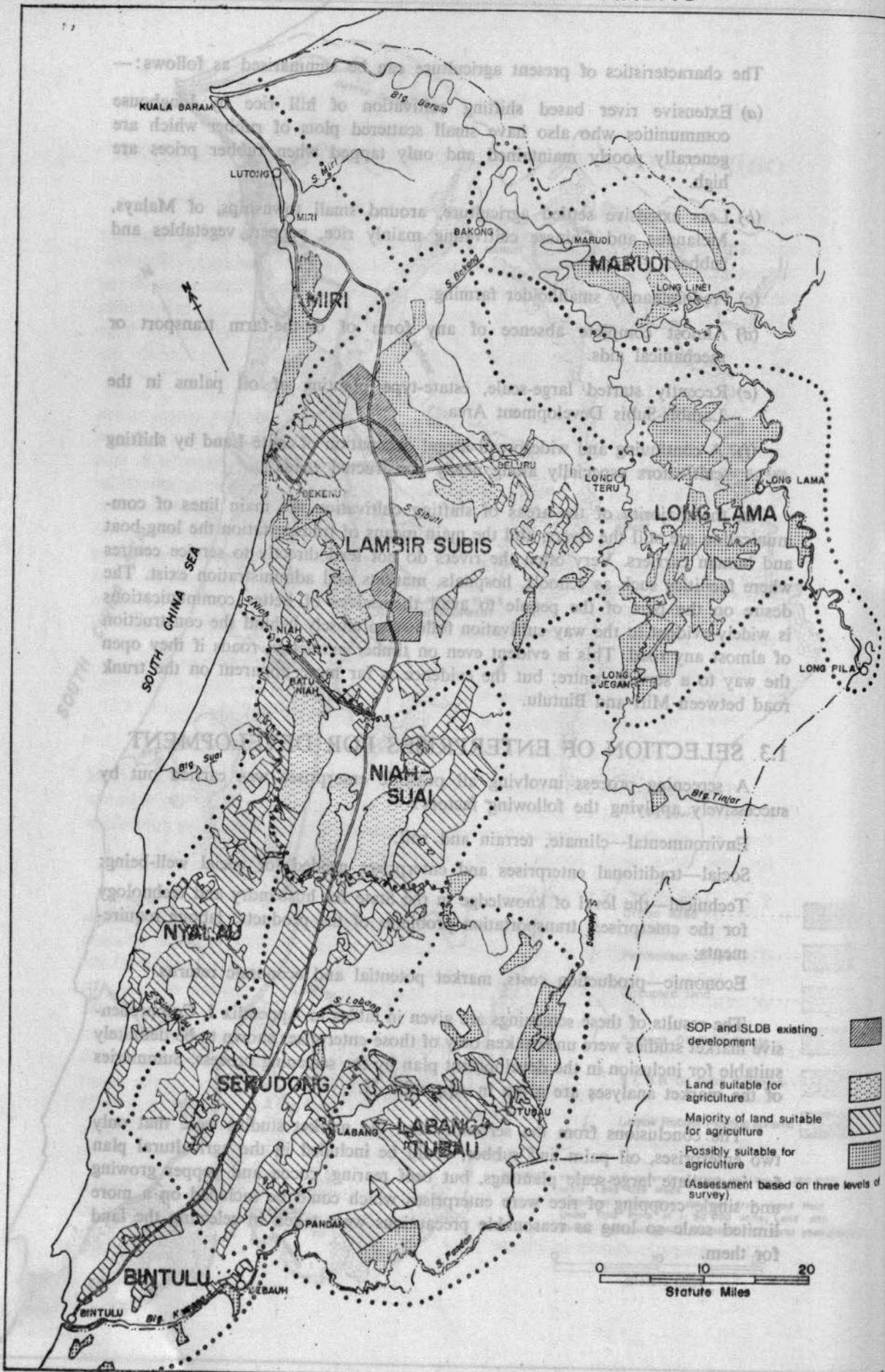
Economic—production costs, market potential and economic returns.

The results of these screenings are given in tables in Appendix I. Comprehensive market studies were undertaken only of those enterprises shown to be definitely suitable for inclusion in the development plan by the screening process. Summaries of the market analyses are given in Appendix II.

The conclusions from the screening and the market studies were that only two enterprises, oil palm and rubber, could be included in the agricultural plan for immediate large-scale plantings, but beef rearing, cocoa and pepper growing and single cropping of rice were enterprises which could be included on a more limited scale so long as reasonable precautions were taken in selecting the land for them.

RURAL DEVELOPMENT AREAS

FIGURE



Other potentially remunerative activities that could be undertaken on a small-scale include in growing of annual grain, pulses and vegetable crops, the planting of fruit trees, several spices, cashew nuts, annatto and some essential oils as well as the rearing of pigs, poultry and pond cultured fish. The choice and size of these latter enterprises would often depend upon the distance from an urban market.

1.4 BASIC STRATEGIES ADOPTED FOR AGRICULTURAL DEVELOPMENT IN THE AREA

The essence of plans for future development have been to select promising, accessible areas for agriculture and to concentrate in them an intensive effort, in which all the technical and social factors affecting development are integrated. These intensive development areas form the core of the plans for rural improvement. But although these areas will progressively expand and increase, it is implicit in such a development policy that many farmers will remain outside the intensive areas for some time to come. For them the normal Agricultural Department extension services should continue, aimed mainly at minimising land destruction, improving the food output and preparing the people by means of markets and continued provision of existing subsidy schemes, for their eventual inclusion in intensive schemes.

For development purposes the Study Area has been divided into nine Rural Development Areas (RDA's) as shown in Figure 1.2. An RDA is a composite geographical area, the size and location of which is determined by physical, organisational, management, processing and investment factors. Each RDA consists of land that can be largely developed independently as a viable undertaking based on agriculture and forestry; but development in one RDA would generally be mutually supporting with previous or subsequent development of an adjacent RDA.

In each RDA the agricultural plan aims to use either a nucleus enterprise that already exists as a basis for development or, where no nucleus exists, to create one by concentrating intensive agricultural inputs into relatively small areas. Thus in the Miri, Marudi, Lambir-Subis and Bintulu RDA's future agriculture has been orientated either towards supplying the needs of the increasing urban populations or towards reinforcing already established agricultural enterprises. In other RDA's a phased creation of nuclei has been planned.

Three basic types of development have thus been adopted; one involving Public Sector projects on State Land, the second Private Sector projects on State Land and the third existing cultivators of Native Customary Land and Titled Land. In choosing the areas for the third type of development the physical problems of vast areas, poor communications, long distances and the remoteness of some of the lands together with technical and social difficulties have necessitated that intensified efforts should be concentrated initially into specific areas which have special advantages. Of particular importance has been the accessibility and proximity to some adjacent nucleus development which can act as a catalyst.

The strategy proposed for initiating the improvement of farming in legally occupied land is to concentrate effort onto a relatively narrow strip of land on both sides of a road. This could be undertaken either as an expansion from existing or planned development on State Land, or as an independent development following a road into an area of legally occupied land currently remote from market centres and/or development schemes.

Fundamentally the agricultural development has been based on land capability classification. This presupposes the carrying out of semi-detailed soil surveys to define the limits of each land-use category. Detailed recommendations for matching agricultural enterprises with land capability classes has been given in the Final Report for this Study. In Appendix I of this part of the Report the grouping of possible enterprises according to their suitability for different land slopes is given.

Financial returns to farmers in Sarawak and in the Study Area are at present lower than in Peninsular Malaysia. Transport and handling costs are higher, which adds to the cost of imported farm inputs and to the expense of marketing export products. Import duties are also higher on vehicles and plant; labour wage rates are higher, and labour productivity on the average is lower. Management staff salaries, in both the public and private sectors, are substantially greater and, in the Study Area, road and port facilities are poor and road construction costs are high. Finally expensive soil conservation measures are required on much of the land.

In general this situation is likely to continue in the future and will necessitate that all development undertakings are efficiently managed; this need for good management is accentuated by the heavy reliance on tree crops in the development plan. Costs of establishing crops of this type are high, and no income accrues for some years. The standard of management during the years of establishment is known to have a marked influence on the later productivity of the mature plantation. There will be need for expensive processing facilities, particularly for oil palm fruits. This, in turn, will make demands on management, which must ensure that the production of good quality fruit is matched to the capacity of the mill. Moreover, as the oil deteriorates quickly after harvesting of the fruit bunch, it will be essential to have a strict system of quality control in the field, and efficient, quick transport of the bunches to the mill.

It is planned that the experience and efficiency of the SLDB be used to develop the land for smallholdings and for public nucleus estates around which selected smallholders and others can be helped to manage their own affairs.

The SLDB would also provide centralised processing and marketing facilities for palm oil and wherever possible for the other enterprises too so that advantage can be taken of economies of scale. The need to provide small-scale farmers with guidance on the correct husbandry techniques and give them support in the form of credit and marketing is met in the agricultural plan by the proposal to create a special organisation within the Department of Agriculture—The Agricultural Development Unit.

CHAPTER 2

DESCRIPTION AND PHASING OF THE PROJECT

2.1 INTRODUCTION

The need to assist people positively in the legally occupied land has been met by planning road based improvement schemes in areas where circumstances permit.

The proposed agricultural development is based on the enterprises and strategies previously described. The Agricultural Development Unit (ADU) would provide all the various services that the farmers included whether the programmes will require. This is explained in Chapter 3.

Plans for road based improvement have been made only for those schemes that can be started by 1980 along existing or already planned roads. No roads have been planned specifically for road based schemes. Planning for such schemes beyond 1980 was not considered meaningful because if by then they have proved successful, the possibilities for expansion are such that completely new plans would have to be made beyond 1981.

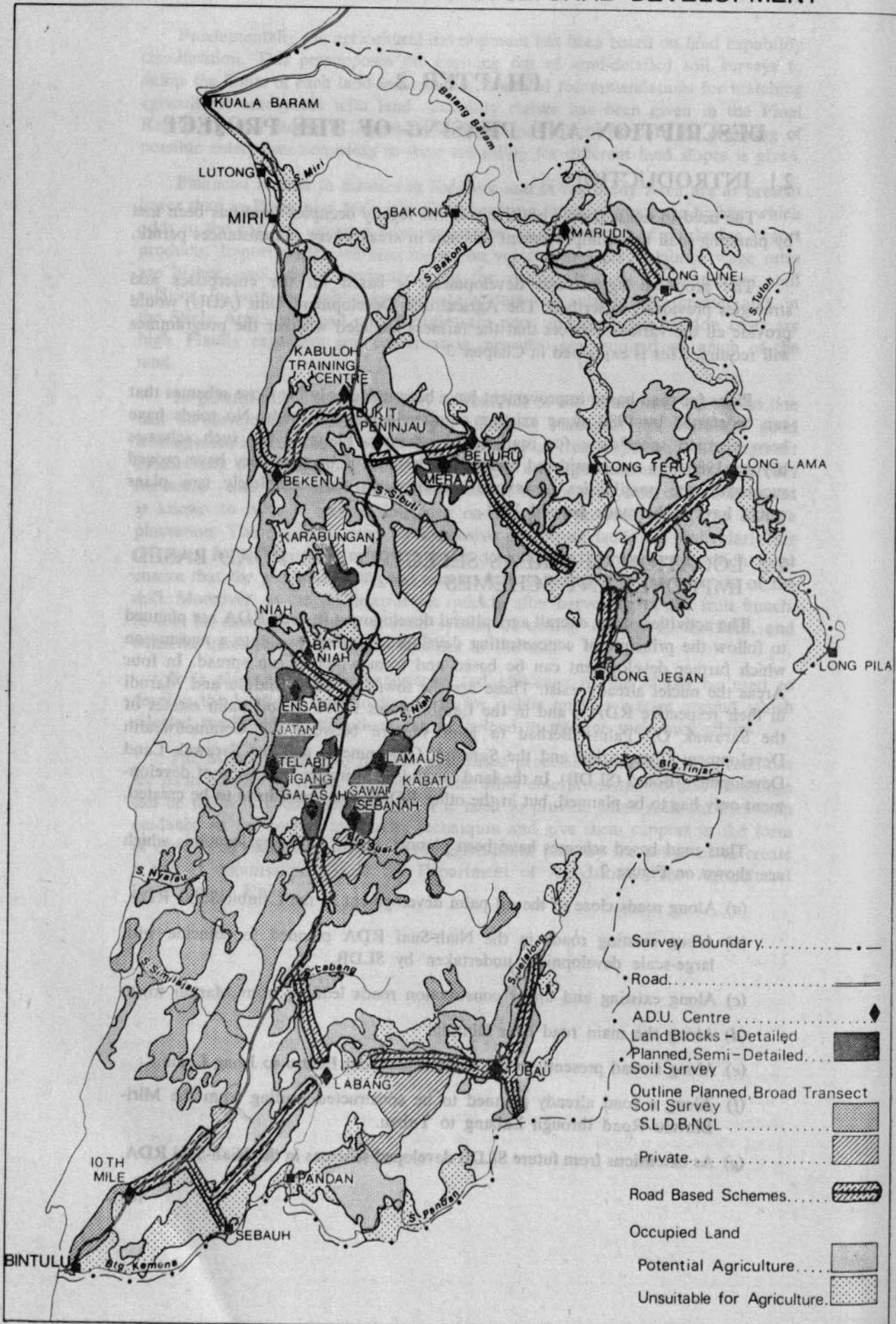
2.2 LOCATION OF AREAS SELECTED FOR ROAD BASED IMPROVEMENT SCHEMES

The activities of the overall agricultural development in each RDA are planned to follow the principle of concentrating development effort to create a nucleus on which further development can be based and from which it can spread. In four Areas the nuclei already exist. These are the towns of Miri, Bintulu and Marudi in their respective RDA's, and in the Lambir-Subis RDA the oil palm estates of the Sarawak Oil Palms Berhad (a joint venture between the Commonwealth Development Corporation and the Sarawak Government) and the Sarawak Land Development Board (SLDB). In the land around these nuclei expansion of development only has to be planned, but in the other RDA's the nuclei have to be created.

Thus road based schemes have been planned in the following locations which are shown on Figure 2.1.

- (a) Along roads close to the oil palm development in the Lambir-Subis RDA.
- (b) Along existing roads in the Niah-Suai RDA planned to coincide with large-scale development undertaken by SLDB.
- (c) Along existing and under construction roads leading from Marudi town.
- (d) Along the main road near Bintulu.
- (e) Along a road presently being constructed from Beluru to Long Lama.
- (f) Along a road already planned to be constructed leading from the Miri-Bintulu Road through Labang to Tubau.
- (g) As extensions from future SLDB developed schemes in the Niah-Suai RDA.

LOCATION OF PLANNED AGRICULTURAL DEVELOPMENT



- Survey Boundary.....
- Road.....
- ADU. Centre
- Land Blocks - Detailed
- Planned, Semi-Detailed.....
- Soil Survey
- Outline Planned, Broad Transect Soil Survey
- S.L.D.B.N.C.L.
- Private.....
- Road Based Schemes.....
- Occupied Land
- Potential Agriculture.....
- Unsuitable for Agriculture.....

2.3 THE PRESENT SITUATION IN THE AREAS SELECTED

The general situation in the areas selected for Road Based Improvement is that they are occupied mostly under the Customary Right System of land tenure. Some areas though consist of titled holdings. These are usually close to the towns, for example, Bintulu, Marudi, Batu Niah and Bekenu. The agriculture in these areas is usually of rice, pepper, rubber with subsistence growing of vegetables and fruit, and the rearing of pigs, poultry and pond culture of fish.

In the Native Customary Areas the land is usually under shifting cultivation and could be recently cleared or under various stages of regenerating forest. In some places there will be scattered plantings of rubber, pepper, fruit trees and rice.

In Appendix III descriptions are given of the present position and the future planned development within the RDA's in which road based schemes are proposed.

2.4 CROPPING PATTERNS

Two different diversified cropping patterns are recommended: one for areas within easy reach, about 20 miles, of a palm oil mill; the other for areas more remote from this facility, more than 20 miles away.

Generally the size and type of holdings would be expected to vary considerably, not only from scheme to scheme but also within a scheme. For planning purposes the following assumptions have been made:

- (i) That a diversified cropping pattern would be followed.
- (ii) That improvement work would extend to 500 yards on either side of the road. The gross acreage of land per mile of road would be 364 acres, but the net usable agricultural land per mile of road would be 255 acres (assuming a loss of 30 per cent for unsuitable land, buildings, tracks, etc.).
- (iii) That the average holding size would be 16 acres, i.e. 16 holdings per mile of road.
- (iv) Oil Palms would be grown only within 20 road miles of a mill and only on suitable land (slopes less than 20 degrees) within 200 yards of the road. Assuming 90 per cent of the usable agricultural land would be suitable for oil palms then the acreage of oil palms per mile of road would be 90.
- (v) Sufficient flat valley land would be developed to permit each participating family to plant one acre of wet rice, i.e. an average of 16 acres of rice per mile of road.
- (vi) Rubber would be grown on the steeper land (20 to 25 degrees) within 200 yards of the road; equivalent to five acres per mile of road.
- (vii) From 200 to 500 yards from the road, representing a total of about 144 acres of usable agricultural land, the less steep land would be planted to pepper, cocoa and other specified crops, while the remaining land would be planted to rubber. The acreages of each have been estimated to be:

Pepper	...	...	...	...	10 acres
Cocoa	...	...	...	...	20 acres
Rubber	...	...	...	...	100 acres
Other crops	...	...	...	...	14 acres

The overall cropping pattern per mile of road in areas within 20 miles of an oil palm mill would be:

Oil palms	90 acres
Rubber	105 acres
Cocoa	20 acres
Rice	16 acres
Pepper	10 acres
Other crops	14 acres
Total	255 acres

In those road based schemes over 20 miles from an oil palm mill the assumed cropping pattern per mile of road would be:

Rubber	180 acres
Cocoa	20 acres
Rice	20 acres
Other crops	35 acres

2.5 PHASING OF SCHEMES

Schemes cannot be started on a significant scale until specially trained staff are available and an organisation has been set up to administer them. Plans for doing this are described in Chapter 3 where it is explained that the first out-turn of special trainees is expected at the end of 1975. Hence most schemes are not scheduled to start until 1976 or later. However, there is need in two places, Bukit Peninjau and Batu Niah, for immediate support to on-going schemes.

Near Bukit Peninjau the Department of Agriculture has already started road based planting of oil palms, and a target of 900 acres by the end of 1974 has been set. At Sepupok near Batu Niah, Government has started a block alienation scheme covering some 3,000 acres and involving about 210 settler families. Both these schemes require intensive guidance and support as soon as possible. It is important that the schemes are successful in order to convince the local farmers that Government's promises to help them are sincere. It is recommended that special staff should be seconded from the Agricultural Extension Service to these schemes in 1975.

In Appendix IV are detailed the assumptions made which allow for the gradual increase in the number of farmers handled by the teams of specialised staff. Using these assumptions together with the assumed cropping patterns previously given it has been possible to estimate the total number of farmers handled and the total acreage of their crops on each scheme. These estimates are given in Table 2.1 for schemes solely concerned with road based improvement and in Table 2.2 for those schemes where road based improvement is an extension from an SLDB developed area. Summaries are given in Tables 2.3 and 2.4.

TABLE 2.1 STAFF BUILD-UP AND ACTIVITIES ON ROAD BASED IMPROVEMENT SCHEMES UP TO 1981

Centres	Year	Total Staff by Sections					Estimated Total Number of Farmers Handled	Estimated Annual Acreage Supervised				
		Extension	Economic	Credit and Saving	Accounts	Total Staff		Oil Palm	Rubber	Cocoa	Rice	Other Crops and Enterprises
BUKIT PENINJAU	1975	5	2	1	1	9	75	425	495	95	75	115
	1976	5	2	1	1	9	105	175	205	45	35	55
	1977	5	4	1	1	11	150	255	295	65	45	75
	1978	7	5	1	2	15	200	285	325	65	55	75
	1979	7	7	1	2	17	220	125	145	25	25	35
	1980	12	8	1	2	23	325	585	685	135	105	165
	1981	12	9	1	2	24	355	175	205	45	35	55
Total up to 1981		12	9	1	2	24	355	2,025	2,355	475	375	575
BATU NIAH	1975	5	2	3	1	11	75	425	495	95	75	115
	1976	5	2	3	1	11	105	175	205	45	35	55
	1977	10	5	3	2	20	225	675	795	115	125	185
	1978	12	6	3	2	23	305	455	525	105	85	125
	1979	14	9	3	2	28	370	365	425	85	65	105
	1980	14	10	3	2	29	450	455	525	105	85	125
	1981	19	11	3	2	35	575	705	825	165	125	195
Total up to 1981		19	11	3	2	35	575	3,255	3,795	755	595	905
EACH OF BELURU AND BEKENU	1976	5	2	1	1	9	75	425	495	95	75	115
	1977	5	2	1	1	9	105	175	205	45	35	55
	1978	5	4	1	1	11	150	255	295	65	45	75
	1979	7	5	1	2	15	200	285	325	65	55	75
	1980	7	7	1	2	17	220	125	145	25	25	35
	1981	12	8	1	2	23	325	585	685	135	105	165
	Total up to 1981		12	8	1	2	23	325	1,850	2,150	430	340	520
MARUDI	1976	5	2	1	1	9	75	nil	855	95	95	165
	1977	5	2	1	1	9	105	nil	345	45	45	75
	1978	5	4	1	1	11	150	nil	505	65	65	185
	1979	7	5	1	2	15	200	nil	565	65	65	115
	1980	7	7	1	2	17	220	nil	235	35	35	45
	1981	7	7	1	2	17	250	nil	325	45	45	65
	Total up to 1981		7	7	1	2	17	250	nil	2,830	350	350	650
BINTULU	1976	5	2	1	1	9	75	nil	855	95	95	165
	1977	5	2	1	1	9	105	nil	345	45	45	75
	1978	5	4	1	1	11	150	nil	505	65	65	105
	1979	6	5	1	1	13	175	nil	275	35	35	55
	1980	6	7	1	2	16	185	nil	135	15	15	25
	1981	6	7	1	2	16	200	nt	165	25	25	35
	Total up to 1981		6	7	1	2	16	200	nil	2,280	280	280	460
LONG LAMA	1977	5	2	1	1	9	75	nil	855	95	95	165
	1978	5	2	1	1	9	105	nil	345	45	45	75
	1979	5	4	1	1	11	150	nil	505	65	65	185
	1980	7	5	1	2	15	200	nil	565	65	65	115
	1981	7	7	1	2	17	220	nil	235	35	35	45
	Total up to 1981		7	7	1	2	17	220	nil	2,505	305	305	585
LABANG	1977	5	2	1	1	9	75	nil	855	95	95	165
	1978	5	2	1	1	9	105	nil	345	45	45	75
	1979	5	3	1	1	10	150	nil	505	65	65	105
	1980	6	7	1	1	15	175	nil	275	35	35	55
	1981	6	7	1	2	16	185	nil	135	15	15	25
Total up to 1981		6	7	1	2	16	185	nil	2,115	255	255	425
TUBAU	1978	5	2	1	1	9	75	nil	855	95	95	165
	1979	5	2	1	1	9	105	nil	345	45	45	75
	1980	5	4	1	1	11	150	nil	505	65	65	105
	1981	7	7	1	2	17	200	nil	565	65	65	115
Total up to 1981		7	7	1	2	17	200	nil	2,270	270	270	460

TABLE 2.2 STAFF BUILD-UP AND ACTIVITIES OF THE ADU CENTRES ASSOCIATED WITH SLDB DEVELOPMENT OF SMALLHOLDER SCHEMES

Centres	Year	Total Staff Build-up by Sections				Estimated Total Number of Farmers Handled(1)	Estimated Total Acres of Crops Handled					Remarks	
		Extension	Economic	Credit and Saving	Accounts		Total Staff	Oil Palm	Rubber	Cocoa	Rice		Pepper and Other Crops
GALASAH	1978	6	2	1	1	10	162	(0)	nil	nil	160	162	Work confined to smallholder rice and homestead plots.
	1979	7	3	1	1	12	187	(25)	nil	nil	160	162	Road based improvement starts; land clearing occurs in addition to smallholder support.
	1980	7	3	1	1	12	197	(35)	145	175	185	207	Road based improvement continues in addition to smallholder support.
	1981	8	7	3	2	20	222	(60)	1,800	775	210	232	Road based improvement continues and ADU takes responsibility for all smallholder land.
	1982	8	7	3	2	20	237	(75)	1,955	960	245	277	Road based improvement completed on first constructed road.
SEBANAH	1978	11	4	1	1	17	265	(0)	nil	nil	265	265	Work confined to smallholder rice and homestead plots.
	1979	13	6	1	1	21	315	(50)	nil	nil	265	265	Road based improvement starts; land clearing occurs in addition to smallholder support.
	1980	13	6	1	1	21	329	(64)	285	325	315	340	Road based improvement completed on first constructed road in addition to smallholder support.
	1981	14	9	3	2	28	329	(64)	2,875	1,480	355	395	Road based improvement could be expanded ADU takes responsibility for all smallholder land.
LAMAUS	1979	11	6	1	1	19	331	(0)	nil	nil	330	331	Work confined to smallholder rice and homestead plots.
	1980	12	6	1	1	20	356	(25)	nil	nil	330	331	Road based improvement starts; land clearing occurs in addition to smallholder support.
	1981	12	6	1	1	20	363	(32)	145	175	355	376	Road based improvement completed on first constructed road in addition to smallholder support.
	1982	13	9	3	2	27	363	(32)	3,370	1,570	405	456	Road based improvement could be expanded ADU takes responsibility for all smallholder land.
ENSABANG	1980	11	5	1	1	18	318	(0)	nil	nil	300	318	Work confined to smallholder rice and homestead plots.
	1981	12	5	1	1	19	334	(16)	nil	nil	300	318	Road based improvement starts; land clearing occurs in addition to smallholder support.
	1982	12	5	1	1	19	334	(16)	95	105	316	343	Road based improvement completed on first constructed road in addition to smallholder support.
	1983	13	8	3	2	26	334	(16)	3,585	1,375	316	343	Road based improvement could be expanded; ADU takes responsibility for all smallholder land.

NOTE: (1) The figures in brackets are the number of farmers on total bonded improvement schemes.

TABLE 2.3 CROPPING PATTERN AND PHASING OF ROAD BASED IMPROVEMENT 1975 TO MID-1981 (net acres)

Year	Oil Palm	Rubber	Cocoa	Rice	Other Crops	Total
1975	850	990	190	150	230	2,410
1976	1,200	3,110	470	410	670	5,860
1977	1,280	3,900	590	520	850	7,140
1978	1,250	3,995	615	545	955	7,360
1979	1,490	2,915	615	555	945	7,520
1980	1,735	3,730	610	540	830	7,445
1981	2,415	4,250	750	640	970	9,025
Total	10,220	23,890	2,840	3,360	5,450	46,760

TABLE 2.4 NUMBER OF FARMERS INVOLVED IN ROAD BASED IMPROVEMENT SCHEMES 1975 to MID-1981

Year	Total Number of Farmers Handled in RDA's							Total Number Farmers
	Marudi	Lambir Subis	Long Luma	Niah Suai	Labang-Tubau	Sekudong	Bintulu	
1975	—	75	—	75	—	—	—	150
1976	75	180	—	105	—	—	75	435
1977	105	255	75	225	—	75	105	840
1978	150	350	105	305	75	105	150	1,240
1979	200	420	150	445	105	150	175	1,645
1980	220	545	200	574	150	175	185	2,049
1981	250	680	220	762	200	185	200	2,497

However, the envisaged Kuching organisation does not yet exist and perhaps need not for several years until at least the staff training programme has got underway. But this fact necessitates that the ADU in the Fourth Division, which would be the first Divisional ADU and would be associated with considerable development, should be larger and stronger than subsequent ADUs. It would require a headquarters of its own and a staff training organisation which could train staff for the state-wide ADU as described in Appendix V. The training would come under the jurisdiction of the Department of Agriculture's Training Branch.

12 THE FOURTH DIVISION ADU

The Divisional headquarters would consist of an Agricultural Leader (an agriculturist with a degree and several years experience), a Training Leader (a specialist in extension training), an Administrative Leader (a trained administrator) and office staff.

CHAPTER 3

ORGANISATION OF THE ADU

3.1 INTRODUCTION

The road based improvement schemes cannot be contemplated without the organisation of special staff to initiate and run them. An analysis of the Department of Agriculture's likely future commitment of its extension staff throughout Sarawak and the planned expansion of its training facilities shows that the Extension Branch cannot be expanded quickly enough to provide a service level over and above that at present attained in the country. Furthermore the training of the normal extension agent is not particularly orientated towards the intensive work required for the successful establishment and operation of road based improvement schemes. These facts have necessitated the recommendation for establishment of the ADU within the Department of Agriculture.

Because the operation and tasks of the ADU are vital to the success of the road based schemes which, as has been explained, are designed to ensure participation of existing local farmers in the future development of the Study Area, it is important that the envisaged method of operation of the ADU is clearly understood. This is described in this Chapter.

The ADU would eventually to be a state-wide organisation under the control of a Farmers' Organisation Branch in the Department of Agriculture. The existing Farmers' Organisation Section would require gradual expansion to undertake this extra work. The Kuching headquarters would eventually include senior staff to head the following Sections of the Branch:

- (a) an Extension Section;
- (b) an Economic Section to handle agricultural supplies marketing and farm mechanisation;
- (c) a Credit Section to handle agricultural loans and savings;
- (d) an Accounts Section for keeping records of all transaction.

However, the envisaged Kuching organisation does not yet exist and perhaps need not for several years until at least the staff training programme has got underway. But this fact necessitates that the ADU in the Fourth Division, which would be the first Divisional ADU and would be associated with considerable development, should be larger and stronger than subsequent ADUs. It would require a headquarters of its own and a staff training organisation which could train staff for the state-wide ADU as described in Appendix V. The training would come under the jurisdiction of the Department of Agriculture's Training Branch.

3.2 THE FOURTH DIVISION ADU

The Divisional headquarters would consist of an Agricultural Leader (an agriculturist with a degree and several years experience), a Training Leader (a specialist in extension training), an Administrative Leader (a trained administrator) and office staff.

The field staff would be grouped into Teams each consisting of staff trained in the work of the various Sections of the Unit. The Teams would be organised to form ADU Centres in villages associated with the development and located as close as possible to the farmers with whom the staff would be dealing. The staff would live in the village and they would share a composite office block. In this way physical Centres, consisting of offices and stores, and staffed by people catering specifically for the requirements of the smallholders and small-scale independent farmers, would be created in the villages. Thus the ADU would be undertaking work in widely separated places in the Study Area but grouped together in Teams.

The Divisional headquarters should be started during 1974 and located at the existing Kabuloh Training Centre. The Agricultural Leader would be in charge of the Divisional ADU. He would be responsible for the technical aspects of the field work and would be in regular contact with the Divisional Action Committee where at the Divisional level the activities and services of the various Government Departments and Institutions would be co-ordinated. In addition close contact would be necessary with the Regional Manager and Scheme Managers of the SLDB in order to ensure a co-ordination of effort. In many instances the ADU would require the assistance of the SLDB; for example, in the purchase of agricultural supplies, hire of heavy equipment and maintenance of tractors. Much of the Agricultural Leader's time would be in the field checking the work and assisting the extension staff of the Teams. He would be the initiator and chief organiser of farm competitions, agricultural shows, visits by farmers to research stations and other such activities which would promote interest and a competitive spirit among farmers to improve their holdings. He would be responsible for deciding maximum value of materials and farm services supplied to the farmer.

The training leader would be responsible mainly for directing and organising on-the-job training of the ADU staff but would be closely associated with the special training centre at Kabuloh where he would assist with the teaching and would ensure that the syllabus is correctly orientated to the needs of the ADU. He would assist the Agricultural Leader and research staff in preparing crop and enterprise Extension Manuals for use by the ADU Teams. The Manuals would provide detailed guidance to the ADU staff and thus ensure that the same type and standard of advice and services are made available to all the farmers handled. The basis for the initial Extension Manual could be the agronomic and economic assumptions made for each crop in Supporting Report 2 Part IV of the Final Report together with numerous Department of Agriculture publications. The Training Leader's duties would also cover the encouragement and training of farmers to form Farmers' Organisations.

The Administrative Leader would be responsible for the smooth operation of the ADU. He would eventually have under him a fully equipped office, secretaries and clerks. Much of his time would be occupied with day-to-day problem such as organising the construction of houses, offices and stores for the staff; purchase of vehicles and other equipment; staff recruitment; pay and allowances for the staff. In fact he would relieve the Agricultural Leader of non-technical administrative problems. In particular he would be responsible for compiling and forwarding to the Kuching headquarters summarised monthly statements of farmers accounts. (See Paragraph 3.2.4 (d)).

The staff making up the Teams at the ADU Centres would consist of:

- (a) one or more Extension Teams, each consisting of a Supervisor, up to five Extension Agents and a Home Demonstrator. The actual number of Agents would depend on the number of smallholders and other farmers being handled from the Centre. If the number of farmers was too great for one Extension Team then a second one would be moved in rather than overstretch the capabilities of one Extension Team. On the assumptions outlined in Appendix IV the maximum number of farmers that one Extension Team could handle would be 250. A Supervisor would be nominated leader of each ADU Centre, and for every seven Centres a Senior Supervisor or Section Leader would be nominated to supervise and co-ordinate the work of the Centres;
- (b) staff from the Economic Section to handle:
 - (i) supply of materials for production.
 - (ii) mechanical assistance for certain agricultural operations.
 - (iii) marketing of farm produce.
- (c) staff from the Credit Section who would be the only members of the ADU Centre who would handle cash transactions with the farmers. These transactions could be:
 - (i) cash payments to farmers for work done.
 - (ii) provide a savings or banking service to the farmers until such time as a proper banking service is established in the area.
- (d) staff from the Accounts Section who would be responsible for keeping records of all the transactions undertaken between the farmers and the staff of the Economic Section.

The specific tasks of these various staff are described below and details of their recommended minimum qualifications are given in Appendix VI.

3.2.1 The Extension Team

The Supervisors would be the leaders of each ADU Centre but their main work would be in the field supervising, training and assisting the Extension Agents under their control. The fact that all the staff of the ADU Centre would be living in the same village implies that there would be almost daily contact between the Supervisor and all the staff.

The Extension Agents would be in daily contact with the farmers and would endeavour to become their friends. The Agents' tasks would be to show and to teach the farmers the cultural methods of crop and animal husbandry as specified in the Extension Manuals; also to ensure the farmers know exactly what would be expected of them, where they fit into the scheme, what aids and facilities would be available, how to obtain these and to use them correctly.

The Home Demonstrator's work would be mainly in the homes of the participant families teaching and helping the people to adjust and take advantage of the opportunities being offered. Home economics, child care, cooking, sewing and hygiene would be important subjects.

An important task of the Extension Agents would be to assist the farmers they serve in drawing up plans of work for every crop each season. These plans would include work involving whole groups of small families; for example, arranging the harvesting of oil palm so that whole groups of holdings would be harvested on the same day, or, deciding upon the acreage of land to be cleared and planted to oil palms or cocoa. Only those crops or enterprises considered suitable for the particular holding or situation and detailed in the Extension Manuals would be recommended and supported by the ADU Team. Either the farmer or the Extension Agent could be the initiator of a particular undertaking but only with the farmer's full agreement and co-operation would an enterprise be implemented.

In effect the details of work for individual farmers would form annual farm budgets. These should be simple documents drawn up at the same time each year, covering every crop and enterprise for the coming year. Three tables for each crop or enterprise would suffice. The basic layout and headings of the tables for each enterprise could be standardised and printed on one page for issue to Extension Agents. The first table could contain:

- the area of crop or size of enterprise;
- the weight of produce expected for sale;
- the unit value of produce at farmgate;
- the gross value of produce.

The total of gross values for all crops and enterprises would give the gross income expected from the holding.

The second table could contain the material inputs required for every crop or enterprise as laid down in the Extension Manuals. These would show the standard input packages to be supplied by the ADU. The quantity and value of all inputs would be shown. By subtracting the total value shown in the second table from the gross income shown in the first table an estimate of the net income from the holding would be obtained.

The third table could show the estimated number and timing of man-days labour that the farmer would have to work.

Such budgets could become more and more accurate as experience is gained. They would show the farmer his year's work programme and likely financial status. But possibly a more important use of the budgets would be as the source of information for estimating the quantity of materials and the level of services required in the development areas. In addition they would provide valuable teaching material and would assist the Agricultural Leader in his control of the quantities and value of inputs provided to every farmer. An example of a budget covering the standard input package for swamp rice is given in Appendix VII.

A similar and equally important task would be the drawing up of a farm plan for every farmer. This would be a map of each holding and would show the locations of various crops and enterprises. The plan would include a farming calendar, in diagram form, showing operations to be performed each month. Also included would be an analysis of every enterprise over its lifetime. These would show the expected performance and profitability of each undertaking. Thus the farmer would be fully aware of his commitments.

Inevitably there would be a degree of overlapping between the annual budgets and the farm plans but this would be desirable in that it would ensure that the farm plan is realistic and continually brought up to date. Every farm budget and farm plan would be made in duplicate; one kept by the farmer and one passed to the Agricultural Leader.

3.2.2 The Economic Section

The tasks of the Economic Section staff would fall into three main categories each handled by different groups of persons.

- (i) to supply, on credit, the materials for production;
- (ii) to supply, on credit, mechanical assistance for certain agricultural operations;
- (iii) to organise and assist in the marketing of farm produce.

These services would be part of the whole package service operated by the ADU. Having provided the farmers with the materials and means to carry out the improvements and innovations promoted by the Extension Team, the task of the Economic Section would be to recover the cost of these through the marketing of produce from the oil palm, rubber and cocoa areas on the farms served. Generally there would be no provision of credit in the form of cash. Only limited cash payments are foreseen; these would be made by the staff of the Credit Section and are explained in paragraph 3.2.3.

The tasks and functions of the staff of the Economic Section would be as follows:

(a) The Supply of Materials

A trained Storeman and an Assistant Storeman would be attached to each Centre and would handle the supply of materials such as fertilisers, insecticides, herbicides, seeds, bags etc., to the farmers. The materials would be in accordance with standard input packages as laid down in the Extension Manuals. Only the specified items would be supplied and generally the whole package, not only part of it, would have to be accepted by all participating farmers.

Finance for the purchase of the materials in bulk would be provided as credit to the ADU by the Bank Pertanian, for instance, which would be required to set up an office in Sarawak.

Purchase of the materials, at least during the early years, would be through the SLDB who would be requested to add the estimated requirements of the whole ADU to their bulk orders. SLDB would handle the supplies right up to their stores in development areas. At this stage the supplies would be handed over in bulk to the ADU who would be responsible for their safe-keeping and further distribution to the farmers which would be handled like in any retail delivery store. Materials required in large quantities, or heavy bulky goods like fertilisers, would be delivered to specific places at specific times as arranged with the farmers or the Extension Team. Individual farmer requirements of materials in small quantities, like pesticides, could be collected personally from the store.

Every participating farmer would have an account with the ADU Centre serving his particular area and every delivery, whether in the field or at the store, would be recorded against the individual receiving the supplies.

There should be special printed forms for this purpose and the farmer's signature would have to be obtained each time for every delivery of material. There would be a limit to the value of goods and services that any one farmer could obtain. This limit would vary from farmer to farmer and would be set by the Extension Team Supervisor upon guidance from the Agricultural Leader. Generally the limit would be equivalent to about 60 per cent of the estimated value of sales of produce for which the only outlet would be through the ADU organised marketing. Such produce would be oil palm fresh fruit bunches (ffb), fresh rubber latex or sundried rubber sheets or rubber coagulum (either polybag or bucket), wet cocoa beans and essential oil material. Estimates of the likely sales value of these products from every holding could be obtained from the farm budgets. The sum of the budgets would be the source of estimates for the total quantity of materials to be ordered by the ADU.

(b) The Provision of Mechanical Aids

Every ADU Centre would have a trained mechanic who would have trained machine operators under him. Their purpose would be to operate and maintain certain machinery to assist the farmers in working their holdings. The major assistance would be to provide mechanical preparation of wet rice land. Equipment required for this is of two types. Large units consisting of tractors of the Ford 5000 type fitted with cage wheel extensions and operating heavy duty rotovators; one such unit for every 200 acres of wet rice land developed within a reasonable distance of the village. Small units of the power-tiller type, to handle smaller total acreages and small isolated blocks of rice land. In addition there should be:

- (i) spraying equipment of the knapsack type, both hand operated and motor operated.
- (ii) motor driven rice threshing equipment and chain saws.
- (iii) hand tools such as cross cut saws, axes, spades, hoes etc.

All the mechanically driven equipment, (power-tillers, sprayers and chain saws) would be worked by the trained mechanic and the operators. The services of this equipment would be for hire (on credit terms) by the farmers. The hand operated equipment would be available on similar terms for use by the farmers themselves. Records of all hiring would be kept, again using a system of printed forms which would be signed by the farmer.

Requirements for heavy equipment like bulldozers, graders and ditchers for road construction and maintenance, or for land drainage, would be met by contracting the work out to SLDB, Public Works Department, Drainage and Irrigation Department or any suitable private contractor.

Generally the ADU would not become involved in the processing of farm produce. Expensive installations such as palm oil mills, large cocoa fermenting and drying centres and essential oil stills are expected to be erected and run by organisations such as SLDB and SEDC. However, the building and running of small cocoa processing

centres by groups of smallholders, for example, could be encouraged and supported as part of the process of forming Farmers' Organisations. Also private firms could be encouraged to set up padi drying and milling facilities.

(c) The Marketing of Farm Produce

At each Centre a trained Recorder would be in charge of this service and would have under him trained Assistant Recorders. Their task would be to ensure that there is an organised marketing outlet for all products from enterprises recommended and supported by the ADU Team.

The task would fall into two main categories depending on the commodity being handled:

- (i) a collection, recording and delivery function which would operate in the case of those commodities for which the only outlet would be the one organised by the ADU. These are the products already mentioned, oil palm ffb, rubber and cocoa beans. For these commodities a time and date collection round would be organised, records of quantities produced by individual farmers would be kept and whole consignments would be delivered to the processing plant;
- (ii) assistance would be given to farmers, if they wish it, to sell any other commodities the production of which has been part of the ADU Team's programme but for which other outlets could exist. This includes such products as rice, pepper, fruits, vegetables, fish, poultry, pigs, coffee, annatto and cashew nuts. Some of these commodities the farmers themselves would consume, others they may wish to sell, either privately through some local trader or through the ADU. Generally there would be no obligation on the farmers as to the disposal of these commodities but the ADU would ensure that there would be a convenient outlet, in fact handling the product if there is no other market in the area. Every effort would be made to channel all these products through any State organised marketing organisations: for example, the Pepper Marketing Board.

The value of all commodities handled by the ADU would be credited to the account of the individual farmer. Instances could arise, in practice, where the farmers in an area do not have sufficient crops which would be automatically handled by the ADU to provide sufficient credit-worthiness to obtain the materials and services needed. In such cases arrangements would have to be made for the ADU to become the only convenient outlet for some other specific product. For all the products handled by the ADU records on printed forms should be kept.

3.2.3 The Credit System

There would generally be three specially trained clerks in the Credit Section of the ADU Teams; a Senior Clerk and two Assistant Clerks. They would be the only ones who would have cash transactions with the farmers. Transactions could be either payments to farmers or payments by farmers into a savings or banking service. The Senior Clerk would be ultimately responsible for correct recording of all transactions and safe-keeping of cash. Payments to farmers would be made only for work done.

Every farmer would have an account at the Centre and payments into the account could occur in three ways:

- (a) cash paid in by the farmer;
- (b) a credit statement from the Accounts staff;
- (c) a credit due for work done by the farmer.

Facilities would be made for cash withdrawals by the farmers as well as allocations to any particular Federal and State saving schemes.

3.2.4 The Staff of the Accounts Section

Trained accountants would handle the work in the Centres where they would keep accounts of all transactions undertaken by the ADU Team. The accountants would be required to make up monthly statements of every farmer's account and arrange payment of amounts due to the farmers and to the bank which provided the original loan.

At each Centre a copy of the forms recording every transaction carried out by the staff of the ADU Team in their area would be passed to the Accounts staff who would also receive monthly payments from the processing plants and other outlets for bulk deliveries of farm produce. Thus a monthly statement of all farmers' transactions could be made. This should show the value of materials and services received by every farmer from the ADU Team and the value of the produce handled by the Team. The amounts due to every farmer could be calculated by deducting from the total sales value a previously agreed sum for the materials and services received. The acceptance, by the farmer, of these deductions from his earnings would be a pre-requisite for participation as an independent small-scale farmer.

A vital aspect in the working of the whole system would be the recording of the transactions. This should be kept as simple, practical and foolproof as possible. Given below are some suggestions as to how the system could be run at each ADU Centre.

- (a) Every farmer could be identified by name and by a number. Both these should appear on every form recording any transaction involving the farmer.
- (b) All transactions involving a farmer should be in triplicate; one copy for the farmer, one for the particular ADU staff involved and one passed to the ADU Accounts staff.
- (c) Records of bulk deliveries of farm produce to the processing plants should also be in triplicate; one copy for the plant, one for the ADU Marketing staff and one passed to the Accounts staff.

In addition, a summary record, showing the quantities contributed by every farmer, should be made for every bulk delivery. These summaries should be in duplicate, one for the Marketing staff and one for the Accounts staff.

- (d) Monthly statements of every farmer's account should be made in triplicate; one for the farmer, one kept by the Accounts staff and one passed to the Agricultural Leader. The statements should show, very simply:
 - (i) the type and value of materials and services received by the farmer during the month. These should be itemised and totalled;

- (ii) the value of produce sold, itemised and totalled;
- (iii) deductions for the month, itemised and totalled;
- (iv) total outstanding for production materials and services received;
- (v) amount due to the farmer.

The set of copies passed to the Agricultural Leader would enable him to obtain valuable information on the progress of every farmer, and, indirectly the efficiency of the ADU staff at the different Centres. This information could also be used in making assessments of the farmers credit worthiness.

At the Divisional ADU headquarters the monthly statements from the ADU Centres would be combined into a Divisional statement and forwarded to the Branch Headquarters in Kuching.

3.3 SOURCE OF FUND AND PAYMENT PROCEDURE

The Bank Pertanian, it is suggested, could be the source of funds required by the Economic and Credit Sections of the ADU. The Bank would need to start an office in Sarawak and a system could be established whereby the Bank would operate under its basic charter and regulations and would have its own accounts and staff, but the Agricultural Department would be responsible for auditing and supervision of the accounts kept by the ADU staff at each Centre. Such checks would need to be combined with supervision and on-the-job training, and be made about every three months by senior accounts staff of the Department. The handling of funds should be simple. The ADU could be allocated annually a credit account with the Bank. The amount would be appropriate to the estimated combined requirements of the Divisional ADUs. Repayments to the Bank would be made by the Headquarters Accounts Section using the deductions from every farmer's account.

The visits of the senior accounts staff should be made the opportunity for taking any necessary disciplinary action against farmers who are not complying with the terms of their agreement. These actions should, as far as the farmer is concerned, be unassociated with the local ADU staff but should be seen as a result of the inspection of the records and accounts. Application of the discipline, whether a warning or stoppage of further assistance, should be administered by the senior staff accompanied, if necessary, by a representative of the District Action Committee. It would be most important that the local ADU staff would not be directly involved because success in their work would depend largely on their maintaining friendly relations with the farmers.

3.4 THE CREATION OF FARMERS' ORGANISATIONS

Farmers' Organisations (FOs) are new to Sarawak. A modest start was made in 1971 with four organisations which are still in their earliest stages of development. They are under the direction of the Farmers' Organisation Section of the Department of Agriculture. The Farmers' Association Act of 1967 and the Farmers' Organisations Acts of 1973 show that this type of organisation is regarded by Government as an integral part of agricultural development. The intention to create FOs would be stressed from the earliest stages of ADU staff training. In fact the establishment and functioning of the ADU is seen as an essential stage in the creation of FOs.

CHAPTER 4

PROJECT DEVELOPMENT AND OUTPUT

4.1 INTRODUCTION

The overall assumptions and planning of the road based improvement programme have been described in the foregoing Chapters. It remains to combine these various aspects into a co-ordinated development plan, particularly the creation of supporting infrastructure which should be undertaken by the appropriate Government Departments and institutions. In this Chapter the build-up of the ADU is described and estimates of production and output value are given.

4.2 BUILD-UP OF THE ADU

4.2.1 Establishment of ADU Centres

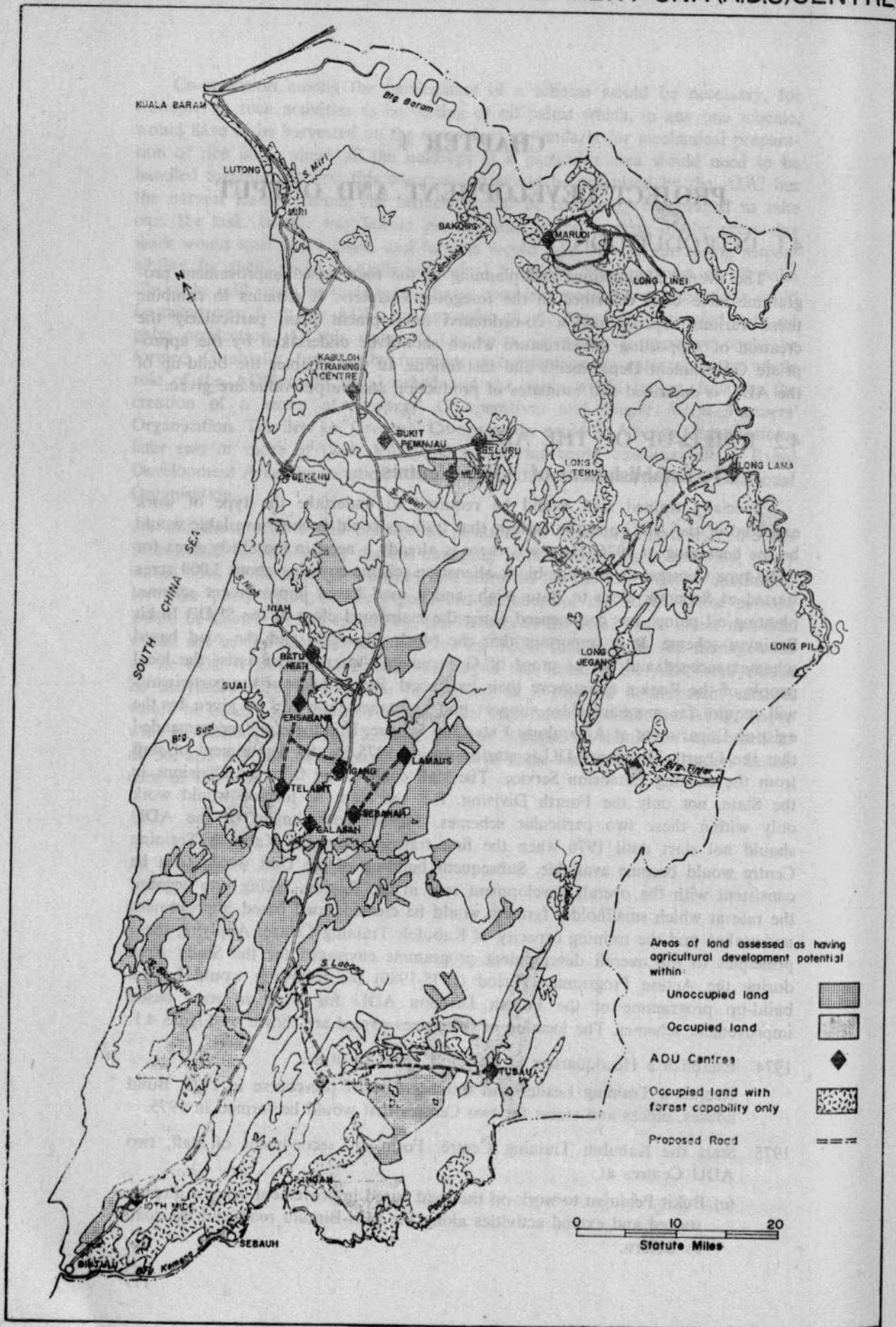
Specially trained staff would be required to undertake the type of work expected of the ADU and the earliest that trainees could become available would be the beginning of 1976. However, there is already a need in the Study Area for ADU-type Centres: there is the block alienation scheme covering about 3,000 acres started at Sepupok close to Batu Niah, and a road based improvement scheme, planting oil palms, has commenced along the main road close to the SLDB Bukit Peninjau scheme. It is important that the block alienation and the road based schemes succeed and act as proof of Government's intention to assist the local people of the Region to improve their livelihood. But to succeed the participants will require far more intensive support and assistance than can be given by the existing Department of Agriculture Extension Service. It is therefore recommended that the Fourth Division ADU is started during 1975 by the secondment of staff from the existing Extension Service. The staff could come from all Divisions in the State, not only the Fourth Division. But the team so formed would work only within these two particular schemes. Further commitment of the ADU should not start until 1976 when the first trainees from the Kabuloh Training Centre would become available. Subsequent build-up of the Unit would then be consistent with the overall development rate in the Region, taking into account the rate at which smallholder farmers would be created, road based improvement undertaken and the training capacity of Kabuloh Training Centre. Applying these principles to the overall development programme envisaged for the Study Area during the Action Programme Period (1975-1980) the following would be the build-up programme of the Fourth Division ADU for work in road based improvement schemes. The location of the places named are shown on Figure 4.1.

1974 Establish a Headquarters at Kabuloh Farm Institute.

Recruit a Training Leader and trainees to start the course in 1975. Build houses, offices and stores for two Centres that would be formed in 1975.

1975 Start the Kabuloh Training Centre. Form, by secondment of staff, two ADU Centres at:

(a) Bukit Peninjau to work on the road based improvement scheme already started and extend activities along the Miri-Bintulu road and the road to Beluru.



(b) Batu Niah to work with the participants of the Sepupok Block Alienation Scheme.

Build houses, offices and stores for Centres that would be formed in 1976.

1976 Maintain the first two Centres, and continue training course at Kabuloh. Form new Centres at:

(a) The new Farmers Training Centre (about 10 miles from Bintulu on the road to Miri) to undertake road based improvement along the Miri-Bintulu road.

(b) Beluru to undertake road based improvement along the new road extending from Beluru towards Long Lama, and along the road to Mera-a village.

(c) Marudi to undertake road based improvement along the existing circular road and along the new road to Long Linei.

(d) Bekenu to undertake road based improvement along the existing road to Bekenu.

Build houses, offices and stores for the Centre to be established in 1977.

1977 Maintain all previous Centres and continue training course. Form new Centres at:

(a) Long Lama to undertake road based improvement along the new road extending from Beluru to Long Lama.

(b) Labang to undertake road based improvement along the new road joining Labang to the Miri-Bintulu road.

Move in a second Extension Team at Batu Niah to extend road based improvement in the area. Build houses, offices and stores for Centres to be established in 1978.

1978 Maintain all previous Centres and continue the training course. Form new Centres at:

Tubau to undertake improvement on the new road from Labang to Tubau.

Reinforce Extension Teams at Bukit Peninjau and Batu Niah. Build houses, offices and stores for Centres to be established in 1979.

1979 Maintain all previous Centres and continue training course.

Reinforce Extension Teams at Batu Niah, Long Lama, Bekenu and Beluru. Also reinforce the Teams at the SLDB Sub-schemes at Galasah and Sebanah to undertake road based improvement into surrounding legally occupied land.

1980 Maintain all previous Centres and continue the training course.

Move in a second Extension Team at Bukit Peninjau to extend road based improvement in the area.

Reinforce Extension Team at Labang.

1981 Maintain all Centres and continue the training course.

Move in new Extension Teams at Batu Niah, Bekenu and Beluru. Reinforce Extension Teams at Tubau and the SLDB sub-scheme of Ensabang to undertake road based improvement into nearby legally occupied land.

Build houses, offices and store for Centre to be formed in 1982.

1982 Maintain all previous Centres and continue the training course.

Move in second Extension Teams at Beluru and Bekenu. Reinforce teams at Tubau and the SLDB sub-schemes of Galasah and Sebanah.

A summary of the Centres formed is given in Table 4.1.

TABLE 4.1 SUMMARY OF BUILD-UP OF ADU CENTRES FOR ROAD BASED IMPROVEMENT SCHEMES

Rural Development Area	ADU Centre Formed at	Year Formed	Extension Teams		
			Initial Number	Year of Other Teams	Year of Reinforcement
Lambir-Subis	Bukit Peninjau	1975	1	1980	1977 & 1980
Niah-Suai	Batu Niah ⁽¹⁾	1977	1	1981	1978 & 1979
Lambir-Subis	Bekenu	1976	1	1981	1979
Bintulu	Bintulu 10th Mile	1976	1	—	1979
Lambir-Subis	Beluru	1976	1	1981	1979
Marudi	Marudi	1976	1	—	1979
Long Lama	Long Lama	1977	1	—	1980
Sekudong	Labang	1977	1	—	1980
Labang-Tubau	Tubau	1978	1	—	1981

(1) An ADU Centre will have been formed at Batu Niah in 1975 for support of settlers on the Sepupok Block Alienation Scheme.

4.2.2 Staff Requirements

Summaries of the estimated staff requirements to fulfil the build-up described above are given in the following tables while the assumptions used to obtain the estimates are given in Appendix IV.

The Headquarters and the Extension Teams together with the number of farmers handled—Table 4.2.

The supply, marketing and farm mechanisation services, (The Economic Section)—Table 4.3.

The credit, savings and accounting services—Table 4.4.

The numbers given in each table include those staff and farmers associated with all ADU Centres, including those created to guide and assist smallholder farmers on large-scale schemes undertaken by SLDB. These persons are included here because to do so gives a true picture of the size and scope of the ADU.

It is shown that the supply, credit, farm mechanisation, marketing and accounting functions are kept to a minimum during 1975. This is because these activities require specially trained men who would not be available in any numbers until the ADU training scheme comes into operation; this would not be before 1976. The Marketing function will not be required until sufficient progress has been made by each Centre to warrant it or until the oil palm and cocoa plantations come into bearing.

TABLE 4.2 ESTIMATED NUMBER OF STAFF REQUIRED FOR THE ADU HEADQUARTERS AND EXTENSION TEAMS AND THE NUMBER OF FARMERS HANDLED

Year	Staff Required									Farmers Handled			
	Headquarters Section			Extension Section						Total Staff	Small-holders	Road Based	Total
	Agric. Leader	Training Leader	Adm. Leader	Section Leader	Super-visors	Exten-sion Agents	Home Demon-strators	Forest Guards					
1975	1	1	1	nil	2	6	2	nil	10	nil	150	150	
1976	1	1	1	1	7	21	7	1	37	194	510	704	
1977	1	1	1	1	10	30	10	1	52	194	945	1,139	
1978	1	1	1	2	14	45	14	3	78	621	1,390	2,011	
1979	1	1	1	4	14	65	16	4	104	952	1,845	2,772	
1980	1	1	1	4	19	78	19	5	125	1,270	2,269	3,539	
1981	1	1	1	6	23	90	23	5	147	1,270	2,797	4,067	
1982	1	1	1	7	25	96	25	6	159	1,538	3,147	4,685	

TABLE 4.3 ESTIMATED NUMBER OF STAFF REQUIRED FROM THE ECONOMIC SECTION (Total Numbers)

Year	For Supply Service		For Marketing Service		Mechanisation Service		Overall Total
	Storeman	Assistant Storeman	Recorder	Assistant Recorder	Mechanic/Tractor Driver	Machine Operator	
1975	2	—	—	—	—	2	4
1976	6	—	—	—	1	7	14
1977	8	1	—	—	3	11	23
1978	9	3	—	—	9	20	41
1979	10	9	3	3	12	31	63
1980	10	12	8	8	14	38	90
1981	12	14	12	12	14	43	107
1982	13	15	13	15	15	45	114

TABLE 4.4 ESTIMATED NUMBER OF STAFF REQUIRED FROM THE CREDIT AND ACCOUNTS SECTION

Year	Credit Section			Accounts Section		Overall Total
	Pay Clerk I/C Section at ADU Centres	Assistant Clerks		Accountant I/C Section at ADU Centres	Assistant Accountant	
		Credit Sub-section	Savings Sub-section			
1975	2	1	1	2	—	6
1976	7	1	1	7	—	16
1977	9	1	1	9	1	21
1978	12	1	1	12	2	28
1979	13	2	2	13	5	35
1980	14	2	2	14	8	40
1981	14	4	4	14	12	48
1982	15	5	5	15	13	53
1983	15	6	6	15	14	56
1984	15	6	6	15	14	56
1985	15	7	7	15	15	59

4.2.3 Transport Requirements

Senior Divisional Headquarters staff and all the staff at the ADU Centres including those working mainly in the offices and stores will need to be mobile. The Agricultural Leader, Administrative Leader and Training Leader would require four-wheel drive vehicles while for the rest of the staff motor-cycles would suffice. It is recommended that loans be made available for the purchase of the vehicles and motor-cycles, and an allowance paid for duty travel. Additional transport (lorries) would be required for moving supplies. It is assumed that at each Centre dealing with road based improvement and block alienation a lorry will be required when the number of farmers handled reaches about 150, but in the other Centres only when SLDB management ceases. The carrying of produce to the processing centres or to market is assumed to be contracted out or handled by SLDB. An estimate of the ADU transport requirements is given in Table 4.5.

TABLE 4.5 THE ESTIMATED VEHICLE REQUIREMENT FOR THE ADU UP TO 1982

Year	Four-wheel Drive		Motor-cycle		Lorries	
	New	Cumulative Total	New	Cumulative Total	New	Cumulative Total
1975	3	3	10	10	—	—
1976	1	4	25	35	1	1
1977	—	4	16	51	2	3
1978	1	5	28	79	6	9
1979	2	7	33	112	3	12
1980	—	7	23	135	2	14
1981	2	9	45	180	—	14
1982	1	10	12	192	1	15

4.2.4 Equipment Requirements

The estimated needs for equipment are shown in Table 4.6. The assumptions used in obtaining these figures are given in Appendix VIII.

TABLE 4.6 ESTIMATED EQUIPMENT REQUIRED BY THE ADU UP TO 1982

Year	Tractor and Rotavator(1)			Power-tiller			Motor Operated Knapsack Sprayer		Hand Operated Knapsack Sprayer		Rice Thresher	
	New	Operating	Standby	New	Operating	Standby	New	Operating	New	Operating	New	Operating
1975	—	—	—	2	2	—	2	2	3	3	2	2
1976	1	1	—	7	7	2	5	7	11	14	5	7
1977	2	3	—	5	11	3	4	11	10	24	4	11
1978	8	9	2	12	20	6	9	20	15	39	9	20
1979	3	12	2	14	31	9	11	31	23	62	11	31
1980	3	14	3	10	38	12	7	38	14	76	7	38
1981	—	14	3	6	43	13	5	43	12	88	5	43
1982	1	15	3	3	45	14	2	45	6	94	2	45

(1) The majority of these would be required on the SLDB developed sub-schemes not on the road based schemes.

4.3 PROJECT OUTPUT

The assumed yields for oil palm, rubber, cocoa and pepper on road based improvement schemes are given in Table 4.7. The yields are 15 per cent lower than those assumed for similar crops in the SLDB developed areas because it is considered unlikely that the high standard of management and crop husbandry expected on the SLDB areas will be also obtained on the road based schemes.

Rice yields are expected to rise, as a result of improvements, from the present 0.78 tons per acre to 1.23 tons per acre in four years.

The prices used in the evaluation of production from the road based schemes are those forecast on the basis of market studies summarised in Appendix II. Although rice is primarily intended for subsistence consumption, for project evaluation a price of \$317 per ton of padi at the farm-gate has been used.

TABLE 4.7 THE ASSUMED CROP YIELDS ON ROAD BASED IMPROVEMENT SCHEMES

Year After Planting	Oil Palm ffb (tons per acre)	Rubber drc (lbs per acre)	Cocoa dbe (tons per acre)	Pepper		
				Green Berries (tons per acre)	Made Black Pepper (tons per acre)	Made White Pepper (tons per acre)
3	0.4	nil	nil	4.58	0.90	0.49
4	3.1	nil	0.19	7.97	1.57	0.86
5	5.2	nil	0.38	9.16	1.81	0.98
6	6.6	nil	0.57	9.16	1.81	0.98
7	7.2	527	0.57	8.15	1.61	0.88
8	7.5	359		6.84	1.35	0.73
9	7.7	1,071		5.89	1.16	0.63
10	7.7	1,207		5.29	1.04	0.57
11	7.7	1,275		4.82	0.95	0.52
12	7.6	1,360		4.58	0.90	0.49
13	7.5	1,445				
14	7.3	1,530				
15	7.2	1,530				
16	7.1					
17	7.0					
18	6.8					
19	6.7					
20	6.7					
21	6.6					
22	6.6					
23	6.5					
24	6.5					
25	6.4					

ffb = fresh fruit bunches.
drc = dry rubber content.
dbe = dry bean equivalent.

of these costs and the computation methods employed are as follows:

(a) Crop costs include land development, production, transport and distribution. For the project as a whole, it has been necessary to adopt a computation procedure which gave the total costs for various items in any given year. The basis of the computations have been the cropping pattern, the costs of various crops and the total acreages developed in each year as given in Chapter 4.

The basic crop costs on which the analysis is based are given in Appendix X. The computed weighted average costs per acre calculated for each cropping pattern are given in Table 5.2.

(b) Processing costs have been based on a rate per ton for products from the main tree crops produced as follows:

oil palm at \$12 per ton ffb from all schemes;

rubber at \$140 per ton drc assuming that latex is delivered to a crumb rubber factory;

cocoa fermentation and drying in Samoan-type driers at \$78.40 per ton dried bean equivalent (dbe).

TABLE 5.2 AVERAGE CROP COSTS DERIVED FOR ROAD BASED IMPROVEMENT SCHEMES (\$ per acre)

Year of Scheme	Areas Within Reach of Oil Palm Mills			Areas Remote from Oil Palm Mills		
	Land Development	Crop Production Materials	Transport and Distribution	Land Development	Crop Production Materials	Transport and Distribution
0	6.6	—	—	7.4	—	—
1	41.3	73.3	—	47.7	52.1	—
2	17.2	47.2	—	21.1	34.2	—
3	2.8	50.9	1.3	3.3	35.3	—
4	2.8	59.3	9.9	3.3	39.3	0.7
5		65.8	17.0		41.5	1.3
6		64.7	21.9		41.2	2.0
7		79.6	32.3		66.5	16.4
8		70.2	36.6		50.8	22.4
9		70.5	39.4		50.8	26.2
10		69.8	40.9		50.1	28.8
11		69.7	41.6		50.1	30.1
12		73.0	42.2		55.7	31.5
13		73.0	42.9		55.7	31.2
14		73.0	43.3		55.7	34.6
15		73.0	43.1		55.7	34.6
16		73.0	42.5		55.7	
17		73.6	42.2		56.5	
18		72.9	41.7		55.7	
19		72.9	41.2		55.7	
20			41.2			
21			40.9			
22			40.9			
23			40.6			
24			40.6			
25			40.4			

The total processing costs have been calculated from the crop production quantities estimated for the project given in Chapter 4.

- (c) ADU management costs have been based on the overall costs given in Appendix IX and include costs of staff training, housing, vehicles, equipment and general running costs. Actual costs to the project of the Extension and Economic Sections of the ADU have been calculated on the basis of staff and equipment employed directly on the different schemes plus two-thirds of the Headquarters Section costs.

5.3 PROJECT REVENUES

The revenues attributed to the project in the analyses have been made up of the value of the crops produced at their projected fob prices given in Appendix II. For commercial analysis the export duties have been deducted at appropriate rates. The value of 'other crops' has been included on the basis of the following estimated net values per acre.

<i>Year of Scheme</i>							<i>Estimated Value of 'Other Crops'</i>
2	...	...	...	...	...	...	100
3	...	...	...	...	...	...	100
4	...	...	...	...	...	...	200
5	...	...	...	...	...	...	200
6 and onwards	...	...	...	...	...	...	300

5.4 ECONOMIC ANALYSES

5.4.1 Economic Evaluation at Market Prices

The net cash flow computed for the Project is summarised in Table 5.3, depicted in Figure 5.1 and detailed in Appendix X. The investment period of the scheme, i.e. when costs exceed revenue, would be nine years and the accumulated annual deficits amount to \$28.4 mn by 1983. The annual cash surplus would rise to a peak of \$14.4 mn in 1999. The analysis has been computed at basic prices and allows for export duties on palm oil and rubber.

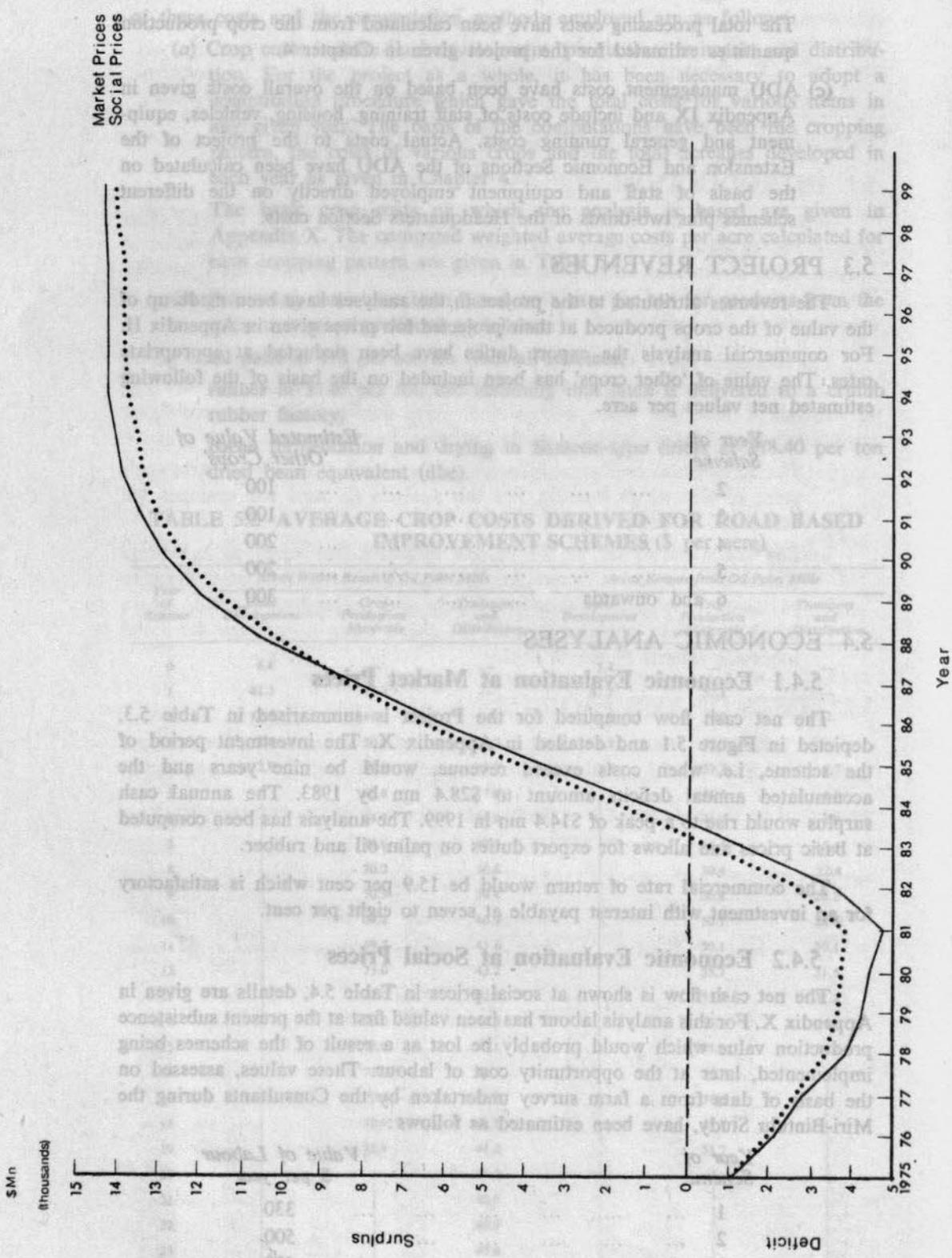
The commercial rate of return would be 15.9 per cent which is satisfactory for an investment with interest payable at seven to eight per cent.

5.4.2 Economic Evaluation at Social Prices

The net cash flow is shown at social prices in Table 5.4, details are given in Appendix X. For this analysis labour has been valued first at the present subsistence production value which would probably be lost as a result of the schemes being implemented, later at the opportunity cost of labour. These values, assessed on the basis of data from a farm survey undertaken by the Consultants during the Miri-Bintulu Study, have been estimated as follows:

<i>Year of Scheme</i>							<i>Value of Labour \$ per year</i>
1	...	...	...	...	...	...	330
2	...	...	...	...	...	...	500
3	...	...	...	...	...	...	670
4	...	...	...	...	...	...	830
5 and onwards	...	...	...	...	...	...	1,000

FIGURE 5-1



ROAD BASED IMPROVEMENT SCHEMES CASH FLOW

**TABLE 5.3 ROAD BASED IMPROVEMENT SCHEMES
CASH FLOW AT MARKET PRICES (\$ 000)**

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Gross Sales Revenue (excl. duty)	—	—	60.4	266.4	821.4	1,808.4	3,167.5	4,991.0	7,643.5
Total Farm Costs	90.9	609.3	1,478.3	2,403.1	3,382.9	4,499.7	5,715.9	6,888.5	7,035.9
Total Project Costs	1,082.4	1,494.2	1,422.7	1,693.5	1,680.1	1,749.7	2,236.5	1,748.2	1,912.7
Net Cash Flow	-1,173.3	-2,103.5	-2,840.6	-3,830.2	-4,241.6	-4,441.0	-4,784.9	-3,645.7	-1,305.1

	1984	1985	1986	1987	1988	1989	1990	1991
Gross Sales Revenue (excl. duty)	10,782.9	14,517.5	17,870.4	20,750.4	23,458.5	25,183.6	26,385.7	27,156.2
Total Farm Costs	7,554.5	8,116.6	8,452.5	8,700.1	8,983.4	9,010.4	9,106.5	9,174.2
Total Project Costs	2,299.1	2,779.2	3,299.1	3,722.5	4,005.8	4,268.8	4,395.3	4,542.2
Net Cash Flow	+929.3	+3,621.7	+6,118.8	+8,327.8	+10,469.3	+11,904.6	+12,883.9	+13,439.8

	1992	1993	1994	1995	1996	1997	1998	1999
Gross Sales Revenue (excl. duty)	27,654.0	27,998.8	28,176.6	28,239.8	28,239.8	28,239.8	28,239.8	28,239.8
Total Farm Costs	9,232.0	9,286.3	9,294.5	9,296.1	9,285.8	9,274.5	9,266.3	9,266.3
Total Project Costs	4,493.3	4,561.3	4,560.0	4,622.7	4,582.5	4,571.0	4,559.6	4,548.8
Net Cash Flow	+13,928.7	+14,151.2	+14,322.1	+14,321.0	+14,371.5	+14,394.3	+14,413.9	+14,424.7

**TABLE 5.4 ROAD BASED IMPROVEMENT SCHEMES
CASH FLOW AT SOCIAL PRICES (\$ 000)**

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Gross Revenue (fob price)	—	—	60.4	268.9	842.5	1,865.6	3,272.0	5,166.6	7,937.8
Total Farm Costs	65.4	509.9	1,261.6	2,030.4	2,818.9	3,717.4	4,694.4	5,709.6	5,737.3
Total Project Costs	1,082.4	1,494.2	1,422.7	1,697.6	1,720.3	1,866.2	2,463.7	2,139.6	2,576.4
Net Cash Flow	-1,147.8	-2,004.1	-2,623.9	-3,459.1	-3,696.7	-3,718.0	-3,886.1	-2,682.6	-375.9

	1984	1985	1986	1987	1988	1989	1990	1991
Gross Revenue (fob price)	11,233.0	15,166.6	18,704.0	21,749.9	24,619.9	26,447.2	27,719.9	28,534.8
Total Farm Costs	6,172.9	6,690.1	7,026.0	7,273.6	7,556.9	7,583.9	7,680.0	7,747.7
Total Project Costs	3,337.9	4,273.6	5,216.7	6,021.2	6,671.3	7,167.4	7,456.3	7,706.8
Net Cash Flow	+1,722.2	+4,202.9	+6,461.3	+8,455.1	+10,391.7	+11,695.9	+12,583.6	+13,080.3

	1992	1993	1994	1995	1996	1997	1998	1999
Gross Revenue (fob price)	29,060.9	29,424.4	29,611.1	29,676.4	29,676.4	29,676.4	29,676.4	29,676.4
Total Farm Costs	7,805.5	7,859.8	7,868.0	7,869.6	7,859.3	7,848.0	7,839.8	7,839.8
Total Project Costs	7,724.6	7,838.4	7,860.4	7,931.0	7,878.4	7,855.4	7,832.6	7,811.0
Net Cash Flow	+13,530.8	+13,726.2	+13,882.7	+13,875.8	+13,938.7	+13,973.0	+14,004.0	+14,025.6

The internal rate of return and net present values calculated on this basis would be:

IRR, 17.7 per cent;

NPV over 25 years \$37.7 mn at seven per cent interest, and \$19.1 mn at 10 per cent interest.

These returns are regarded as satisfactory when compared to the opportunity cost of capital and indicate that the Sarawak economy would benefit from the project.

5.5 FINANCIAL ANALYSIS OF THE PROJECT

In addition to setting up the ADU and training its staff it would be necessary to ensure that sufficient funds are available to meet financial requirements at the farm level. The following analysis attempts to estimate these needs and to assess the overall financial viability of the project.

The financial requirements of farmers have been derived from the overall cash flow of the programme excluding ADU costs and allowing the same labour income to farmers as was used in the commercial economic analysis (see Section 5.4.2). The cash flow computed on this basis is given in Table 5.5 and detailed in Appendix X.

The estimated total financial requirements of farm development derived from the annual deficit cash flows amount to \$14.8 mn over nine years. Including interest at seven per cent the cumulative deficit would amount to \$20.1 mn, and the payback period would be 13 years. This shows that there would be a satisfactory repayment capacity at the farm level.

TABLE 5.5 ROAD BASED IMPROVEMENT SCHEMES
SUMMARY FINANCIAL REQUIREMENT
AND REPAYMENT CAPACITY (\$ 000)

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total Gross Sales Revenue	—	—	60.4	266.4	821.4	1,808.4	3,167.5	4,991.0	7,643.5
Total Costs and Farmer Income Requirements	90.9	609.3	1,478.3	2,407.2	3,423.1	4,616.2	5,943.1	7,279.9	7,699.6
Net Balance Required/Available for Repayment	-90.9	-609.3	-1,417.9	-2,140.8	-2,601.7	-2,807.8	-2,775.6	-2,288.9	-56.1
Cumulative Outstanding Balance Including Interest at 7 per cent	-97.3	-756.1	-2,326.2	-4,779.7	-7,898.1	-11,455.3	-15,227.1	-18,742.1	-20,114.1
		1984	1985	1986	1987	1988	1989	1990	1991
Total Gross Sales Revenue		10,782.9	14,517.5	17,870.4	20,750.4	23,458.5	25,183.6	26,385.7	27,156.2
Total Costs and Farmer Income Requirements		8,593.3	9,611.0	10,370.1	10,998.8	11,648.9	11,909.2	12,167.5	12,338.8
Net Balance Required/Available for Repayment		+2,189.6	+4,906.5	+7,500.3	+9,751.6	+11,809.6	+13,274.4	+14,218.2	+14,817.4
Cumulative Outstanding Balance Including Interest at 7 per cent		-19,179.2	-15,271.8	-8,315.5	—	—	—	—	—
		1992	1993	1994	1995	1996	1997	1998	1999
Total Gross Sales Revenue		27,654.0	27,998.8	28,176.6	28,239.8	28,239.8	28,239.8	28,239.8	28,239.8
Total Costs and Farmer Income Requirements		12,463.3	12,563.4	12,594.9	12,604.3	12,581.7	12,558.9	12,539.3	12,528.5
Net Balance Required/Available for Repayment		+15,190.7	+15,435.4	+15,581.7	+15,635.5	+15,658.1	+15,680.9	+15,700.5	+15,711.3
Cumulative Outstanding Balance Including Interest at 7 per cent		—	—	—	—	—	—	—	—

APPENDIX I

RESULTS OF SCREENING FOR SELECTION OF ENTERPRISES

TABLE II. GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO COMMERCIAL POTENTIALITY

Group	Group Description	Enterprises
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Group I
Enterprises known to be commercially viable for immediate development on a large scale.

Group II
Enterprises known to be commercially viable and suitable for immediate development but on a restricted scale or only for local export.

Group III
Enterprises with promising commercial prospects but requiring an initial period of trial or limited research prior to re-investigation for development on a large scale.

Group IV
Enterprises possibly suited to local environment but requiring considerable research and field trial before they could be considered for commercial planting.

APPENDIX I

Other oil plants

For the same reason, swamp rice (floating crop) is suitable for oil plants. In the same way, essential oils (citronella and sweet grass) are suitable for oil plants. In the same way, essential oils (citronella and sweet grass) are suitable for oil plants. In the same way, essential oils (citronella and sweet grass) are suitable for oil plants.

For the same reason, swamp rice (floating crop) is suitable for oil plants. In the same way, essential oils (citronella and sweet grass) are suitable for oil plants. In the same way, essential oils (citronella and sweet grass) are suitable for oil plants.

Legumes (beans, broadbeans, cowpeas, soya beans, etc.), maize and sorghum for pigs, bananas for export, papaya for human consumption, ginger, cassia, banana, sugar cane (matured sugar) for export, etc. (see table).

APPENDIX I

RESULTS OF SCREENING FOR SELECTION OF ENTERPRISES

TABLE I.1 GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO COMMERCIAL POTENTIALITY

Group Description	Enterprise
<p>Group I Enterprises known to be commercially viable for immediate development on a large scale.</p>	<p>Rubber, oil palms.</p>
<p>Group II Enterprises known to be commercially viable and suitable for immediate development but on a restricted scale or only for local market.</p>	<p>Maize for green cobs; swamp rice (single crop); vegetables for fresh markets; annatto, essential oils (lemon grass, patchouli), pepper, coffee*, cocoa, coconuts, tropical fruits for fresh markets, sago, beef breeding and fattening for fresh meat*, pigs for fresh meat, poultry (eggs, broilers and hatching eggs), aquaculture (fish and fresh water prawns).</p>
<p>Group III Enterprises with promising commercial prospects but requiring an initial period of trial or limited research prior to recommendation for development on a large scale.</p>	<p>Dried chillies, swamp rice (double cropping), tapioca for chips or feed, cashew nuts*, essential oils (citronella and vetiver grass), grasses and legumes for grazing or cutting, (beef production), spices (cardamom, turmeric, cloves, nutmegs), lowland tea, aquaculture (brackish water crustacea, turtles).</p>
<p>Group IV Enterprises possibly suited to local environment but requiring considerable research and field trial before they might be considered for commercial planting.</p>	<p>Legumes (beans, groundnuts, cowpea, soya beans, etc.), maize and sorghum for grain, bananas for export, papaya for papain, spices (vanilla, ginger, cassia, cinnamon), sugar cane (unrefined sugar), fruits for processing, sago (cultivated plantation).</p>

* Enterprises which are border-line between the group in which they are shown and the group which follows.

TABLE I.2. GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO ACCESSIBILITY AND TRANSPORT FACTORS

Group Description	Enterprise
<p>Group I Enterprises whose inputs and end-products would be easily transported and for which no special processing facilities would be envisaged. These activities were regarded as suitable for development in remote areas served by minor waterways or tracks.</p>	<p>Dried chillies, swamp rice (single crop)*, annatto, coffee (robusta), spice (cardamom), cashew nuts.</p>
<p>Group II Enterprises whose input requirements are high and whose end-products would be bulky but reasonably durable or could be processed on the farm, requiring simple means of transport on large rivers or rural roads. These activities were considered suitable for semi-remote areas.</p>	<p>Legumes (beans, groundnuts, cowpeas, soya beans, etc.), maize and sorghum for grain, papaya for papain, pepper, spices (tumeric, vanilla, ginger, cassia, cinnamon, cloves, nutmeg), sugar cane (unrefined sugar), cocoa, coconuts (copra), rubber.</p>
<p>Group III Enterprises which due to the bulkiness or perishability of their product or need for specialised large-scale processing of their products require good roads or waterways. These activities were considered suitable only where proximity to an all weather road network, navigable waterway, processing plant or urban market was satisfied.</p>	<p>Maize for green cobs, swamp rice (double cropping), tapioca for chips, vegetables for fresh market, fruits for fresh market or processing, essential oil crops, grasses and legumes for grazing or cutting (i.e. beef cattle rearing), oil palms, sago, tea (lowland), pigs for market, poultry for market, aquaculture schemes.</p>

* Cropping for home consumption only. If rice is grown for market it should be considered only in Group III.

TABLE I.3 ECONOMIC ACHIEVEMENTS OF SELECTED AGRICULTURAL ACTIVITIES

ACTIVITY	Returns to Resources		Internal Rate of Return (Social Prices) per cent	Commercial Rate of Return (Market Prices) per cent	Employment Generated		Investment Required	
	Labour \$/man day	Land \$ per acre/ annum			Full time Workers per 100 acres at Maturity	Cumulative Undiscounted Deficit Cash Flow \$ per acre	Cumulative Deficit Cash Flow Including Interest at 7 per cent \$ per acre	
Oil Palm								
Estate based on 60 ton per hour mill	14.1	148	23	14	6.5	1,356	1,713	
Smallholder farmer	10.0	155	23	15	6.7	1,147	1,430	
Rubber								
Estate based on 10 ton per day factory:								
Large lumps field material) without	2.3	Negative	9	3	18.6	2,213	3,291	
Latex field material) stimulation	3.6	20	11	6	18.1	2,195	3,056	
Latex field material with stimulation	4.2	45	12	8	21.1	2,201	3,063	
Smallholder delivering to central factory:								
Large lumps material) without	3.3	11	11	3	18.1	1,650	2,492	
Latex field material) stimulation	4.5	44	14	8	17.7	1,635	2,331	
Pepper								
Smallholder farmer:								
Average yield situation	7.6	925	38	23	82.5	4,127	4,666	
Low yield situation	5.6	463	26	11	73.7	4,127	4,666	
Cocoa								
Smallholder farmer	9.6	201	25	20	9.3	1,167	1,450	
Rice								
Smallholder farmer	3.7	35	14	3	15.4	1,098	1,316	
Beef								
Ranch (5,000 acres)								
Initial breeding scheme	11.0	40	12	9	1.1	1,630	2,202	
Expansion scheme	10.1	35	13	12	1.1	1,062	1,434	
Smallholder farmer growing-out steers	9.6	46	18	15	2.1	559	717	
Aquaculture schemes: smallholder/farmer								
1 acre Chinese carp	33.2	1,795	> 50	> 50	18.0	4,431	4,741	
1/2 acre Chinese carp	17.8	1,182	45	38	24.0	4,380	4,686	
1/10 acre Local fish	9.6	792	42	31	24.0	3,710	3,970	
1/2 acre prawns and local fish	18.0	1,151	46	39	24.0	4,310	4,612	
Turtles (11/100 acre)	5.0	869	37	13	140.0	4,327	4,864	

TABLE 1.4 GROUPING OF POTENTIAL AGRICULTURAL ENTERPRISES ACCORDING TO SUITABILITY FOR DIFFERENT STEEPNESS OF LAND

Slope Range (degrees)	Enterprises			Remarks	
	Annual Crops	Semi-perennial	Perennial		Other Enterprises
0 — 2	Swamp rice			Aquaculture	
0 — 6	Vegetables, pulses, maize, spices				If terraced, small patches could be grown on steeper land. Erosion control measures would be necessary on slopes above four degrees.
0 — 12		Essential oil crops papaya, pineapples	Bananas		
0 — 20			Oil palms, cardamom, coconuts, pasture, annatto, coffee, cocoa, fruit trees	Pigs, poultry, cattle rearing	The tree and bush crops would need to be contour planted on slopes between 4 and 12 degrees. Terraces or platforms would be required on slopes above 12 degrees and complete ground cover necessary during establishment.
0 — 25			Rubber, pepper, cloves, nutmeg, cashew nut		Terraces or platforms would be required above 12 degrees. Between 4 and 12 degrees contour planting would be necessary and complete ground cover necessary during establishment.

APPENDIX II

SUMMARY OF THE MARKETING ANALYSES

Comprehensive market studies were conducted only in those countries which were shown to be definitely suitable for production of the development plan by the screening process indicated. The objectives of the studies conducted were to estimate the extent to which the selected countries could be developed in the Study Area, the orientation that the development should take, and the likely trend of future prices. These studies are given in detail in Appendices I, II, III, IV and V, and are summarized below.

II. OIL PALMS

At present the world demand for palm oil exceeds supply and prices are high. However, the future market for palm oil and other products derived therefrom in the context of the overall world market for oil, fats and oils and vegetable oils.

The long-term predictions for the market for vegetable oils in the 1970-2000 range of competing products as well as substitutes, namely, animal oils and fats, which may favour or restrict vegetable oils, are given in Appendix I. The long-term predictions for the market for palm oil and other products derived therefrom are given in Appendix II. The long-term predictions for the market for palm oil and other products derived therefrom are given in Appendix II.

APPENDIX II

The Food and Agricultural Organization (FAO) and the United Nations (UN) in Malaysia were to plant an area of 200,000 acres of oil palm in the period 1970 to 1975 and 25,000 to 30,000 acres of oil palm in the period 1985 to 1990. These are targets likely to be exceeded in Malaysia. The total oil palm production would amount to about 40 per cent of the total world production of 3.7 to 4.9 million tons in 1975. The long-term world production of oil palm is projected to increase at a rate of 5.5 per cent per annum over the period 1975 to 1995. The projected world demand for fats and oils is about 2.1 per cent per annum. Thus by 1995 supplies are likely to outstrip demand and result in a sharp rise in the price of oil palm products.

Within the overall Malaysian context it is possible that a total area of 155,000 acres could be planted in the long term in oil palm production, depending on the projected world market situation.

The projected prices of palm oil and other products from the year 2000 onwards are as follows:

Year	Price per ton (US\$)	
	Palm oil	Crude palm kernel
1975	100	100
1985	150	150
1995	200	200

APPENDIX II

SUMMARY OF THE MARKETING ANALYSES

Comprehensive market studies were undertaken only of those enterprises which were shown to be definitely suitable for inclusion in the development plan by the screening process indicated. The objectives of the market analyses were to estimate the extent to which the selected enterprises could be developed in the Study Area, the orientation that the development should have, and the likely trend of future prices. These studies are given in detail in Supporting Report 2, Parts IV and V, and are summarised below.

II.1 OIL PALMS

At present the world demand for palm oil exceeds supply and prices are high. However, the future market for palm oil and palm kernels has to be viewed in the context of the overall world market for all vegetable and animal fats and oils.

The long-term predictions for this market are complex due to the wide range of competing products as well as technical, natural, economic and political factors which may favour or operate against particular products. Over the whole range the increasing possibilities for substitution between the various oils, in conjunction with economic factors, make it likely that there will be a decrease in price differences between particular types of oils and fats.

The Food and Agricultural Organisation's Indicative World Plan shows that if Malaysia were to plant an average of 30,000 acres of oil palms per year during the period 1970 to 1975 and 35,000 to 50,000 acres per year between 1975 and 1985 then the Federation's production would be at least 1.5 mn tons in 1985. These are targets likely to be equalled or exceeded by Malaysia as a whole, and production would amount to about 40 per cent of projected world palm oil productions of 3.7 to 4.0 mn tons by 1985. This total world output represents a growth rate of 5.5 per cent per annum over the period 1970 to 1985. The predicted growth in demand for fats and oils is about 3.5 per cent per annum. Thus by 1985 supplies are likely to outstrip demand and result in a predicted gradual decline in the price of oil palm products.

Within the overall Malaysian planting programme it is considered that up to 155,000 acres could be planted in the Study Area by 1990 without noticeably prejudicing the projected world market situation.

The projected prices of palm oil and palm kernels over the next 20 years are as follows:

Year	Price per ton fob Sarawak (\$)	
	Palm oil	Palm Kernels
1975	520	365
1980	422	315
1985	398	290
1990	398	290
1995	398	290

II.2 RUBBER

In the last decade the world market prospects for natural rubber have been overshadowed by competition from synthetic rubber. However, the very recent change in the marketing of crude oil supplies and the unprecedented increase in its price are reasons to adopt a more optimistic view with regard to demand for natural rubber. The present position is one where demand is greater than supply and prices are higher than for many years.

Since the increases in the price of crude oil considerable uncertainty has been attached to the FAO Indicative World Plan predictions which suggested that natural rubber might command 24 per cent of the elastomer market by 1985. Under the present changed conditions the market share of natural rubber could increase or decrease depending on a number of factors of which the more important are:

- the demand for oil supplies for other uses combined with high crude oil prices; this could induce caution in the rate of investment in synthetic rubber installations and act favourably for increased demand for natural rubber;
- increased refined fuel oil prices; this could cause a decline in the demand for vehicle tyres and therefore a drop in demand for natural rubber;
- improved primary processing techniques for natural rubber aimed at specialised forms catering for specific user needs; this could accelerate the expansion of uses for natural rubber.

A range of figures considered reasonable for natural rubber's share of the world market by 1985 is as follows:

	<i>Market share of natural rubber (per cent)</i>	<i>Equivalent quantity demand on world market (mn tons)</i>
High	32	5.95
Low	17	3.13
Average	24	4.45

These estimates, compared to present demand for natural rubber (about 2.4 mn tons), show that there should be an increased demand for it if it is available at a competitive price.

Projections of future production are extremely difficult to make because production has been so affected by changing prices. For this reason existing statistics are unreliable in gauging future production, but a review by the Rubber Research Institute of Malaysia (1970) estimated Malaysian production would reach 2.1 mn tons by 1980. In addition the widespread use of ethylene based stimulants could increase the figure by 100,000 tons. Continuing these possible production growths to 1985, Malaysian output might reach 2.6 to 2.8 mn tons, or about 60 per cent of world usage projected by FAO.

From available information it appears that the period from 1980 onwards will be a critical time for natural rubber on the world market. By then supplies from Malaysia are likely to have built up and similar increases can be expected from other major producing countries. Therefore, some degree of caution is recommended in rubber planting plans aimed at filling the present shortfall in supplies. Future production should be orientated to provide high yields and an

ensured supply of a uniform, good quality product. New and replacement plantings totalling about 90,000 acres by 1990 would appear a reasonable target for the Study Area. An important respect in this connection is that any new planting of rubber trees will not come into production for seven years by which time market conditions may have changed again.

In view of the uncertainty of the rubber market situation a basic price of 57 cents per pound fob Singapore was used in calculating the returns to rubber. This price would be equivalent to 47 cents per pound fob Sarawak. For a sensitivity analysis a price 20 per cent higher was used.

II.3 COCOA

During the period from the late 1950's to the mid-1960's cocoa production increased more rapidly than demand with the result that prices declined considerably by the mid-1960's. Since then production has increased slowly with virtually no changes over the past three years and prices have generally recovered, indicating that a balance is being reached between supply and demand. But a general feature of the cocoa market is its price instability with rapid changes from month to month and year to year. This has led to the present concerted efforts by major producers and consumers to negotiate an International Cocoa Agreement. Although reactions to this have been favourable final ratification has yet to be achieved.

The FAO commodity projections (1967 and 1971) suggest that supply and demand would be more or less in balance by 1985. However, if the potential which exists for increasing production in a number of countries is utilised there could be an overproduction by that time. Also past experience indicates that due to the relatively low price elasticity of demand in the main importing countries any tendency towards continuously high prices could result in curtailed consumption. Conversely, consumption is stimulated by periods of low prices and, in general, consumption is rising in developing countries at a faster rate than in the traditional consuming countries of the United States and Western Europe (4.0 per cent per annum compared to 3.5 per cent). For example chocolate is already manufactured in Peninsular Malaysia providing a ready market for the good quality cocoa produced in Sabah. Another encouraging feature of the cocoa market in recent years has been the increase in Soviet Union imports and this country was ranked third of world importers in 1971.

The conclusion of the market analysis was that the production from up to about 6,000 acres of cocoa in the Study Area by 1990 could be safely absorbed. Production should at first be aimed at the export of a high standard quality of dried beans. Sophisticated processing should not be undertaken but the manufacture of cocoa butter and powder could possibly be undertaken in Sarawak when local production of dried beans has reached sufficient quantities.

The prices forecast which has been used in the economic evaluations were as follows:

Year	U.S. Future Price	Fob Price Sarawak
	U.S. (\$) per lb.	Malaysian (\$) per lb.
1975	31	60
1980	29	55
1985	27	50
1990	27	50
1995	27	50

II.4 PEPPER

A feature of the world pepper trade is that production occurs only in a limited number of countries from which it is exported throughout the world. Variations in supply tend to cause fluctuating prices and contribute to competition between the exporting countries. Also the demand for pepper is very inelastic, thus prices respond to any change in the supply situation and wide fluctuations have tended to occur in the past. International measures to derive a buffer-stock operation to reduce price fluctuations are currently being examined but little progress has been made so far in the face of upward price trends.

Most pepper is consumed in its raw state, and in the producing countries little progress has been made up to now in discovering new uses or developing processing facilities. However, in the world market there is considerable increase in the use of oleoresin extraction of piperine from black pepper.

At present Sarawak pepper is mainly sold through brokers and agents in Singapore who provide credit, storage, clearing, grading and packing facilities as well as contact with overseas buyers. Marketing channels are, however, currently under review and a Pepper Marketing Board, aimed at promoting direct sales to consuming countries and securing a larger share of the world market for the Malaysian product, was established in 1973. The intention is to introduce a compulsory grading of all pepper exported from Sarawak. This will offer an opportunity (of which the Director of the Pepper Marketing Board is fully aware) for Sarawak to sell a grade of light berries directly to the oleoresin extraction firms thus gaining an opening in this expanding market.

Over the period 1968 to 1970 Sarawak on average accounted for 29 per cent of world exports. The world demand for pepper is projected to increase at the rate of two per cent per year (FAO, 1970). Sarawak's possible share of this demand is shown below on the basis of two assumptions—either retaining a constant share, or obtaining an increasing share of one per cent of the annual increase per year.

Year	World Demand Assuming a 2 per cent Annual Increase (Thousand tons)	Sarawak's Share			
		Assuming Constant Share		Assuming Share Increases	
		Quantity (Thousand tons)	% of World Demand	Quantity (Thousand tons)	% of World Demand
1970	85.0	24.5	29	24.5	29
1975	93.8	27.2	29	27.6	29.5
1980	103.6	30.0	29	32.0	31
1985	114.4	33.2	29	37.9	33
1990	126.3	36.6	29	45.7	36

The figures show that there are opportunities for increasing production of pepper in Sarawak and it is recommended that the crop is included in the cropping pattern for the Study Area. It should be considered an important supplementary crop to be grown by most farmers.

The prices used in the economic evaluations were the 1964 averages:—

\$125 per picul for white pepper

\$100 per picul for black pepper

II.5 RICE

Sarawak is an importer of rice. Overall consumption in the State has increased with population growth and local production has generally kept pace with, but has not equalled, the increased demand. Thus while imports have been necessary to supply total demand, the proportion of imports has tended to fall over the last decade from around 50 per cent in the early 1960's to under 40 per cent in the early 1970's. The most significant contribution to increasing local supplies is attributed to swamp rice production which has grown by about 70 per cent over the last decade. Overall production increased by 50 per cent over the same period.

Available statistics indicate that total local consumption of rice rose from about 120,000 tons in 1961 to about 159,000 tons in 1971. The per capita consumption has however shown no specific trend, averaging around 340 pounds of milled rice equivalent per year in Sarawak as a whole to 310 pounds in the Study Area. In poor crop years subsistence farmers go short of rice; imports do not balance the deficit because farmers in remote areas do not usually buy additional supplies in the market. Thus demand for rice in Sarawak is largely a function of population growth and, to a much lesser extent, income changes. For the purpose of projecting possible future local demand for rice the population of Sarawak has been assumed to grow at 2.8 per cent per annum, and per capita income at three per cent per annum. The income elasticity of demand for rice at that income growth rate is likely to be zero or negative (i.e. minus 0.2). On the basis of these assumptions two possible levels of per capita consumption of rice over the next 20 years have been calculated as shown.

Year	Average consumption per capita at two demand levels of income elasticity	
	A	B
	0	-0.2
Basic level	340	340
1975	340	330
1980	340	320
1985	340	310
1990	340	301

Using these consumption figures the following estimated future demands were calculated.

Year	Population '000	Projected Demand at per capita level 'A' ('000 tons rice)	Projected Demand at per capita level 'B' ('000 tons rice)
1975	1,120.5	170.1	165.1
1980	1,286.3	195.2	183.8
1985	1,476.8	224.2	204.4
1990	1,695.5	257.4	227.8

Possible future rice production in Sarawak up to 1990 is shown in Table II.1 and has been calculated on the following assumptions:—

- the total area of swamp rice would increase on average by 3,400 acres per annum or about 52,000 acres over the 20 year period;
- the total area of hill rice would remain static at about 186,000 acres;
- average yields of swamp rice would increase to 2,265 pounds padi by 1990 while hill rice yields would remain static at 640 pounds padi per acre.

On the basis of these estimates local production would be unlikely to supply the total Sarawak demand for rice by 1990, but the country would be 74 per cent self-sufficient.

Two alternative possibilities were examined for the 1990 situation:

Alternative I: assumes there would be a slight increase in the area under hill rice, and yields would increase to 2,750 and 800 pounds padi per acre for swamp and hill rice respectively. Under these assumptions the country would still not be self-sufficient.

Alternative II: assumes the area of swamp rice would increase by 6,800 acres per annum, and yields increase to the levels proposed for Alternative I. Total production would then possibly meet local demand.

Calculations similar to those above were carried out for the Study Area but applicable to a population growth of 4.0 per cent per annum which allows for in-migration. Future demand for rice was shown to reach almost 33,600 tons by 1990. It was found that if the yields from existing areas of rice cultivation were to remain at their present levels and there was no increase in the area under hill rice then to supply the demand would require the opening up of about 37,600 acres of new swamp rice land assuming present yields. But if yields on the new areas was 2,750 pounds per acre then roughly 22,000 new acres of swamp rice would suffice. If yields on existing swamp rice areas also increased to the higher level then only about 15,000 acres of new swamp rice land would be required.

TABLE II.1 PROJECTED SARAWAK RICE PRODUCTION 1975-1990

Year	Acreages			Yields of Padi		Total Production		
	Swamp Rice	Hill Rice	Total	Swamp Rice	Hill Rice	Swamp ⁽¹⁾ Rice	Hill ⁽¹⁾ Rice	Total
	Thousand acres			lb. per acre		Thousand tons rice		
1975	158	186	344	1,625	640	72.2	36.1	108.3
1980	175	186	361	1,840	640	90.6	36.1	126.7
1985	192	186	378	2,052	640	110.8	36.1	146.9
1990	209	186	395	2,265	640	133.1	36.1	169.2
1990 Alternative I	209	200	409	2,750	800	161.6	48.6	210.2
1990 Alternative II	260	186	446	2,750	800	201.1	48.6	249.7

NOTE: (1) Conversion rates of padi to milled rice equivalent were on the following basis:
Swamp rice, 63 per cent
Hill rice, 68 per cent.

These calculations show that, to meet the Government's target of at least self-sufficiency in rice, the development programme for the Study Area must include the opening up of sufficient new swamp land to supply the local population. This must be a minimum target.

The price for rice used in the economic calculation, was a farm-gate value of \$317 per ton of padi.

II.6 BEEF

Livestock production is of limited importance in Sarawak at present. Domestic production of pigs and poultry adequately supply the demand for these products. However, there has been no apparent change in the population of cattle and buffaloes over the past decade and about \$1.3 mn worth of beef is currently being imported either as live animals for slaughter or as frozen meat. There is thus an established local market for beef. On a worldwide basis FAO predictions indicate that future demands are likely to exceed supplies. This situation will undoubtedly lead to a hardening of beef prices and would enable a local beef industry to enter export markets.

The possible effect in Sarawak of an increase in local supplies of beef would be a decrease in retail prices which, if brought to the levels prevailing in Peninsular Malaysia of \$1.6 per pound, would increase annual consumption from the present 1.33 pounds per capita to about 4.3 pounds. Future rises in living standards would increase this consumption rate to about 9.0 pounds by 1995. Using these assumptions, projections of quantities of beef, carcasses and animals required in Sarawak are given in Table II.2.

TABLE II.2 **PROJECTED BEEF CONSUMPTION IN SARAWAK 1975-1995 AT PRICES EQUIVALENT TO THOSE IN PENINSULAR MALAYSIA**

Year	Beef Consumption		Equivalent Number of Carcasses at 400 lb each	Equivalent Number of Animals required in the National Herd
	Per Capita lb.	Total ('000 lb.)		
1975	5.0	5,480	13,700	63,125
1980	5.8	7,192	17,940	89,875
1985	6.7	9,400	23,500	117,500
1990	7.8	12,386	37,212	150,500
1995	9.0	16,164	40,412	208,250

The main external markets to which Sarawak beef might be exported are Hong Kong, Japan, Brunei and Singapore. All these are already supplied with live animals and/or meat by large-scale, well established organisations in Australia, New Zealand, China, Thailand and Indonesia. To compete with these traditional suppliers will require efficient production methods and high veterinary standards. On the other hand demand in the potential markets will rise considerably. For example, the Singapore market is currently estimated to require 12,000 live animals and seven million pounds of frozen beef annually, and by 1990 demand,

even at a conservative growth rate, is expected to treble. So there should be ample scope for Sarawak to enter the export trade. But initial developments in Sarawak should aim at supplying the local market. When this has been achieved the first exports should be live animals because the production of chilled or frozen meat will require costly slaughterhouse and refrigeration plant, which would not be worth establishing for an output of less than 25,000 head per annum.

The prices used in the economic evaluation were:

- for weaners and steers, between 50 and 60 cents per lb. liveweight;
- breeding heifers were valued in relation to future production potential assessed on the basis of seven calves, worth \$540 each, produced over eight years;
- for cull cows \$450 each.

II.7 FRESHWATER FISH AND PRAWNS

Fish is by far the greatest source of protein in the human diet in Sarawak and production of pond cultured fish should be aimed for the foreseeable future at satisfying local demand. The market for freshwater fishes is in two main categories:

- (i) rural domestic demand for fresh fish, mainly smaller sized and locally bred;
- (ii) the speciality urban fish market linked to the restaurant and special occasion (such as Chinese New Year) trade.

Probably the greatest need is in the rural areas where the supply of fresh fish from marine sources is usually not available. Freshwater culture of fish in these areas will be appropriate because most rural people are already familiar with freshwater fish and there is no sales resistance to this commodity.

II.8 TAIWAN TURTLES

These can be sent to market alive and, provided they are occasionally moistened with water and kept in the shade, they can survive for a number of days out of the pond. Therefore, easily reached markets anywhere in Sarawak can be considered.

There is already a good demand for the local soft-shelled turtle in the Kuching and Sibuan restaurants, but generally most of the local turtles are too large for an average family. The Taiwan turtle, which is ideal for market at about two pounds, would have an initial novelty value and would appeal to the housewife.

Once local demand is satisfied the export markets could be exploited. Kuala Lumpur, Singapore, Hong Kong and Japan are all potential markets where the price could be expected to be double that in Sarawak. In Hong Kong and Japan turtles are not only a source of food, but medicine is made from the blood and bile.

II.9 OTHER CROPS

II.9.1 Robusta Coffee

In Sarawak local production does not satisfy demand. In 1972 imports of coffee, in one form or another, amounted to about \$1.46 mn. Recent market estimates made for Peninsular Malaysia (FAMA, 1973) indicated that there is an immediate market for about 2,500 tons of coffee beans per year.

II.9.2 Annatto (*Bixa orellana*)

The seed of this small tree is covered by a red substance which has a value as a colouring agent in foods and cosmetics. World market demand has risen recently due to increased restrictions in the United States, Western Europe and Japan on the use of synthetic colourings. A ready market exists for the dried seeds in Singapore.

II.9.3 Cashew Nuts

The export market consists of three products; unshelled cashew nuts, cashew kernels and cashew nut shell liquid. The last product need not be considered at this stage because supply already exceeds demand and future demand is not likely to increase faster than the present large-scale producers could easily match. But the potential markets for unshelled nuts and kernels are good.

India is the main purchaser of unshelled nuts; it imports between 150,000 and 200,000 tons of nuts a year to supply its processing factories which re-export the extracted kernels. However, the present main supply of unshelled nuts (East Africa) is already diminishing as an increasingly large proportion of the crop is diverted to the extraction plants recently introduced into those countries. Despite efforts by India to increase its domestic supply of nuts it seems likely that it will create a strong demand for unshelled nuts in the foreseeable future.

A possible further market for unshelled nuts from Sarawak is Peninsular Malaysia where cashew plantations and processing facilities are being established with Government support.

The market situation for cashew kernels has been extremely favourable over the last ten years. Both demand and prices have followed an upward trend. The prospects for further growth in demand in North America, Western Europe, Japan and Australia are good. It is expected that the market will be able to absorb all presently planned increases.

Thus, from the market point of view the planting of cashew nuts could be confidently undertaken in Sarawak and in the Study Area. Production should at first be aimed at the export of unshelled nuts because a total raw nut production of about 650 tons a year is required before it is worth installing a nut decorticating plant.

II.9.4 Spices

In most cases the aim in planting spice crops would be production for sale to the oleoresin extraction industry.

Prepared oleoresins are the residues isolated by evaporation of solvent extracts of plant material. They are mostly used as food flavouring and colouring and can come from almost any spice or herb.

Prepared oleoresins are normally sold to the food industry in the form of dispersed spice extracts, i.e. spread on a variety of dry sterile bases. In this form the products can be blended easily with other ingredients. The food industry is content to pay premia for the oleoresins which compete commercially with the dry spices because in the form of a dispersed extract it is sold weight for weight equivalent in strength to the dry spice. The advantages are:

- it avoids the high bacterial load carried by most major species;
- it is standardised in strength and quality to a greater extent than the dry spices.

Dispersed spice extracts have made, and continue to make, a large impact on the industrial market for spices. In the United States they have replaced about 70 per cent of this market, in the United Kingdom about 50 per cent and in Western Europe about 15 percent, but the percentage is rising.

The prospective demand for oleoresins is, therefore, great and their extraction would appear a profitable business for the major spice producing countries to enter. However, there are many technical and marketing problems which would demand caution in starting such an undertaking. The solution for Sarawak would be to sell the dried spice to an established nearby oleoresin extraction firm, in Singapore for example. The distance to Singapore is not great and freight charges would not be high. An established firm would have the technical know-how and the markets. Reasonably large, regular supplies of a standard dried product would be necessary.

Turmeric (*Curcuma longa*)

The present world demand for turmeric for oleoresin extraction is greater than 5,000 tons, which was the 1968 demand. It is used for both colouring and flavouring. For oleoresin extraction the rhizomes, after washing, can be chipped and then sun dried.

Ginger (*Zingibes officinale*)

There is a limited local market for undried ginger. For the oleoresin market the growing and preparation of ginger is the same as for turmeric.

Sweet and Hot Chillies (*Capsicum spp.*)

This group is the most important for oleoresin extraction. There is a large and expanding market for it. Paprika (*C. annum*) is valued for its flavour and its red colouring but is not likely to be of great promise in the Study Area because of the difficulty of drying the very fleshy fruits. But the small, very hot chilli *C. minimum* should not present this problem. The drying of locally collected samples presented no problem but evaluation for capsaicin content proved that the local variety is lacking in this ingredient and is not of commercial value. It will be necessary to introduce a sufficiently 'hot' variety. Seed of a commercial variety was obtained and passed to the Department of Agriculture in the Fourth Division. Other seed samples could be obtained from processing firms.

Nutmeg and Mace (*Myristica fragrans*)

Nutmeg is the seed of this tree crop and mace the covering which surrounds the shell containing the nutmeg. There is a limited market for these products.

Cloves (*Eugenia caryophyllata*)

There is a reasonable market for this crop in the world trade, but an interesting possibility would be to supply Indonesia. Although that country grows cloves itself the oil content of the variety is too high for inclusion in the cigarettes that are so popular there. Indonesia imports large quantities of cloves from Zanzibar for the cigarettes. Cloves of the correct variety, grown in Sarawak, would be in a good geographical position to supply that market.

Cardamom (*Ellettaria cardamomum*)

There is a limited but expanding market for this spice.

II.9.5 Essential Oil Crops

Generally it is difficult for a new producer to enter the essential oil market which is dominated by well established trading houses who have their traditional suppliers. Also quality standards of the refined oils are extremely stringent. Nevertheless there are possibilities of entering the market for the more widely used, and easily produced oils. The least possible processing should be undertaken locally.

There is a ready market in Singapore for the dried leaves and young stems of patchouli (*Pogostemon cablin*). The harvested material requires merely drying and bailing.

Citronella grass (*Cymbopogon nardus*) and Lemon grass (*C. citratus*) are crops which also produce oils in this category, but there would be need for simple distillation plants if these crops are to be included in the development.

APPENDIX III

THE PRESENT POSITION AND PLANNED FUTURE DEVELOPMENT IN RDA'S IN WHICH ROAD BASED IMPROVEMENT SCHEMES ARE RECOMMENDED

III.1 THE MARUDI RDA

III.1.1 The Present Situation

(a) General

The Area consists of the middle reaches of the Baram Basin and its tributaries. The centre of the Area is Marudi town, which has developed into a rich and continuing function as a trading and administrative centre for the whole Baram District. Timber logging is the main activity undertaken based on the vast swamp forests in and around the Area.

(b) Population

Urban (Marudi) 4,000

Rural and semi-urban in the remaining parts 500

(c) Communications

There are schools, health centres, and a post office in Marudi. The Marudi Station to Marudi from Miri, however, the Baram river and its tributaries which are navigable by large launches and dug-out canoes, will remain, for a long time, the main lines of communication. The existing circular road system is presently being extended to Long Linau.

(d) Agriculture

Apart from some 7,000 acres of rubber around Marudi town and about 1,000 acres at Kampung Karip as shown on Figure III.1, the farming is mainly of smallholdings along the river banks where breadfruit, fruits, sugar cane, wheat and rice are grown, while shifting hill rice cultivation predominates in the hills east of Marudi. However, within the Baram Basin system there are a large number of scattered plantings of already established rubber, however, of the total acreage vary between 20,000 and 40,000 acres and although much of it has been badly neglected it nevertheless represents a large potential production which might be exploited.

III.1.2 The Future Development

It is recommended that the development should be based largely on the production of rubber. Marudi town is already a rubber collection and marketing centre and this function should be strengthened. For several years more the river leading to Kuala Baram will be the only marketing outlet for the whole watershed. Thus it should be simple to control the movement of rubber in the Area and direct it to Marudi. This would make the town an ideal site for a processing factory, but a special study of the feasibility of a factory is required, mainly because the potential for securing a reliable, steady supply of rubber from the existing plantings of watered rubber is unknown. The Department of Agriculture is making this investigation.

APPENDIX III

THE PRESENT POSITION AND PLANNED FUTURE DEVELOPMENT IN RDA'S IN WHICH ROAD BASED IMPROVEMENT SCHEMES ARE RECOMMENDED

III.1 THE MARUDI RDA

III.1.1 The Present Situation

(a) General

The Area consists of the middle reaches of the Batang Baram and its tributaries. The centre of the Area is Marudi town, which has developed from its early and continuing function as a trading and administrative centre for the whole Baram District. Timber logging is the main activity undertaken based on the peat swamp forests in and around the Area.

(b) Population

Urban (Marudi), 4,000.

Rural and semi-urban in the remaining parts, 7,500.

(c) Communications

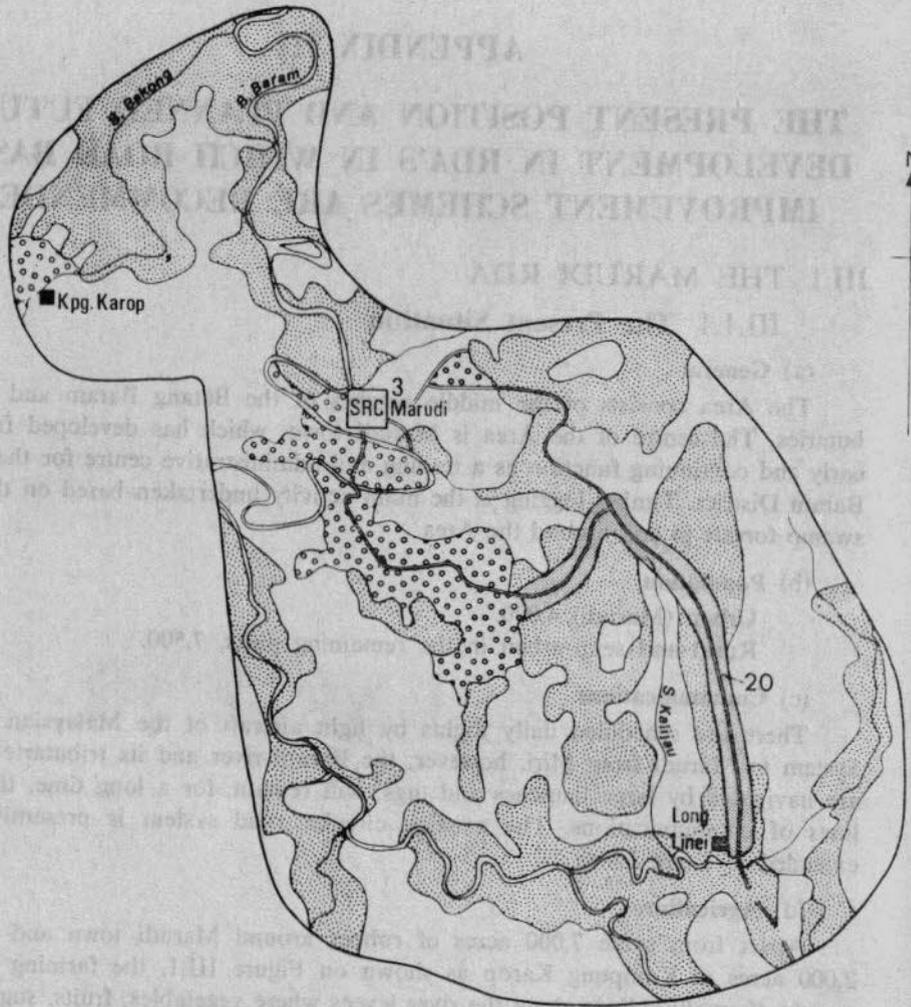
There are scheduled daily flights by light aircraft of the Malaysian Airline System to Marudi from Miri, however, the Baram river and its tributaries which are navigable by large launches and tugs, will remain, for a long time, the main lines of communications. The existing circular road system is presently being extended to Long Linei.

(d) Agriculture

Apart from some 7,000 acres of rubber around Marudi town and roughly 2,000 acres at Kampung Karop as shown on Figure III.1, the farming consists mainly of smallholdings along the river levees where vegetables, fruits, sugar cane, rubber and rice are grown, while shifting hill rice cultivation predominates in the hills east of Marudi. However, within the Batang Baram system there are a large number of scattered plantings of already established rubber. Estimates of the total acreage vary between 20,000 and 40,000 acres and although much of it has been badly neglected it nevertheless represents a large potential production which might be exploited.

III.1.2 The Future Development

It is recommended that this development should be based largely on the production of rubber. Marudi town is already a rubber collection and market centre and this function should be strengthened. For several years more the river, leading to Kuala Baram, will be the only marketing outlet for the whole catchment. Thus it should be simple to control the movement of rubber in the Area and direct it to Marudi. This would make the town an ideal site for a processing factory, but a special study of the feasibility of a factory is required before one is built because the potential for securing a reliable, steady supply of rubber from the existing plantings of scattered rubber is unknown. The Department of Agriculture is making this investigation.



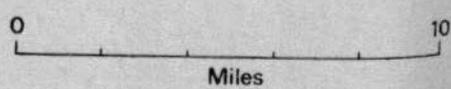
a: Development package presented in ANNEXURE II

EXISTING:

- Road [dotted line symbol]
- Occupied Land [stippled area symbol]
- Rubber [dotted area symbol]
- Village [solid black square symbol]

PROPOSED 1976-1980:

- Road [dashed line symbol]
- Road Based Improvement [thick solid line symbol]
- Sub-Regional Centre: [box with 'SRC' symbol]
- Rural Development Area Boundary [thick solid line symbol]
- Rural Development Package Number [box with '20' symbol]
- Town Development Package Number [box with '3' symbol]



In order to increase future production and create a firm basis for future improved rubber processing facilities it is proposed that there should be a road based improvement scheme, in which rubber would be given high priority, along the existing circular road and the new road to Long Linei. To support these efforts it is recommended that the subsidised Rubber Planting Scheme is re-introduced into this specific Area.

The road based improvement scheme has been planned to start in 1976. Details of the ADU Centre proposed for establishment in Marudi are given in Chapter 2. A semi-detailed soil survey would have to be carried out during 1975 along the roads concerned, covering about 6,000 acres. This survey would provide the information for planning the development to be undertaken by the ADU Team. A summary of the associated activities for this scheme are given in Table III.1.

TABLE III.1 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT IN MARUDI RDA

Activity	Agency			Specification	Phasing						
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980
Construction of Marudi-Long Linei Road ...	PWD	PWD	PWD	Secondary Road	—	|					
Semi-detailed Soil Survey ...	D of A	D of A	D of A	6,000 acres	—	|					
Establishment and Operation of Marudi ADU Centre ...	D of A	ADU	D of A	See Chapter 2 of this part					→		
Clearing and Planting Land in Road Based Improvement (RBI) Area ...	ADU	Private	Private	4,180 net acres					→		
Housing in RBI Area ...	Private	Private	Private	55 temporary units					→		
Construction and Operation of Cocoa Dryer ...	ADU	Private	Private	1 Samoan-type unit						→	

PWD = Public Works Department.
D of A = Department of Agriculture.

III.2 LAMBIR-SUBIS RDA

III.2.1 Present Situation

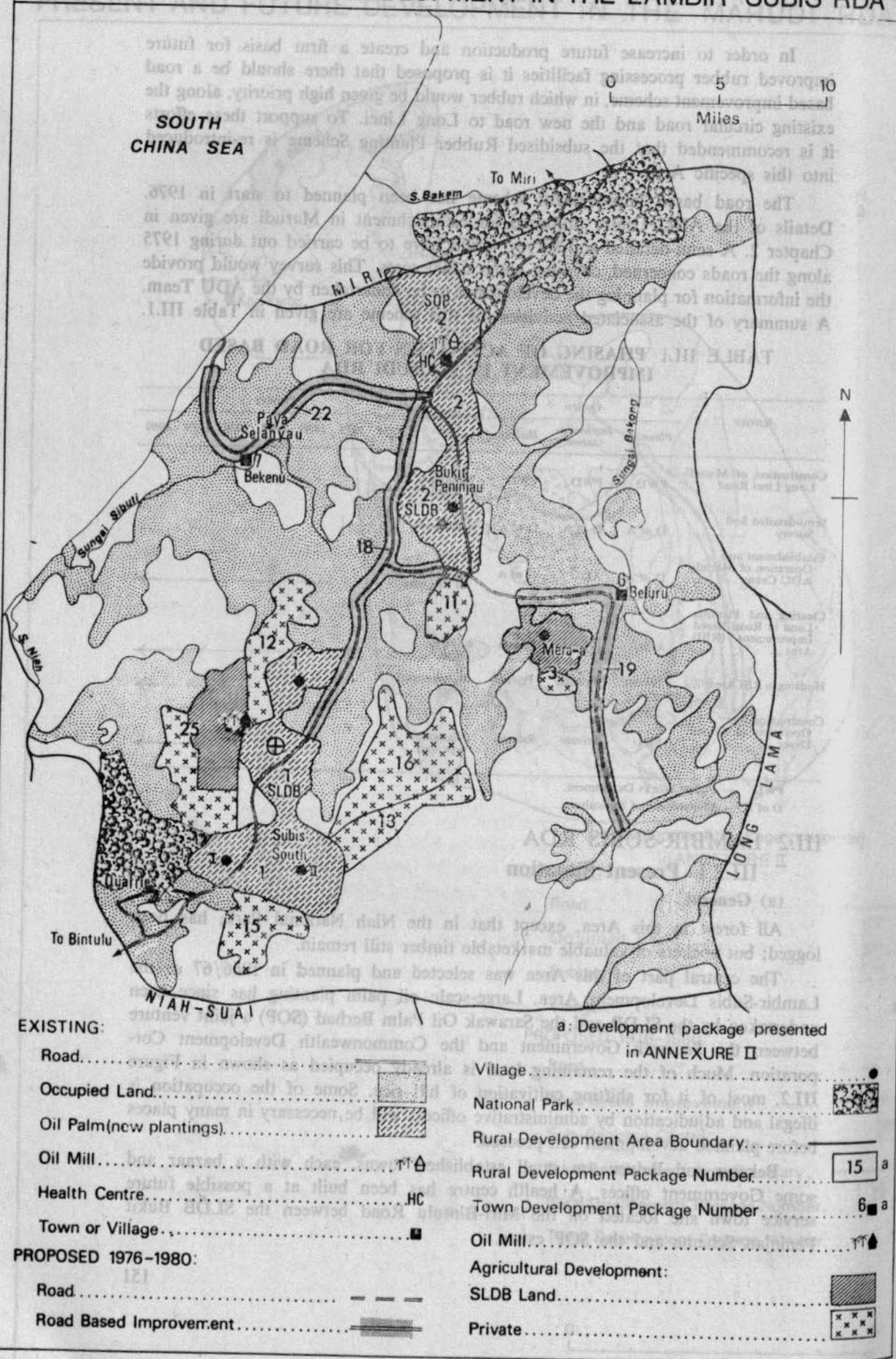
(a) General

All forest in this Area, except that in the Niah National Park, has been logged; but pockets of valuable marketable timber still remain.

The central part of this Area was selected and planned in 1966/67 as the Lambir-Subis Development Area. Large-scale oil palm planting has since been undertaken by the SLDB and the Sarawak Oil Palm Berhad (SOP) a joint venture between the Sarawak Government and the Commonwealth Development Corporation. Much of the remaining land is already occupied as shown in Figure III.2, most of it for shifting cultivation of hill rice. Some of the occupation is illegal and adjudication by administrative officers will be necessary in many places before planned development can proceed.

Bekenu and Beluru are small established towns, each with a bazaar and some Government offices. A health centre has been built at a possible future service town site located on the Miri-Bintulu Road between the SLDB Bukit Peninjau Scheme and the SOP estate.

PRESENT AND FUTURE DEVELOPMENT IN THE LAMBIR-SUBIS RDA



EXISTING:		a: Development package presented in ANNEXURE II
Road.....		Village.....
Occupied Land.....		National Park.....
Oil Palm(new plantings).....		Rural Development Area Boundary.....
Oil Mill.....		Rural Development Package Number.....
Health Centre.....		Town Development Package Number.....
Town or Village.....		Oil Mill.....
PROPOSED 1976-1980:		Agricultural Development:
Road.....		SLDB Land.....
Road Based Improvement.....		Private.....

(b) Population

Urban (Bekenu) 700.

Rural and semi-urban in the remaining parts 21,300.

(c) Communications

The all-weather Miri-Bintulu road passes right through the Area with other all-weather roads leading off it to Bekenu and Beluru. This latter road is currently being extended south-eastwards towards Long Lama.

The Sungai Niah and Sungai Sibuti are navigable by trading launches as far inland as Batu Niah and Bekenu respectively. However, the outlets to the sea of both the rivers have sand-bars which, together with the shallow coastal waters, severely restrict the size of vessels that can enter or leave the rivers. Just east of Batu Niah are two stone quarries which are the only easily accessible large sources of stone between Miri and Bintulu.

(d) Agriculture

The SOP and SLDB oil palm plantings are estate-type undertakings commenced in 1969 and covering, by the end of 1974, approximately 10,000 and 27,600 acres respectively. The earliest oil palm plantings, those of SOP, will come into bearing in early 1974 when the SOP palm oil mill with an eventual capacity of 20 tons ffb per hour is due for completion. The mill's capacity is expected to be a little in excess of the production from the SOP plantings. Thus it might be possible to provide processing facilities for fruit from a limited area of oil palms planted by local farmers in the vicinity.

The SLDB mill currently being planned is expected to be located on the north-western boundary of the SLDB Subis Scheme and is expected to have an ultimate capacity of about 60 tons of ffb per hour. The first stage should be operational in 1975. The mill is expected to be able to process fruit from nearby private growers. The Department of Agriculture has already initiated a road based scheme near Bukit Peninjau to plant 300 acres of oil palms on Native Customary Land during 1973/74.

Much of the agriculture in the occupied areas is shifting cultivation of hill rice, but around Bekenu, along the road leading to it and along the Sibuti river much of the land is divided into smallholdings, issued under title, where swamp rice, fruit trees and rubber are grown. Also near Bekenu, at Paya Selanyau, there is a partially completed Government rice scheme where drainage and irrigation works are planned to cover eventually about 3,350 acres.

III.2.2 The Future Development

ADU Centres have been planned to be established at Bukit Peninjau in 1975, and at Beluru and Bekenu in 1976. Summaries of the staff build-up and the estimated number of farmers handled from each Centre are given in Chapter 2.

The early establishment of the Centre at Bukit Peninjau is recommended because of the need to continue and expand the already started oil palm road-based planting scheme near Bukit Peninjau.

A road has been planned to be built in 1981 and 1982 from Bekenu southwards, through existing occupied land, to Niah. This road would provide the opportunity to extend road based improvement into this presently remote and isolated area.

The integrated phasing of all the activities associated with each of these road based schemes are shown in Tables III.2, III.3 and III.4.

TABLE III.2 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM BUKIT PENINJAU

Activity	Agency			Specification	Phasing								
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980		
Semi-detailed Soil Survey ...	D of A	D of A	D of A	8,400 acres	—								
Establishment and Operation of the ADU Centre ...	D of A	ADU	D of A	See Chapter 2 of this part	→								
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	5,800 net acres	→								
Housing in RBI area ...	Private	Private	Private	48 temporary units	→								
Construction and Operation of Cocoa Dryer ...	ADU	Private	Private	1 Samoan-type unit	→								

TABLE III.3 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM BEKENU

Activity	Agency			Specification	Phasing								
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980		
Semi-detailed Soil Survey ...	D of A	D of A	D of A	5,800 acres	—								
Establishment and Operation of ADU Centre ...	D of A	ADU	D of A	See Chapter 2 of this part	→								
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	4,100 net acres	→								
Housing in RBI Area ...	Private	Private	Private	38 temporary units	→								
Construction and Operation of Cocoa Dryer ...	ADU	Private	Private	1 Samoan-type unit	→								

TABLE III.4 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM BELURU

Activity	Agency			Specification	Phasing								
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980		
Semi-detailed Soil Survey ...	D of A	D of A	D of A	7,300 acres	—								
Establishment and Operation of ADU Centre ...	D of A	ADU	D of A	See Chapter 2 of this part	→								
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	5,100 net acres	→								
Housing in RBI Area ...	Private	Private	Private	36 temporary units	→								
Construction and Operation of Cocoa Dryer ...	ADU	Private	Private	1 Samoan-type unit	→								

III.3 LONG LAMA RDA

III.3.1 The Present Situation

(a) General

The township of Long Lama is a typical upcountry small bazaar town having developed from one of the more flourishing longhouses. There is a small Department of Agriculture Station close to the town as well as a few administrative and school buildings.

East, south-east and south of Long Lama are large areas of virgin Mixed Dipterocarp Forests.

(b) Population (1970)

Urban (Long Lama), 600.

Rural and semi-urban in the remaining parts, 4,900.

(c) Communications

Only the River Baram provides any line of communication, leading northwards to Marudi, some 50 miles away, and southwards to the interior.

(d) Agriculture

There are large areas of occupied land, totalling over 100,000 acres to the north, west and south of Long Lama as shown in Figure III.3. Practically all is shifting cultivation of hill rice, but there are scattered patches of rubber.

III.3.2 Future Agricultural Development

About 90,000 acres of the occupied land was assessed at the schematic reconnaissance soil survey level as being possibly suitable for agriculture. This represents about 49,000 acres where development could occur, but the lack of communications rules out any immediate start for intensive activities. However, the road currently being constructed eastwards from Beluru is planned to continue to Long Lama and it is expected to reach there in 1977. This road, if it passes through occupied land as is recommended, would provide the opportunity to undertake road based improvement in the area. The road would also provide an easy outlet to the markets of Miri and Bintulu for the produce from Long Lama and from the upper reaches of the Baram and Tinjar rivers. This diversion of trade would reduce the volume of goods handled by Marudi. Thus Long Lama is expected to grow at the expense of Marudi.

It is proposed that road based improvement should be conducted by an ADU Centre established in Long Lama as soon as the road reached there. The area is too far from any proposed oil palm mill to justify the encouragement of oil palm planting. Therefore agriculture should follow the same pattern as is proposed for Marudi; the production of easily processed, easily transported non-perishable goods, rubber being the most important.

Details of the proposed ADU Centre are summarised in Chapter 2. Semi-detailed soil surveys covering a total of about 5,500 acres of land on either side of the road will have to be carried out during 1976.

EXISTING:

- Occupied Land
- Village

PROPOSED 1976 - 1980:

- Road
- Road Based Improvement

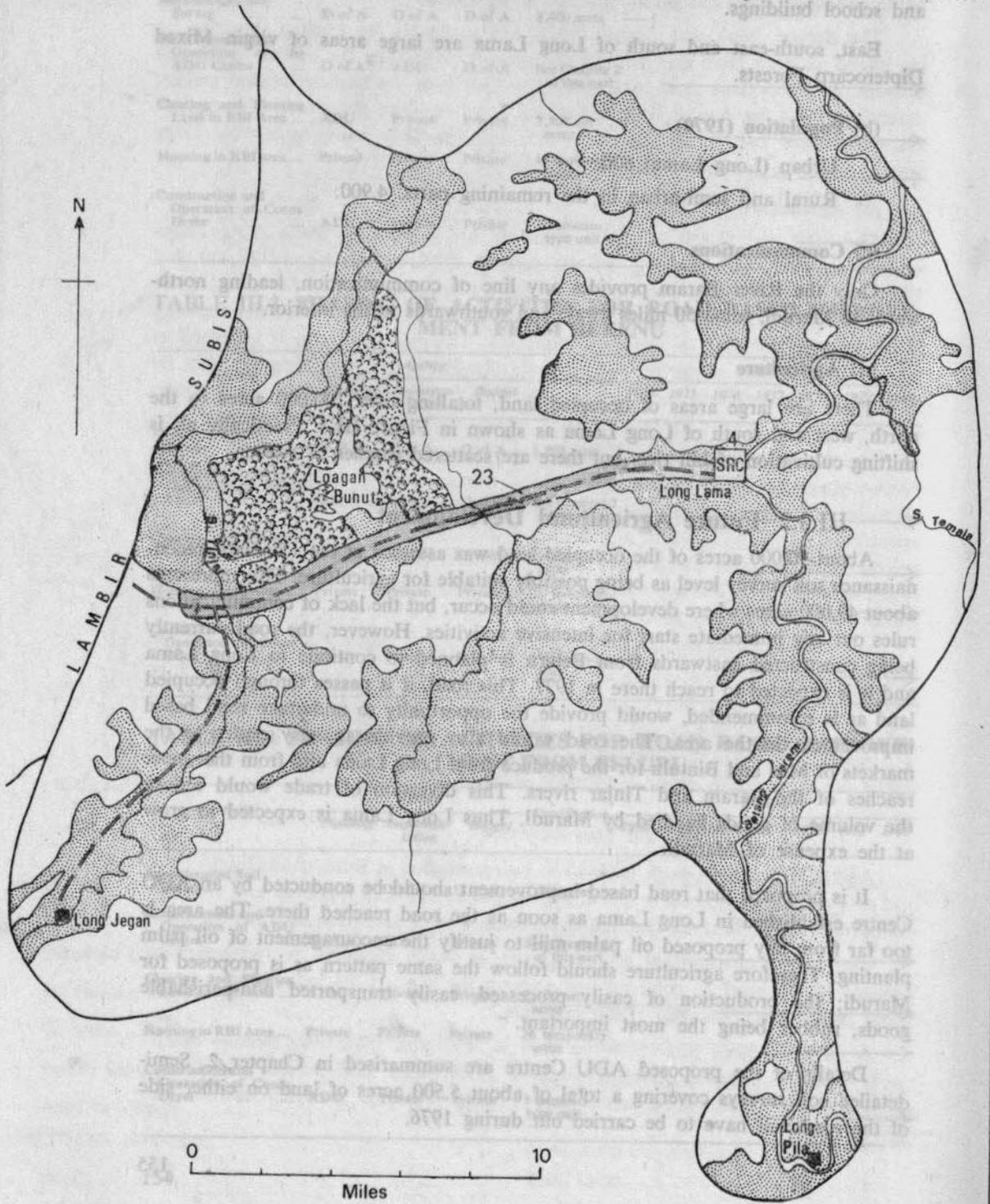
a: Development package presented in ANNEXURE II

- Sub-Regional Centre
- National Park
- Rural Development Area Boundary
- Rural Development Package Number
- Town Development Package Number

SRC

23

4 a



The integrated phasing of all the activities associated with this road based scheme are shown in Table III.5. A future road to Long Jagan is planned to be started in 1983, and its construction will provide the opportunity to extend road based improvement. However, neither of these schemes have been included in the present project because they occur after 1980.

TABLE III.5 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM ADU CENTRE AT LONG LAMA

Activity	Agency			Specification	Phasing							
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980	
Construction of Beluru-Long Lama Road ...	PWD	PWD	PWD	31 miles of trunk road	—————|							
Semi-detailed Soil Survey ...	D of A	D of A	D of A	5,400 acres	|—————|							
Establishment and Operation of ADU Centre ...	D of A	ADU	D of A	See Chapter 2 of this part	—————→							
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	3,800 net acres	—————→							
Housing in RBI Area ...	Private	Private	Private	52 temporary units	—————→							
Construction and Operation of Cocoa Dryer ...	ADU	Private	Private	1 Samoan-type unit	—————→							

III.4 THE NIAH-SUAI RDA

III.4.1 The Present Situation

(a) General

This Area lies between two rivers, the Sungai Niah in the north and the Batang Suai in the south as shown in Figure III.4. The only two existing towns, Niah and Batu Niah are situated on the Sungai Niah. Both towns are typical small country settlements.

About half the forest has already been logged. Forest harvesting is continuing in the central part, while in the south-east there is virgin forest which forms part of the forest planned for harvesting by a forest industry complex.

Just east of Batu Niah are the two stone quarries previously mentioned.

(b) Population

Urban (Niah and Batu Niah), 2,000.

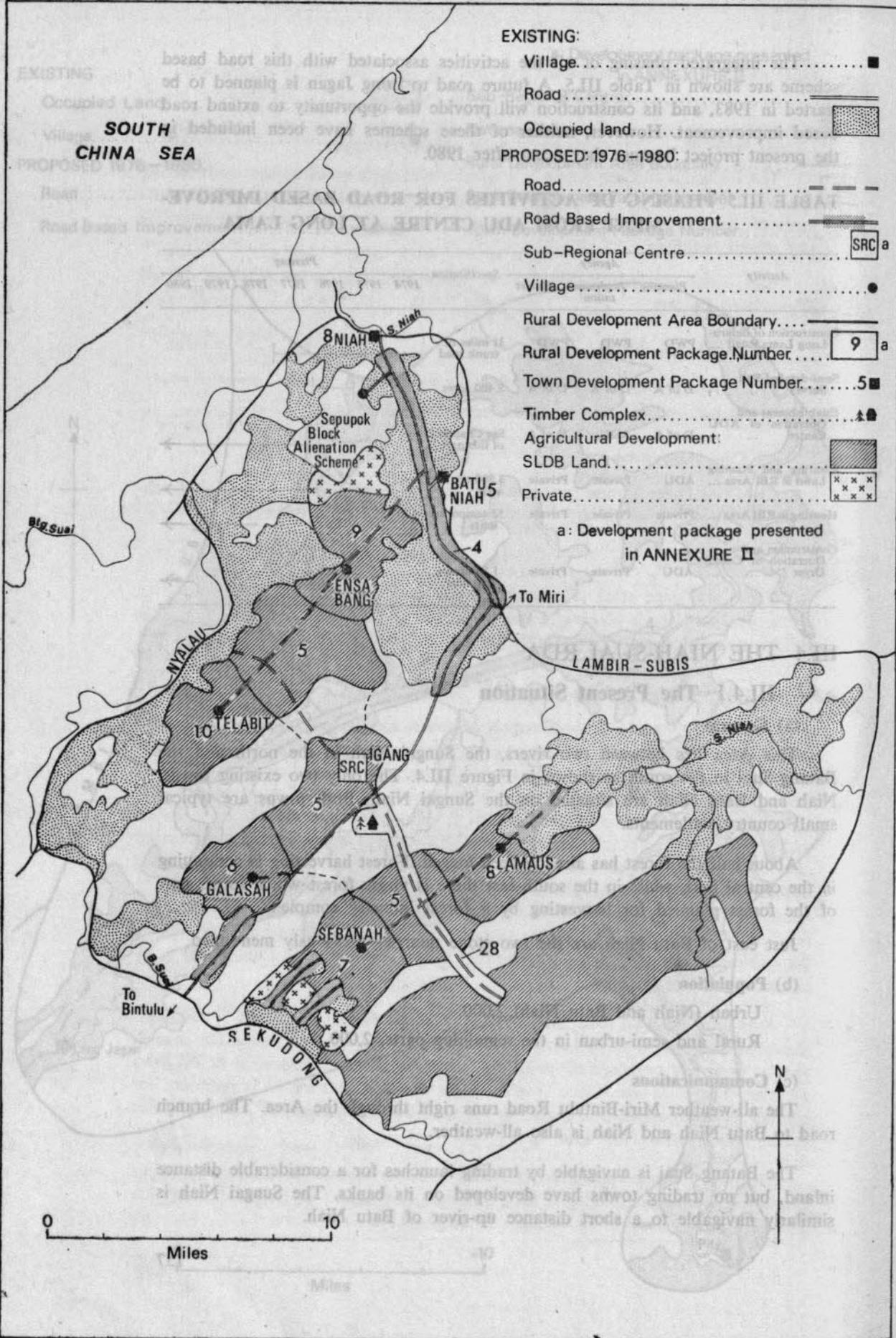
Rural and semi-urban in the remaining parts, 2,000.

(c) Communications

The all-weather Miri-Bintulu Road runs right through the Area. The branch road to Batu Niah and Niah is also all-weather.

The Batang Suai is navigable by trading launches for a considerable distance inland, but no trading towns have developed on its banks. The Sungai Niah is similarly navigable to a short distance up-river of Batu Niah.

PRESENT AND FUTURE DEVELOPMENT IN THE NIAH-SUAI RDA



(d) **Agriculture**

Around Niah and Batu Niah are a cluster of Chinese smallholdings where rice, pepper, fruit, vegetables and rubber are grown. Practically all the rest of the occupied land is under shifting cultivation of hill rice with small rubber plantings scattered throughout.

During 1973 the Department of Agriculture started a 3,000 acre block alienation settlement scheme at Sepupok.

III.4.2 Future Agricultural Development

The early soil and terrain investigations carried out by the Consultants revealed that this general area contained the majority of the easily accessible already logged, unoccupied State Land suitable for agricultural development. Consequently, semi-detailed soil surveys were largely concentrated here, eventually covering roughly 80,000 acres. The areas are shown in Figure III.4. The land assessed as suitable for agriculture at the semi-detailed soil survey level are those subsequently planned as the major agricultural development effort in the period 1975 to 1980.

The majority of this development is planned to be undertaken by SLDB as large-scale schemes which will consist of a nucleus public estate and five sub-schemes (Galasah, Sebanah, Lamaus, Ensabang and Telabit), which will subsequently be sub-divided into smallholdings allocated to settlers living in villages.

Road based improvement schemes have been planned to be undertaken by additional staff attached to the ADU Centres established in the villages of Galasah, Sebanah, Lamaus and Ensabang. These small schemes are seen as extensions of the development taking place in the SLDB sub-schemes, and should be undertaken jointly by SLDB and the ADU; the access road would be constructed by SLDB while the agricultural extension and support work would be carried out by the ADU. A summary of this development is given in Chapter 2.

An ADU Centre has also been proposed for establishment at Batu Niah in 1975. This early action is needed to guide and support the farmers in the Sepupok Block Alienation Scheme. In 1977 this Centre would be reinforced with more staff to begin road based improvement work along the Miri-Bintulu road and along the existing branch road to Batu Niah and Niah. Semi-detailed soil surveys and maps of the road-side lands would be needed during 1975 covering a total area of about 10,300 acres.

In both the block alienation scheme and the road based scheme the agriculture encouraged should be the same as, and orientated towards, that undertaken by SLDB in the nearby intensive development area. A summary of the staff build-up and activities of this ADU Centre is given in Chapter 2 while the integrated phasing of all the activities associated with it are given in Table III.6.

III.5 SEKUDONG RDA

III.5.1 The Present Situation

(a) **General**

Huge tracts of this Area are covered by virgin forest and form part of the forest industry complexes planned in FAO Units 1 and 2. There are also large areas of occupied land. In the north the occupation is associated with the Suai

river and has extended along the Miri-Bintulu road. In the south the occupation has spread along the Batang Kemena and its tributary the Sungai Labang as well as along the Miri-Bintulu Road. There are no towns of significance in the Area.

(b) **Population**

Rural and semi-urban in the whole Area, 5,000.

(c) **Communications**

The Miri-Bintulu road runs right through the Area. The Sungai Labang is navigable to small river craft a long way upstream from its junction with the Kemena.

(d) **Agriculture**

The agriculture is predominantly shifting cultivation of hill rice with small, scattered plots of rubber throughout the occupied areas.

TABLE III.6 PHASING OF ACTIVITIES FOR SUPPORT OF THE SEPUPOK BLOCK ALIENATION SCHEME AND ROAD BASED IMPROVEMENT FROM BATU NIAH

Activity	Agency			Specification	Phasing						
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980
Construction of Access Road to Sepupok ...	PWD	PWD	PWD	1.8 miles of feeder road	—|						
Detailed Planning of Sepupok Village ...	L & SD	L & SD	L & SD			|—					
Clearing Sepupok Village Area ...	D of A	Private	D of A	10 acres	|—						
Establishment and Operation of ADU Centre at Batu Niah	D of A	ADU	D of A	See Chapter 2							→
Clearing and Planting Land in Sepupok Area ...	ADU	Private	Private	1,900 net acres							→
Semi-detailed Soil Survey of RBI Area	D of A	D of A	D of A	10,300 acres			|—				
Reinforce ADU Centre for work in RBI Area ...	D of A	ADU	D of A	See Chapter 2				X			
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	7,400 net acres							→
Construct and Run a Primary School in Sepupok ...	D of E	PWD	D of E	1 stream							→
Establish Parks and Playground in Sepupok ...	D of E	PWD	D of E	1 acre			|—				
Construct Community Hall Sepupok ...	PWD	PWD	PWD				|—				
Construct Shops in Sepupok ...	Private/SEDC	Private/SEDC	Private/SEDC	7 service units			|—				
Housing in Sepupok ...	Private	Private	Private	196 units							→
Construct and Operate Cocoa Dryers in Sepupok ...	ADU	Private	Private	2 units				X		X	→
Construct and Operate Cocoa Dryer in RBI Area ...	ADU	Private	Private	1 unit							→
Housing in RBI Area ...	Private	Private	Private	27 temporary units							→

L & SD = Land and Survey Department.
 D of E = Department of Education.
 SEDC = Sarawak Economic Development Corporation.

PRESENT AND FUTURE DEVELOPMENT IN THE SEKUDONG RDA

a: Development package presented in ANNEXURE II

EXISTING:

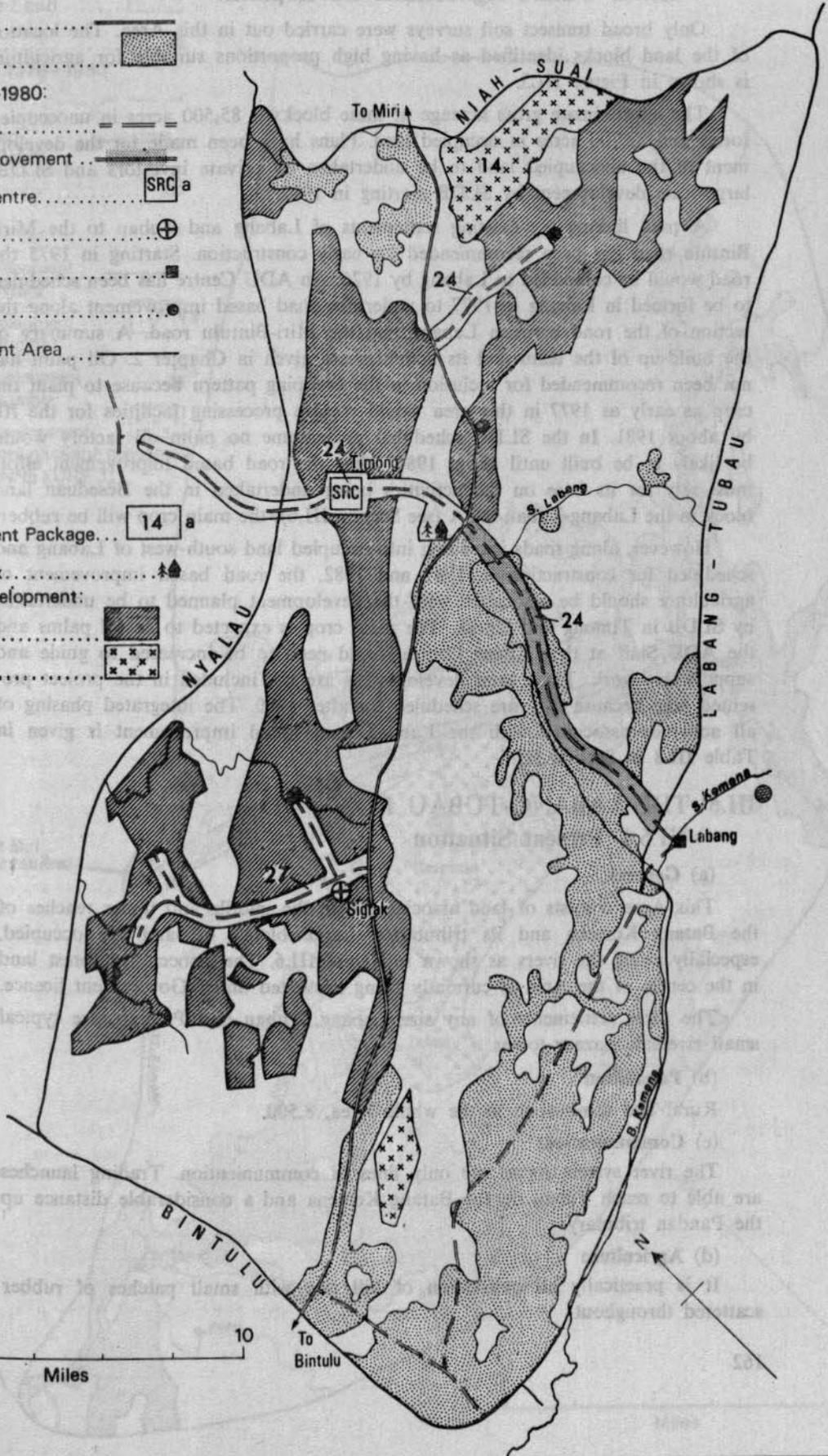
- Road.....
- Occupied Land.....

PROPOSED 1976-1980:

- Road.....
- Road Based Improvement
- Sub-Regional Centre..... SRC a
- Service Centre.....
- Town.....
- Village.....
- Rural Development Area.....
- Boundary.....

Rural Development Package... 14 a

- Timber Complex.....
- Agricultural Development:
- SLDB Land.....
- Private.....



III.5.2 Future Agricultural Development

Only broad transect soil surveys were carried out in this Area. The location of the land blocks identified as having high proportions suitable for agriculture is shown in Figure III.5.

The approximate gross acreage of these blocks is 85,500 acres in unoccupied forest and 52,700 acres in occupied land. Plans have been made for the development of the unoccupied land to be undertaken by private investors and SLDB; large-scale development by SLDB starting in 1982.

A road linking the existing settlements of Labang and Tubau to the Miri-Bintulu road has been recommended for early construction. Starting in 1975 the road would be completed to Labang by 1976. An ADU Centre has been scheduled to be formed in Labang in 1977 to undertake road based improvement along the section of the road between Labang and the Miri-Bintulu road. A summary of the build-up of the team and its activities are given in Chapter 2. Oil palm has not been recommended for inclusion in the cropping pattern because to plant the crop as early as 1977 in this area would require processing facilities for the ffb by about 1981. In the SLDB scheduled programme no palm oil factory would be likely to be built until about 1986. Thus the road based improvement effort must rely for its base on the activities being undertaken in the Besedian land block in the Labang-Tubau RDA (see Section III.6); the main crop will be rubber.

However, along roads extending into occupied land south-west of Labang and scheduled for construction in 1981 and 1982, the road based improvement of agriculture should be associated with the development planned to be undertaken by SLDB in Timong and Sigrak. The main crop is expected to be oil palms and the ADU Staff at the Labang Centre would need to be increased to guide and support this work. These later developments are not included in the project presented here because they are scheduled for after 1980. The integrated phasing of all activities associated with the Labang road based improvement is given in Table III.8 in Section III.6.

III.6 THE LABANG-TUBAU RDA

III.6.1 Present Situation

(a) General

This Area consists of land associated with the middle and upper reaches of the Batang Kemena and its tributaries. Large blocks of land are occupied, especially along the rivers as shown in Figure III.6. The unoccupied forest land in the centre of the Area is currently being harvested under Government licence.

The three settlements of any size Labang, Tubau and Pandan, are typical small riverside bazaar towns.

(b) Population

Rural and semi-urban in the whole Area, 8,500.

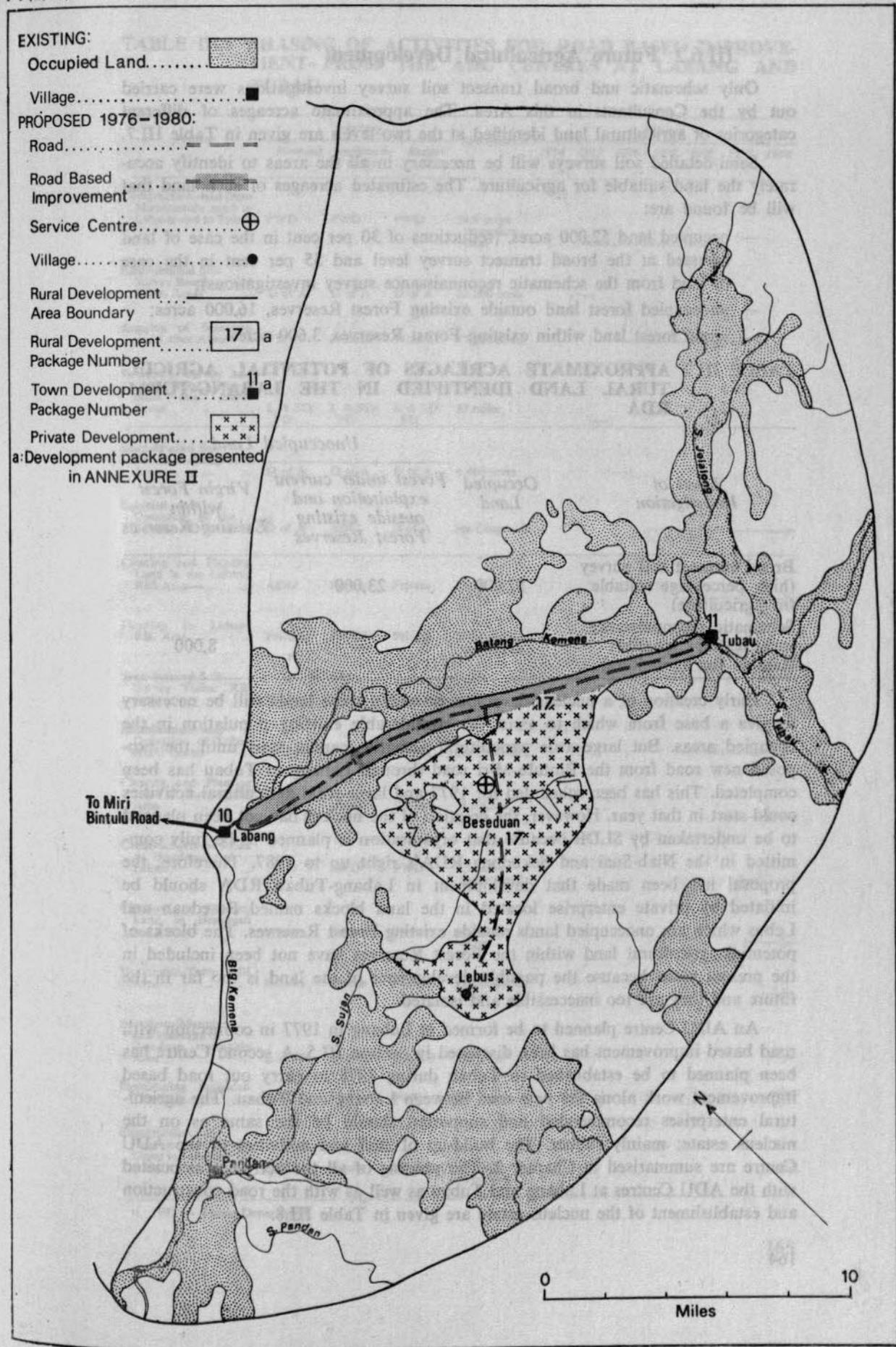
(c) Communications

The river system forms the only lines of communication. Trading launches are able to reach Tubau on the Batang Kemena and a considerable distance up the Pandan tributary.

(d) Agriculture

It is practically all cultivation of hill rice with small patches of rubber scattered throughout.

PRESENT AND FUTURE DEVELOPMENT IN THE LABANG - TUBAU RDA



III.6.2 Future Agricultural Development

Only schematic and broad transect soil survey investigations were carried out by the Consultants in this Area. The approximate acreages of different categories of agricultural land identified at the two levels are given in Table III.7.

Semi-detailed soil surveys will be necessary in all the areas to identify accurately the land suitable for agriculture. The estimated acreages of such land that will be found are:

- occupied land 52,000 acres, (reductions of 30 per cent in the case of land assessed at the broad transect survey level and 55 per cent in the case of land from the schematic reconnaissance survey investigations);
- unoccupied forest land outside existing Forest Reserves, 16,000 acres;
- virgin forest land within existing Forest Reserves, 3,600 acres.

TABLE III.7 APPROXIMATE ACREAGES OF POTENTIAL AGRICULTURAL LAND IDENTIFIED IN THE LABANG-TUBAU RDA

<i>Level of Investigation</i>	<i>Occupied Land</i>	<i>Unoccupied Land</i>	
		<i>Forest under current exploitation and outside existing Forest Reserves</i>	<i>Virgin Forest within Existing Reserves</i>
Broad transect soil survey (high percentage suitable for agriculture)	57,000	23,000	—
Schematic reconnaissance investigations (possibly suitable for agriculture)	27,000	—	8,000

Early creation of a nucleus development within these lands will be necessary to give a base from which to assist the considerable existing population in the occupied areas. But large-scale agricultural activities cannot start until the proposed new road from the Bintulu-Miri road through Labang to Tubau has been completed. This has been scheduled for 1977 and large-scale agricultural activities could start in that year. However, the creation of the nucleus has not been planned to be undertaken by SLDB because that organisation is planned to be fully committed in the Niah-Suai and Sekudong RDA's right up to 1987. Therefore, the proposal has been made that development in Labang-Tubau RDA should be initiated by private enterprise located in the land blocks named Besedian and Lebus which are unoccupied lands outside existing Forest Reserves. The blocks of potential agricultural land within the Forest Reserves have not been included in the present plans because the possible development of the land is too far in the future and they are too inaccessible and isolated.

An ADU Centre planned to be formed at Labang in 1977 in connection with road based improvement has been discussed in Section III.5. A second Centre has been planned to be established in Tubau during 1978 to carry out road based improvement work along the new road between Labang and Tubau. The agricultural enterprises recommended and supported should be the same as on the nucleus estate; mainly rubber. The build-up of staff and activities of the ADU Centre are summarised in Chapter 2. The phasing of all the activities associated with the ADU Centres at Labang and Tubau as well as with the road construction and establishment of the nucleus estate are given in Table III.8.

TABLE III.8 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM THE ADU CENTRES AT LABANG AND TUBAU

Activity	Agency			Specification	Phasing					
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980
Construction road from Miri-Bintulu road to Labang and to Tubau	PWD	PWD	PWD	28.8 miles secondary road	|-----|					
Semi-detailed Soil Survey Beseduan and Lebus Areas ...	D of A	D of A	D of A	23,000 acres	|-----|					
Logging of Beseduan and Lebus Areas ...	FD	Private	Private	15,700 acres	|-----|					
Boundary Survey and demarcation Beseduan and Lebus Areas ...	L & SD/ FD	L & SD/ FD	L & SD/ FD	39 miles	|-----|					
Semi-detailed Soil Survey Labang RBI Area ...	D of A	D of A	D of A	4,400 acres	|-----|					
Establishment and Operation of the Labang ADU Centre	D of A	ADU	D of A	See Chapter 2	----->					
Clearing and Planting Land in the Labang RBI Area ...	ADU	Private	Private	3,050 net acres	----->					
Housing in Labang RBI Area ...	Private	Private	Private	114 temporary units	----->					
Semi-detailed Soil Survey Tubau RBI Area ...	D of A	D of A	D of A	5,500 acres	|-----|					
Establishment and Operation of Tubau ADU Centre ...	D of A	ADU	D of A	See Chapter 2	----->					
Clearing and Planting Land in Tubau RBI Area ...	ADU	Private	Private	3,800 net acres	----->					
Construct Access Road to Beseduan and Lebus ...	PWD	PWD	PWD	8.5 miles feeder road	|-----|					
Clearing and Planting Land in Beseduan and Lebus ...	Private	Private	Private	14,130 net acres	|----->					
Housing in Tubau RBI Area ...	Private	Private	Private	37 temporary units	|----->					
Air-photo/Mapping and Planning of Beseduan township Area ...	L & SD	L & SD	L & SD	500 acres	----->					
Destumping Beseduan Township Area ...	PWD	PWD	PWD	500 acres	----->					
Construction and Operation of Cocoa Dryer in Labang RBI Area ...	ADU	Private	Private	1 Samoan-type unit	----->					

FD = Forest Department.

III.7 THE BINTULU RDA

III.7.1 The Present Situation

(a) General

Bintulu town has become established as a natural result of the trading activities associated with timber and other products produced in the catchment areas of the Batang Kemena and its tributaries. The town is a Government District headquarters with a trading bazaar and several small industries, including sawmills and a sago mill. Sebauh is a small riverside bazaar town.

(b) Population (1970)

Urban (Bintulu), 6,000

Rural and semi-urban in the remaining parts, 6,000.

(c) Communications

The all-weather road runs northwards to Miri some 130 miles away. Bintulu is a scheduled stop for the Malaysian Airline System's internal flights.

The Batang Kemena is navigable by trading launches, timber tugs and barges for its whole length in the Area, but communications seawards are restricted by the shallow coastal waters and a sand-bar at the river mouth.

(d) Agriculture

Important features are the concentration of rubber plantings close to Bintulu and around Sebauh as shown on Figure III.7. Government has plans to establish a crumb rubber factory in Bintulu to handle the potential rubber production from these plantations as well as from the numerous scattered plots throughout the river catchment area. On the coast south of Bintulu, there are coconut plantations where cattle rearing as a supplementary enterprise is practised. Much of the remaining occupied land is under shifting cultivation of hill rice, although there is some market gardening close to Bintulu and, in the riverside swamps, some wet rice is grown and some exploitation of sago palms is undertaken.

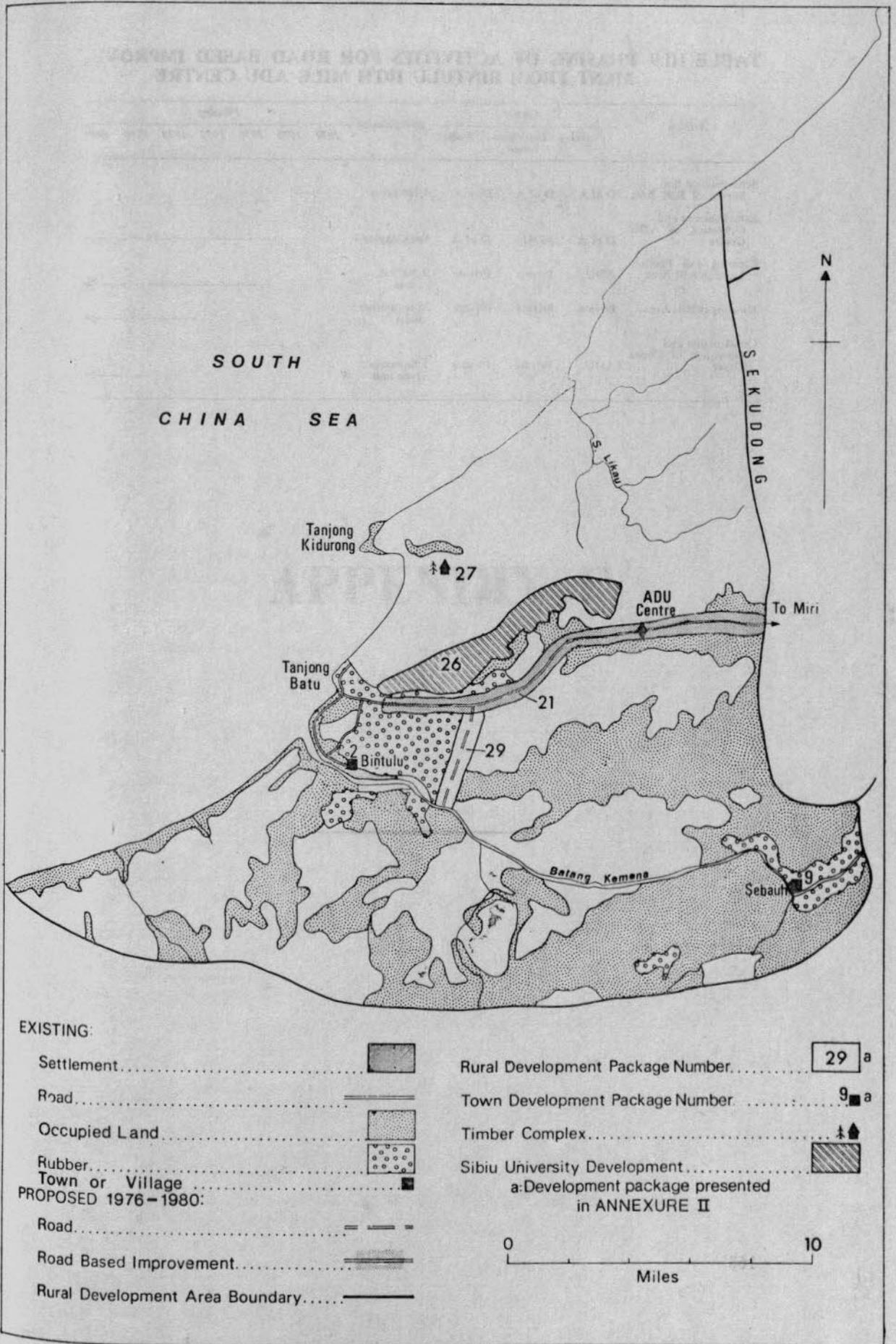
III.7.2 Future Agricultural Development

The broad transect soil survey identified about 17,800 acres of occupied land and 3,000 acres of unoccupied forest land as having high proportions of land suitable for agriculture. Much of the occupied land is around Bintulu town and along the Miri-Bintulu road.

To guide and support improved agriculture in the occupied land an ADU Centre has been planned to be formed in 1976 at an Agriculture Department Station about 10 miles from Bintulu on the road to Miri. The agricultural activities of the ADU should be concerned mainly with increasing the acreage of rubber along the main road to support the future factory, and with market gardening, the raising of pigs and poultry and pond culture of fish. All the latter enterprises should be aimed at supplying the market created by the expected rapid increase of population (15,000 by 1980 and 40,000 by 1990) associated with activities at Tanjung Kidurong. The expected build-up of the staff and activities of the ADU Centre are summarised in Chapter 2.

The phasing of all the activities associated with this road based development are given in Table III.9.

PRESENT AND FUTURE DEVELOPMENT IN THE BINTULU R D A



EXISTING:

- Settlement..... [Symbol]
- Road..... [Symbol]
- Occupied Land..... [Symbol]
- Rubber..... [Symbol]
- Town or Village..... [Symbol]

PROPOSED 1976-1980:

- Road..... [Symbol]
- Road Based Improvement..... [Symbol]
- Rural Development Area Boundary..... [Symbol]

- Rural Development Package Number..... [Symbol] 29 a
 - Town Development Package Number..... [Symbol] 9 a
 - Timber Complex..... [Symbol]
 - Sibu University Development..... [Symbol]
- a: Development package presented in ANNEXURE II

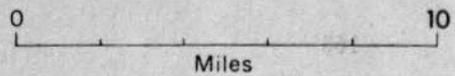
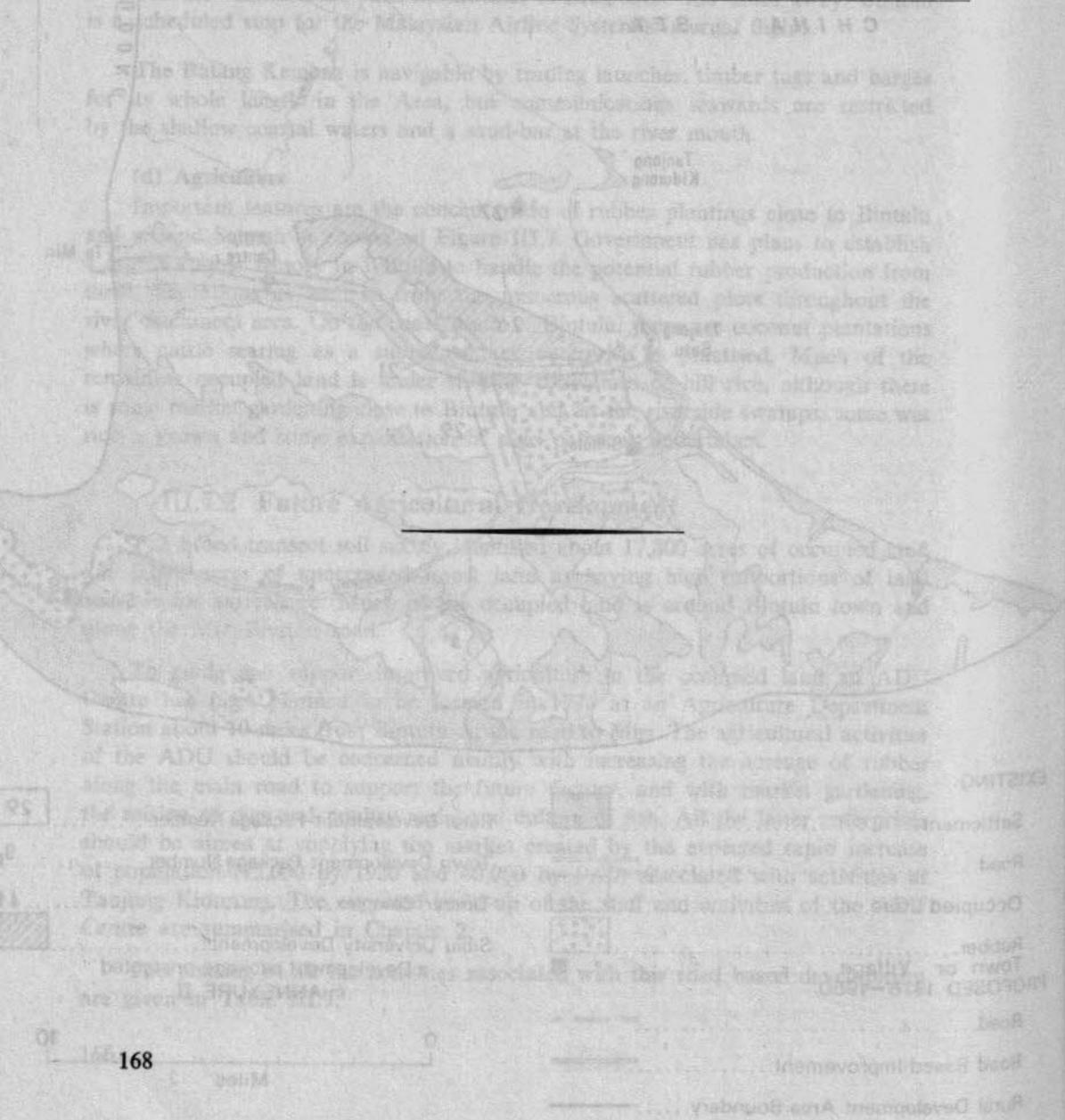


TABLE III.9 PHASING OF ACTIVITIES FOR ROAD BASED IMPROVEMENT FROM BINTULU 10TH MILE ADU CENTRE

Activity	Agency			Specification	Phasing						
	Planning	Implementation	Budget		1974	1975	1976	1977	1978	1979	1980
Semi-detailed Soil Survey of RBI Area	D of A	D of A	D of A	4,700 acres	—|—						
Establishment and Operation of ADU Centre	D of A	ADU	D of A	See Chapter 4				—————			—————>
Clearing and Planting Land in RBI Area ...	ADU	Private	Private	3,300 net acres				—————			—————>
Housing in RBI Area ...	Private	Private	Private	38 temporary units					—————		—————>
Construction and Operation of Cocoa Dryer	ADU	Private	Private	1 Samoan-type unit							—————>



APPENDIX IV

ASSUMPTIONS USED IN ESTIMATING STAFF AND EQUIPMENT REQUIREMENTS FOR THE ADU

IV.1 STAFF

IV.1.1 The Extension Team

20 That the Supervisors, Extension Agents, Home Science Agents and Forest Guards required to form the teams in ADU areas to be operational directly from the Agriculture and Forest Department. Their staff overheads, the Supervisor and Extension Agent overheads would be filled by staff trained in the Training Centre at Teshalon.

21 That the Extension Team in an ADU Centre working with smallholders in SLDB developed land would consist initially of a Supervisor, three Extension Agents, a Home Science Agent and a Forest Guard. The number of families that an Extension Agent could handle would start and remain at about 25 during the first four years the work would consist only of a low

APPENDIX IV

level of extension work. The Extension Agents and farmers are unskilled to each other and relatively inexperienced. By year five when SLDB responsibilities would be withdrawn and the oil palm and sugar plantations would be subdivided into holdings, the Extension Agents and farmers would be mutually acquainted and experienced to enable the necessary increased output and production to be achieved with roughly the same ADU staff.

If these is legally occupied land area by in which improvement work is to be undertaken then the ADU Team would be interfered especially for that work in year two.

22 Teams working on road based improvement would also consist of a Supervisor and three Extension Agents. The number of farmers that would be attended in each of the road based improvement schemes is not known. But it is assumed that the number of participants that an Extension Agent could handle would probably increase from about 25 at the outset to around 50 in three years. This arrangement allows for both farmers and Extension Agents to gain experience.

23 For every seven Extension Teams formed it has been assumed necessary to appoint an experienced supervisor in the post of Extension Leader to help the Agricultural leader in the task of coaching the Supervisors.

IV.1.2 The Economic, Credit and Accounts Services

24 That a complete coverage of all the services would be gradually built up in each ADU Centre.

APPENDIX IV

ASSUMPTIONS USED IN ESTIMATING STAFF AND EQUIPMENT REQUIREMENTS FOR THE ADU

IV.1 STAFF

IV.1.1 The Extension Team

- (a) That the Supervisors, Extension Agents, Home Demonstrators and Forest Guards required to form the teams in 1974 would be appointed directly from the Agriculture and Forest Departments. From 1976 onwards the Supervisor and Extension Agent positions would be filled by staff trained in the Training Centre at Kabuloh.
- (b) That the Extension Team in an ADU Centre working with smallholders on SLDB developed land would consist initially of a Supervisor, three Extension Agents, a Home Demonstrator and a Forest Guard. The number of families that an Extension Agent could handle would start and remain at about 50. During the first four years the work would consist only of support and guidance for the homestead and rice plots, i.e. a low level of work with each family at the time when Extension Agents and farmers are unknown to each other and relatively inexperienced. By year five when SLDB management would be withdrawn and the oil palm and cocoa plantations would be sub-divided into holdings, the Extension Agents and farmers should be sufficiently acquainted and experienced to enable the necessary increased support and guidance to be achieved with roughly the same ADU staff.

If there is legally occupied land close by in which improvement work is to be undertaken then the ADU Team would be reinforced especially for this work in year two.

- (c) Teams working on road based improvement would also consist of a Supervisor and three Extension Agents. The number of farmers that would be handled in each of the road based improvement schemes is not known. But it is assumed that the number of participants that an Extension Agent could handle would gradually increase from about 25 at the outset to around 50 in three years. This arrangement allows for both farmers and Extension Agents to gain experience.
- (d) For every seven Extension Teams formed it has been assumed necessary to appoint an experienced Supervisor to the post of Extension Leader to help the Agricultural Leader in the task of checking the Supervisors.

IV.1.2 The Economic, Credit and Accounts Services

- (a) That a complete coverage of all the services would be gradually built up in each ADU Centre.

- (b) Within each Centre the staff from the Economic Section would consist of:
- (i) For supply: a Storeman in charge (he would accompany the first Extension Team into the Centre) and an Assistant Storeman (arriving about three years later or when a second team is formed in the Centre).
 - (ii) For marketing: a Recorder and an Assistant Recorder; both would arrive when the oil palms and cocoa commence bearing, sometimes earlier in those Centres where the creation of a marketing organisation is considered important, for example in Marudi and Long Lama.
 - (iii) For farm mechanisation: a Mechanic/Tractor Driver (arriving when about 150 farmers are being handled by the ADU Team) and a Machine Operator for roughly every 100 farmers handled by the ADU Team.
- (c) Within each Centre the staff from the Accounts Section would consist of a trained Accountant in charge with an Assistant Accountant (both arriving with the first Extension Team).
- (d) The Credit Section staff would consist of one Clerk in every Centre associated only with road based improvement, but in those Centres where transference of management of land from SLDB to smallholders would be taking place or where block alienation schemes are handled the staff would consist of a Senior Clerk and two Assistant Clerks (one clerk each for the credit and savings functions).

IV.2 EQUIPMENT

IV.2.1 Machinery for Preparation of Swamp Rice Land

Starting from 1976 each Centre would have a tractor and rotavator as soon as the acreage of swamp rice land handled from the Centre approached 200 acres (i.e. 150 to 200 families). Also a stand-by supply of similar units would be allowed for as emergency replacements in the case of serious breakdowns.

While building up to the 200 acre stage and after the arrival of the tractor there would be one power-tiller for each machine operator stationed at the Centre.

IV.2.2 Spraying Equipment

- (a) A motor operated knapsack sprayer for every machine operator stationed at the Centre.
- (b) A hand operated knapsack sprayer for every 50 farmers handled by the Centre.

IV.2.3 Other Equipment

- (a) A power-tiller operated rice thresher for every power tiller allocated to the Centre.
- (b) Hand tools: at each Centre there would be a supply of spades, axes, cross-cut saws, hoes, etc. available for hire by the farmers.

APPENDIX V

PROPOSALS AND COSTS FOR TRAINING ADU STAFF

INTRODUCTION

Success in any new scheme or organization can rarely always be expected to be obtained with untrained and uneducated staff. However, the level of training and education needed is often exaggerated or ignored. The highest efficiency of efforts and costs spent on training and education is gained where every participant has the necessary know-how needed for the job he or she is doing.

The belief that an Extension Agent must be able to answer all agricultural questions is either not so true or a misconception; an agent answer anything but a knowledge with a purpose to find out the farmer's introduction, progress and understanding between farmer and agent. However, the misconception has resulted in the belief that specialist advisers are necessary at the farm level. Such specialization would be extremely costly and would place too great and unnecessary demands on education and training.

A particular principle envisaged in the transfer of the ADU is that the staff of the ADU would be trained in the language of the farmer. The education of these staff would be designed to develop their ability to communicate with the farmer in the language of the farmer, on their familiarity with local and practical agriculture and particularly on their knowledge of and ability to operate the current extension or development programmes. The training programme recommended is designed specifically to provide staff for the ADU. Training would commence at a special centre and would continue during service. It should be of all ages.

THE AGRICULTURAL TRAINING CENTRE AT KARBLOH

It is proposed that the Farm Institute at Karbloh be converted into an Agricultural Training Centre aimed at catering specifically for the needs of the ADU. The Karbloh Institute has been particularly chosen because it is conveniently located in the Study Area and would have the advantage of active land development taking place close by where practical training and demonstration could be undertaken. The capacity of the existing boarding and lodging accommodation which, as can be seen from Table V.1, is somewhat greater than the requirements of the Fourth Division ADU. However, it is possible that agricultural development similar to, and ranging in intensity with, that planned in the Study Area would be taking place in other parts of Karbloh and it too would require suitably trained staff. Thus the staff from the Centre is expected to be fully employed.

The Centre should remain under the Training Branch of the Department of Agriculture, but the teaching syllabus should be specially selected to include subjects related to new techniques and planned agricultural development. Extension

APPENDIX V

PROPOSALS AND COSTS FOR TRAINING ADU STAFF

V.1 INTRODUCTION

Success in any new scheme or organisation can nearly always be credited to a well-trained and educated staff. However, the level of training and education needed is often exaggerated or misused. The highest efficiency of efforts and funds spent on training and education is gained where every participant has the precise know-how needed for the job he or she is doing.

The belief that an Extension Agent must be able to answer all agricultural questions in order not to lose face is a misconception; an honest answer admitting lack of knowledge with a promise to find out the correct facts introduces respect and understanding between farmer and agent. However, the misconception has often led to the belief that specialist advisors are necessary at the farm level. Such specialisation would be extremely costly and would place too great and unnecessary demands on education and training.

A particular principal envisaged in the operation of the ADU is that the staff of the ADU would be in frequent, direct contact with the farmers. The efficiency of these staff would therefore depend on their personality, on their ability to converse with the farmers in the language of the farmers, on their familiarity with local and practical agriculture and particularly on their knowledge of, and ability to operate, the current extension or development programme. The training scheme recommended is designed specifically to provide staff for the ADU. Training would commence at a special centre and would continue during service. Trainees should be of all races.

V.2 THE AGRICULTURAL TRAINING CENTRE AT KABULOH

It is proposed that the Farm Institute at Kabuloh be converted into an Agricultural Training Centre aimed at catering specifically for the needs of the ADU. The Kabuloh Institute has been particularly chosen because it is conveniently situated in the Study Area and would have the advantage of active land development taking place close by where practical training and demonstration could be undertaken. The capacity of the existing boarding and teaching accommodation is 60 which, as can be seen from Table V.1, is somewhat greater than the requirements of the Fourth Division ADU. However, it is probable that agricultural development similar to, and running concurrently with, that planned in the Study Area would be taking place in other parts of Sarawak and it too would require specially trained staff. Thus the out-turn from the Centre is expected to be fully utilised.

The Centre should remain under the Training Branch of the Department of Agriculture, but the teaching syllabus should be specially orientated to include subjects related to new settlements and planned agricultural development. Extension

Agents should undergo a one-year course followed by on-the-job training directed and supervised by the Training Specialist attached to the ADU. The training would rely heavily on local research for providing much of the technical details of cultural and managerial practices. The method of study would include considerable practical work aimed at teaching the techniques of dealing with farmers and assisting them to adjust to the new agricultural environment. This would be in addition to the general agricultural syllabus now followed at the Institute. The additional training needed by all staff to eventually work in Farmers' Organisations would also be taken into account and special short courses, about six months, in the handling of credit, marketing, supply and machinery would be given.

TABLE V.1 ESTIMATED NUMBER OF NEW STAFF REQUIRING TRAINING EACH YEAR UP TO 1982

<i>Year</i>	<i>Extension Station (Excluding Forest Guards)</i>	<i>Credit and Accounts Section</i>	<i>Economic Section (Supply and Marketing Services)</i>	<i>Total</i>
1975	10	6	2	18
1976	26	10	4	40
1977	15	5	3	23
1978	24	7	3	34
1979	26	7	13	46
1980	19	5	13	37
1981	22	8	12	42
1982	12	5	4	21

The incentives of planned, practical training leading to ensured employment, following a successful completion of the training, are expected to prove sufficiently attractive to eliminate problems of enrolment. Prospective students should be males having passed Form V and be at least 17 years old, slightly older students would be preferable. This academic requirement is the same as demanded by the Natural Resources Training Centre near Kuching: (this is the main training centre for the non-graduate extension staff of the Department of Agriculture). Thus ADU students having completed their course would be equivalent to the AA cadre in the Department of Agriculture.

The conversion of the Farm Institute into an ADU Training Centre is not likely to take place before January 1975 because this Report will not be available until after June 1974, and it is unlikely that the Training Specialist will be recruited sufficiently quickly to take up his post before January 1975. Thus the first output of trainees could be expected in January 1976. This timing has been taken into account in the projected build-up of the Fourth Division ADU described in Chapter 2.

V.3 COSTS OF TRAINING ADU STAFF

The existing facilities at Kabuloh would be fully utilised. In addition a bus costing about \$35,000 and teaching equipment totalling about \$45,000 would be necessary. Recurrent annual costs, based on present expenditures of operating the Farm Institute, are estimated as follows:—

	\$
Agricultural Officer, Principal of the Centre (salary plus allowance)	20,000
Two Assistant Agricultural Officers (salary plus allowances)	15,000
Woodwork and Machinery Instructors	12,000
Maintenance of buildings	10,000
Provision of electricity and maintenance of water supplies	4,000
Training and travelling	6,000
Messing (say 40 students for 330 days and 20 students for 180 days all at \$2.50 per day)	42,000
Other student allowances	5,000
Farm expenditures (in addition to sale of farm produce)	15,000
Labour (cooks, drivers and farm labour)	16,000
Administration (office and teaching equipment, telephone, etc.) ...	4,000
Total:	<u>\$149,000</u>
say:	<u>\$150,000</u>

APPENDIX VI

RECOMMENDED MINIMUM QUALIFICATIONS OF STAFF IN THE NORTH DIVISION ARE:

Agricultural Leader

This post would require a general degree in agriculture, with at least three years experience as a confirmed Agricultural Officer in the Department of Agriculture, Serdang, or other parts of Malaya.

Administrative Leader

This post would require a trained administrative work at least three years experience in the Sarawak Civil Service. The appointee would need to be familiar with accountancy and book-keeping.

Training Leader

Because the whole concept of the ADU is new to Sarawak and because many techniques would have to be taught in the field it would be necessary to have a training specialist during the first few years to instruct, supervise and guide the training. The qualifications required for the post of Training Leader would be a degree in education, or a diploma in education, with at least three years experience in a similar position. This qualification would be essential.

APPENDIX VI

It is unlikely that a suitable man will be found locally and it is suggested that consideration should be made to PAO or, for instance, to the Swedish Agency for assistance in providing the right type of person.

Supervisors

The first two Supervisors should be appointed from the PAO cadre in the Serdang Branch of the Department of Agriculture. These will not have obtained a degree from Serdang, or equivalent college, and should have had several years' work experience in the Department. Later appointments should be by selection of Extension Agents who would have been trained at Kuching and proved themselves in the field.

Extension Agents

Like the Supervisors the first six Extension Agents should be appointed from the PAO cadre of the Department of Agriculture. They will have attended the two year certificate course at the Natural Resources Training Centre (NRTC), Serdang, and should have had one or two years field experience in the Department. Later appointments should come to ADU through the normal course of recruitment and should receive further in-service training. The minimum educational requirements for entering Kuching should be Form V.

Work Demonstrators

The first two should be appointed from the existing Department of Agriculture staff. Later appointments should be specially selected and trained for these posts.

APPENDIX VI

RECOMMENDED MINIMUM QUALIFICATIONS OF STAFF IN THE FOURTH DIVISION ADU

(a) Agricultural Leader

He would require a general degree in agriculture with at least four years experience as a confirmed Agricultural Officer in the Department of Agriculture in Sarawak or other parts of Malaysia.

(b) Administrative Leader

The post would require a trained administrator with at least three years experience in the Sarawak Civil Service. The appointee would need to be familiar with accountancy and book-keeping.

(c) Training Leader

Because the whole concept of the ADU is new to Sarawak and because particular techniques would have to be taught to the staff it would be necessary to have a training specialist during the first few years to correctly orientate and guide the training. The qualifications required for the post of Training Leader should be a degree in agriculture with specialisation in extension education. Practical experience in teaching and working within an organisation similar to the ADU would be essential.

It is unlikely that a suitable man will be found locally and it is suggested that application should be made to FAO or, for instance, to the Swedish Aid (SIDA) for assistance in providing the right type of person.

(d) Supervisors

The first two Supervisors should be appointed from the AAO cadre in the Extension Branch of the Department of Agriculture. These staff will have obtained a diploma from Serdang, or equivalent college, and should have had several years extension experience in the Department. Later appointees should be by selection and promotion of Extension Agents who would have been trained at Kabuloh and proved themselves in the field.

(e) Extension Agents

Like the Supervisors the first six Extension Agents should be appointed from the AA cadre of the Department of Agriculture. They will have attended the one year's certificate course at the Natural Resources Training Centre (NRTC), Semongok, and should have had one or two years field experience in the Department. Later appointees should enter the ADU through the training centre at Kabuloh and should receive further on-the-job training. The minimum educational requirements for entering Kabuloh should be Form V.

(f) Home Demonstrators

The first two should be appointed from the existing Department of Agriculture staff. Later appointees could be specially selected and trained for these posts.

The training would have to be at the NRTC and would mean an increase in the annual number of women trained there because no plan to include this type of training at the Kabuloh Training Centre is contemplated.

(g) Storemen, Assistant Storeman, Recorders and Assistant Recorders

These would need to be educated, (minimum Form V) trustworthy persons and specially selected for six months training at the Kabuloh Training Centre.

(h) Mechanics and Machine Operators

These persons would require prior training or considerable practical knowledge in the maintenance and repair of tractors and/or vehicles and other machinery. They would undergo further short training at Kabuloh on the type of machinery and equipment they would be using in the field.

(i) Pay Clerks, Assistant Clerks, Accountants and Assistant Accountants

Prior training in book-keeping would be necessary and the Accountants would also require some practical knowledge of banking procedure; all would attend a short orientation course at Kabuloh Training Centre.

It is wished that a suitable man will be found locally and it is suggested that application should be made to IAC of Stockholm, to the Swedish Aid (SIDA) for assistance in providing the right type of person.

The first two supervisors should be appointed from the AAG cadre in the Extension Branch of the Department of Agriculture. These men will have obtained a diploma from a senior or equivalent college and should have had several years' extension experience in the Department. Two applicants should be selected and presented to the Director of Extension Agents who have been trained at Kabuloh and given theoretical in the field.

Like the Supervisors the first six Extension Agents should be appointed from the AA cadre of the Department of Agriculture. They will have attended the one year's extension course at the National Research Training Centre (NRTC), Samsara, and should have had one or two years field experience in the Extension Branch. Two applicants should be selected through the training centre at Kabuloh and should have similar on-the-job training. The minimum educational requirements for Extension Agents should be Form V.

The first two should be appointed from the existing Department of Agriculture and the remaining six could be specially selected and trained for their posts.

APPENDIX VII

EXAMPLE OF A FARM BUDGET FOR WET RICE CULTIVATION

TABLE VIII OUTPUT

Area of wet rice	1.5 acres
Expected weight of produce per acre	2,750 pounds
Expected total weight of produce	4,125 pounds
Expected total weight for sale	2,000 pounds
Unit value of produce	\$19 per picul
Estimated value of rice for sale	\$380

TABLE VIII.2 INPUTS

<i>Operation</i>	<i>Estimated Cost</i>		<i>Quantity Required</i>
Mechanical Cultivation	30	45	1.5 acres (two passes of rotavator or power tiller)
Fertiliser	32	33	180 pounds Nitro-25 37 pounds Triple Super-phosphate
Seed treated with seed dressing	5	7.5	30 gallons
Herbicides, one application	7	16.5	44 pints MCPA
Pesticides, two applications	4	6	3 pounds Agrocid 26 dispersible powder
Bags provided by Marketing Section of ADU)	all	all	10 bags
	\$68	\$102.0	

APPENDIX VII

TABLE VIII.3 LABOUR REQUIREMENT

<i>Operation</i>	<i>No. of Man-days</i>	<i>When Required</i>
Drain maintenance	5 x 2	July/August and February
Nursery	6	Late August
Re-levelling and Bund Making	4½	September
Transplanting	12	Late September/early October
Weeding, Pest Control	4	November-January
Bird Scaring	6	January/February
	(sharing with neighbours)	
Harvesting	24	February-March

APPENDIX VII

EXAMPLE OF A FARM BUDGET FOR WET RICE CULTIVATION

TABLE VII.1 OUTPUT

Area of wet rice	1.5	acres
Expected weight of produce per acre	2,750	pounds
Expected total weight of produce	4,125	pounds
Expected total weight for sale	2,000	pounds
Unit value of produce	\$19	per picul
Estimated value of rice for sale	\$286	

TABLE VII.2 INPUTS

Operation	Estimated Cost per acre to farmer		Quantity Required
	\$	\$	
Mechanical Cultivation	30	45	1.5 acres (two passes of rotavator or power tiller)
Fertiliser	22	33	180 pounds Nitro-26 37 pounds Triple Super-phosphate
Seed (treated with seed dressing)	5	7.5	20 pounds
Herbicides, one application ...	7	10.5	4½ pints MCPA
Pesticides, two applications ...	4	6	3 pounds Agroicide 26 dispersible powder
Bags (provided by Marketing Section of ADU)	nil	nil	10 bags
	\$68	\$102.0	

TABLE VII.3 LABOUR REQUIREMENT

Operation	No. of Man-days	When Required
Drain Maintenance	3 x 2	July/August and February
Nursery	6	Late August
Re-levelling and Bund Making ...	4½	September
Transplanting	12	Late September/early October
Weeding, Pest Control	4	November-January
Bird Scaring	8	January/February
	(sharing with neighbours)	
Harvesting	24	February/March

APPENDIX VIII

CAPITAL AND RECURRENT COSTS OF THE ADU

The total capital costs of establishing the ADU organisation to deal with schemes initiated under the Action Programme have been estimated at about £1.5 m and recurrent costs at about £2.3 m per annum. These costs are summarised in Table VIII.1. They do not include staff training costs which are given in Appendix V. The analysis of the disposition of these costs given in Table VIII.2 shows that of the total capital about £2.5 m would be directed to small holder settlements developed by S.D.B. and taken over by ADU, the balance of about £4.6 m would be required on road based or block allocation projects located in various parts of the Study Area. Thus the overall disposition would be roughly in the ratio of 2:1.

The average cost of ADU per settler or farmer, would be £450 of which £320 would be attributed to economic services. It is assumed that on the schemes these services costs would be recoverable from farmers either as an co-cost for commodities purchased through the ADU or as a levy on produce marketed.

APPENDIX VIII COVERING ALL THE SCHEMES STARTED UNDER THE ACTION PROGRAMME PERIOD 1957

Year	CAPITAL			RECURRENT					Total Annual Cost	
	Buildings and Furniture	Plant and Equipment	Subtotal	Salaries and Wages	Grants and Allowances	Printing and Stationery	Travel and Transport Allowance	General Running Costs		
1957	257.0	86.4	343.4	373.4	18.1	17.0	—	77.2	122.8	1,314.8
1958	1,052.2	121.0	1,215.2	431.4	22.2	41.4	—	24.7	495.7	1,702.3
1959	239.0	160.2	412.2	502.2	21.2	55.6	—	32.0	715.2	1,050.2
1960	912.6	482.0	1,394.6	808.2	26.8	126.2	—	66.2	1,001.2	2,401.8
1961	201.1	289.2	490.3	1,027.5	26.1	224.0	—	76.2	1,308.1	1,798.4
1962	436.2	224.3	660.5	1,223.9	102.2	566.4	—	152.2	1,942.5	2,603.0
1963	242.6	167.9	410.5	1,432.7	22.6	230.1	—	112.2	1,795.3	2,205.8
1964	201.2	136.1	337.3	1,360.9	118.4	247.2	—	110.2	1,726.3	2,063.5
1965	—	22.4	22.4	1,411.6	149.4	231.2	—	110.2	1,783.4	1,925.0
1966	—	—	—	1,411.4	—	221.4	—	—	1,632.8	1,632.8
1967	—	12.4	12.4	1,422.2	—	226.7	—	—	1,648.9	1,648.9
1968	—	—	—	1,422.2	—	226.7	—	—	1,648.9	1,648.9
1969	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1970	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1971	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1972	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1973	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1974	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1975	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1976	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1977	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1978	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1979	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1980	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1981	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1982	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1983	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1984	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1985	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1986	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1987	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1988	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1989	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1990	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1991	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1992	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1993	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1994	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1995	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1996	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1997	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1998	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
1999	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
2000	—	—	—	—	—	—	—	101.2	1,012.2	1,012.2
TOTAL	5,712.2	1,766.7	7,478.9	18,086.2	2,333.0	1,410.2	2,052.2	1,012.2	41,294.4	54,274.4

APPENDIX VIII

CAPITAL AND RECURRENT COSTS OF THE ADU

The total capital costs of establishing the ADU organisation to deal with schemes initiated under the Action Programme have been estimated at about \$7.5 mn and recurrent costs at about \$2.3 mn per annum. These costs are summarised in Table VIII.1. They do not include staff training costs which are given in Appendix V. The analysis of the disposition of these costs given in Table VIII.2 shows that of the total capital about \$2.5 mn would be directed to small-holder settlements developed by SLDB and taken over by ADU, the balance of about \$4.6 mn would be required on road based or block alienation projects located in various parts of the Study Area. Thus the overall disposition would be roughly in the ratio of 2:1.

The average cost of ADU per settler or farmer, would be \$450 of which \$320 would be attributed to economic services. It is assumed that on the schemes these services costs would be recoverable from farmers either as an on-cost on commodities purchased through the ADU or as a levy on produce marketed.

TABLE VIII.1 SUMMARY OF ADU EXPENDITURE 1975-1999 COVERING ALL THE SCHEMES STARTED DURING THE ACTION PROGRAMME PERIOD (\$ 000)

Year	CAPITAL			RECURRENT					Total Annual Cost	
	Buildings and Furniture	Vehicles and Equipment	Sub-total	Salaries and Wages	Building Maintenance	Vehicles and Equipment Operating	Vehicles and Equipment Replacement	General Running Costs		Sub-total
1975	782.0	86.6	868.6	192.4	16.1	17.0	—	17.3	242.8	1,111.4
1976	1,058.5	157.0	1,215.5	433.8	39.8	41.4	—	31.8	546.8	1,762.3
1977	552.0	160.7	712.7	562.8	51.3	63.8	—	37.6	715.5	1,428.2
1978	912.0	488.9	1,401.4	868.2	70.4	124.3	—	46.3	1,109.2	2,510.6
1979	881.5	329.2	1,210.7	1,057.8	89.3	171.9	—	49.2	1,368.2	2,578.9
1980	686.5	224.5	911.0	1,233.4	103.3	199.0	19.8	52.1	1,607.6	2,518.6
1981	532.0	165.9	697.9	1,453.7	113.6	230.2	99.2	52.1	1,948.8	2,646.7
1982	307.5	109.1	416.6	1,569.4	119.4	247.2	57.9	55.0	2,048.9	2,465.5
1983	—	22.4	22.4	1,611.6	119.4	251.4	82.0	55.0	2,119.4	2,141.8
1984	—	—	—	1,611.6	↓	251.4	103.9	↓	2,141.3	2,141.3
1985	—	22.4	22.4	1,652.8	↓	254.7	168.0	↓	2,249.9	2,272.3
1986	—	—	—	1,652.8	↓	254.7	237.2	↓	2,319.1	2,319.1
1987	—	—	—	↓	↓	↓	381.5	↓	2,463.4	2,463.4
1988	—	—	—	↓	↓	↓	240.6	↓	2,322.5	2,322.5
1989	—	—	—	↓	↓	↓	311.0	↓	2,392.9	2,392.9
1990	—	—	—	↓	↓	↓	199.0	↓	2,280.9	2,280.9
1991	—	—	—	↓	↓	↓	284.3	↓	2,366.2	2,366.2
1992	—	—	—	↓	↓	↓	104.6	↓	2,186.5	2,186.5
1993	—	—	—	↓	↓	↓	224.6	↓	2,306.5	2,306.5
1994	—	—	—	↓	↓	↓	159.0	↓	2,240.9	2,240.9
1995 to 1999	—	—	—	↓	↓	↓	161.6	↓	2,243.5	2,243.5
1999	—	—	—	↓	↓	↓	178.0	↓	2,259.9	2,259.9
Total	5,712.5	1,766.7	7,479.2	35,386.7	2,633.0	5,418.1	3,546.2	1,276.2	48,260.4	55,739.6

TABLE VIII.2 ANALYSIS OF ADU COSTS BY SECTIONS COVERING ONLY THE SCHEMES STARTED DURING THE ACTION PROGRAMME PERIOD (\$ 000)

Cost Item	Smallholder Schemes	Road Based Schemes	Headquarters Section	Total ADU
Capital (Total for Scheme)				
Buildings and Furniture	1,771.0	3,576.5	365.0	5,712.5
Vehicles and Equipment	700.3	1,012.4	54.0	1,766.7
Total ...	2,471.3	4,588.9	419.0	7,479.2
Recurrent (Average per annum at full Development)				
Salaries and Wages	686.0	867.0	99.8	1,652.8
Buildings Maintenance	35.9	76.2	7.3	119.4
Vehicles and Equipment Replacement	176.8	240.3	19.4	436.5
General Expenses	17.4	26.1	11.5	55.0
Total ...	916.1	1,209.6	138.0	2,263.7

In addition to the costs outlined above, which are those directly involved in setting-up and running the ADU organisation, there would be the development costs of the crops established on the land. The road based development and block alienation schemes which would handle about 2,800 farmers would require disbursement of the development costs amounting to \$14.8 mn. The source of these funds would probably be the Bank Pertanian.

Year	Smallholder Schemes	Road Based Schemes	Headquarters Section	Total ADU
1971
1972
1973
1974
1975
1976
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APPENDIX IX

COSTS AND RETURNS OF SELECTED AGRICULTURAL ACTIVITIES

IX.1 INTRODUCTION

Detailed costs and returns and labour input requirements have been worked out for the main crops identified for inclusion in the agricultural plan for the Study Area. These costs and returns have been used for the economic and financial analysis of the agricultural development recommended for implementation during the action programme period (1975 to 1980) as well as for farm budget studies. Detailed costs and returns and labour input requirements are presented in tables in this Appendix.

The basis for the costings have been the physical inputs including labour indicated in detailed agronomic sections of the Final Report at prices which prevailed in Sarawak during 1972 adjusted to relate to the Study Area. Wherever possible local records were used for these estimates but in some instances they were based on an estimated basis.

As is usual in studies of this nature a constant price assumption has been used in the estimates although it was realised that even during the course of the Study there were significant price developments for many materials, as well as supply situations, which affected the availability of many items. The most important item affected by these trends was fertilizer due to hardening prices and shortage of basic raw materials.

IX.2 BASIS OF ESTIMATING THE COSTS AND RETURNS

IX.2.1 Initial Development and Maintenance

For economic evaluation and comparison of the activities it was important that costs were established for the basic resources involved in production both from the overall economic and the management point of view. To satisfy these needs the costs have been divided into several categories thus:

On-farm costs covering land development and crop production expenses.

Off-farm costs covering loading and transport, distribution and processing.

The costs of production of tree crops established under road based schemes in legally occupied land have been estimated on the basis of the following changes made to the public sector scheme costs:

- (a) land clearing reduced to account for clearing secondary jungle compared to logged natural jungle;
- (b) road development costs excluded; the road either already exists or would be constructed for purposes other than agriculture;
- (c) production material costs were reduced by 10 per cent because it has been assumed that generally a lower standard of crop husbandry would be achieved on the road based scheme resulting in yields 15 per cent

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Detailed costs and returns and labour input requirements have been worked out for the main crops identified for inclusion in the agricultural plans for the Study Area. These costs and returns have been used for the economic and financial analysis of the agricultural development recommended for implementation during the Action Programme period (1975 to 1980) as well as for farm budget studies. Detailed costs and returns and labour input requirements are presented in tables in this Appendix.

The basis for the costings have been the physical inputs including labour indicated in detailed agronomic sections of the Final Report at prices which prevailed in Sarawak during 1972 adjusted to relate to the Study Area. Wherever possible local records and case studies were used as a basis for these estimates but in some instances it was necessary to calculate them on the empirical basis.

As is usual in studies of this nature a constant prices assumption has been used in the estimates although it was realised that even during the course of the Study there were significant price developments for many materials, as well as supply situations, which affected the availability of many items. The most important item affected by these trends was fertilisers due to hardening prices and shortage of basic raw materials.

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IX.2.1 Initial Development and Maintenance

For economic evaluation and comparison of the activities it was important that costs were established for the basic resources involved in production both from the overall economic and the management point of view. To satisfy these needs the costs have been divided into several categories thus:

On-farm costs covering land development and crop production expenses;

Ex-farm costs covering loading and transport, distribution and processing.

The costs of production of tree crops established under road based schemes in legally occupied land have been estimated on the basis of the following changes made to the public sector scheme costs:

- (a) land clearing reduced to account for clearing secondary jungle compared to logged mature jungle;
- (b) road development costs excluded; the road either already exists or would be constructed for purposes other than agriculture;
- (c) production material costs were reduced by 10 per cent because it has been assumed that generally a lower standard of crop husbandry would be achieved on the road based schemes resulting in yields 15 per cent

below those which would prevail on the public sector schemes or private investor undertakings;

- (d) processing costs were reduced by 15 per cent to account for the lower yields.

IX.2.2 Labour Requirements

The labour inputs of each crop have been assessed on an annual basis according to the major operations performed in that year. The unit used has been a man-day or its equivalent which is the work performed by an adult worker during a normal working day of about eight hours. Labour inputs for a crop on a public sector scheme and on a road based scheme have been assumed to be the same.

IX.2.3 Returns

The gross returns attributed to each crop have been estimated on the basis of the yield of the crop and the fob prices projected for the crop in that year. For the farm budgets a common starting year has been assumed for all activities, other analyses have been related to the specific year of operation.

TABLE IX.1 OIL PALM YIELDS AND RETURNS (PER ACRE)

Year (from planting)	Yield per tons	Palm Oil		Kernels
		FOB(1) Value \$	Gross Sales Value \$	FOB/Gross Sales Value \$
3	0.4	39.6	36.6	4.2
4	3.1	269.7	249.1	34.2
5	5.2	447.0	412.8	60.1
6	6.6	554.2	511.8	62.6
7	7.2	602.5	556.3	86.4
8	7.5	610.8	564.0	88.0
9	7.7	614.6	567.6	88.4
10	7.7	608.0	561.5	86.9
11	7.7	608.0	561.5	86.9
12	7.6	601.3	555.3	85.9
13	7.5	594.5	549.0	85.0
14	7.3	581.0	536.5	83.0
15	7.2	574.3	530.3	82.1
16	7.1	560.7	517.8	80.2
17	7.0	554.0	511.6	79.2
18	6.8	540.4	499.1	77.3
19	6.7	526.9	486.6	75.3
20	6.7	526.9	486.6	75.3
21	6.6	520.2	480.4	74.4
22	6.6	520.2	480.4	74.4
23	6.5	513.4	474.1	73.4
24	6.5	513.4	474.1	73.4
25	6.4	506.7	467.9	72.4

(1) Net of 2 per cent sales commission.

TABLE IX.2 OIL PALM COSTS AND LABOUR REQUIREMENTS FOR ROAD BASED IMPROVEMENT SCHEMES

Year	On-farm Costs (\$ per acre)				Ex-farm Costs (\$ per acre)				Labour Requirements (man-days per acre)	
	Development Including Labour	Production Materials	Production Labour at \$5	Total On-farm	Transport	Processing	Distribution	Total Ex-farm	Development	Production
0	60.0	—	8.5	68.5	—	—	—	—	11.4	1.7
1	70.0	114.2	92.5	276.7	—	—	—	—	11.9	18.5
2	0.6	67.6	63.5	131.7	—	—	—	—	0.1	12.7
3	0.6	75.0	94.0	169.6	1.5	5.1	2.1	8.7	0.1	18.8
4	0.6	93.4	130.5	224.5	10.8	36.7	15.2	62.7	0.1	26.1
5	0.6	105.6	127.0	233.2	18.3	62.2	26.1	106.6	0.1	25.4
6	0.6	101.3	104.5	206.4	23.1	78.5	33.2	134.8	0.1	20.9
7	0.6	101.4	104.5	206.5	25.5	86.7	36.6	148.8	0.1	20.9
8	0.6	100.9	94.0	195.9	26.4	89.8	37.9	154.1	0.1	18.8
9	0.6	100.7	82.0	183.3	27.0	91.8	38.8	157.6	0.1	16.4
10	0.6	100.7	82.0	183.3	27.0	91.8	38.8	157.6	0.1	16.4
11	0.6	100.6	82.0	183.2	27.0	91.8	38.8	157.6	0.1	16.4
12	0.6	100.6	82.0	183.2	26.7	90.8	38.4	155.9	0.1	16.4
13	0.6	100.6	82.0	183.2	26.4	89.8	37.9	154.1	0.1	16.4
14	0.6	100.6	82.0	183.2	25.8	87.7	37.1	150.6	0.1	16.4
15	0.6	100.6	82.0	183.2	25.8	86.7	36.6	149.1	0.1	16.4
16	0.6	100.6	82.0	183.2	24.9	84.7	35.8	145.4	0.1	16.4
17	0.6	100.4	93.5	194.5	24.6	83.6	35.4	143.6	0.1	18.7
18	0.6	100.4	93.5	194.5	24.0	81.6	34.5	140.1	0.1	18.7
19	0.6	100.4	93.5	194.5	23.4	79.6	33.6	136.6	0.1	18.7
20	0.6	100.4	93.5	194.5	23.4	79.6	33.6	136.6	0.1	18.7
21	0.6	100.4	93.5	194.5	23.1	78.5	33.2	134.8	0.1	18.7
22	0.6	100.4	93.5	194.5	23.1	78.5	33.2	134.8	0.1	18.7
23	0.6	100.4	93.5	194.5	22.8	77.5	32.7	133.0	0.1	18.7
24	0.6	100.4	93.5	194.5	22.8	77.5	32.7	133.0	0.1	18.7
25	0.6	100.4	93.5	194.5	22.5	76.5	32.3	131.3	0.1	18.7
Total	144.4	2,468.0	2,316.5	4,928.9	525.9	1,767.0	754.5	3,067.4	25.7	463.3
N.P.V. at 10%	135.4	965.4	946.3	2,047.1	168.9	574.3	242.2	985.6	24.2	189.1

TABLE IX.3 RUBBER YIELDS AND RETURNS (per acre)

Year (from planting)	Road Based Improvement			
	Yield d.r.c. lbs(I)	FOB Value \$	Export Duty \$	Gross Sales Value \$
7	527	258.2	14.2	244.0
8	859	420.7	23.2	397.5
9	1,071	524.8	28.9	495.9
10	1,207	591.4	32.6	558.8
11	1,275	624.8	34.4	590.4
12	1,360	666.4	36.7	629.7
13	1,445	780.1	39.0	741.1
14 and onwards	1,530	749.7	41.3	708.4

(I) d.r.c. = dry rubber content.

TABLE IX.4 RUBBER COSTS AND LABOUR REQUIREMENTS FOR ROAD BASED DEVELOPMENT SCHEMES

Year	On-farm Costs (\$ per acre)			Ex-farm Costs (\$ per acre)				Labour Requirements (man-days per acre)		
	Development Including Labour	Production Materials	Production Labour at \$5	Total On-farm	Transport	Processing	Distribution	Total Ex-farm	Development	Production
0	60.0	—	—	60.0	—	—	—	—	11.4	—
1	70.0	64.8	173.0	307.8	—	—	—	—	11.9	34.6
2	0.6	33.4	114.5	148.5	—	—	—	—	0.1	22.9
3	0.6	33.8	83.0	117.4	—	—	—	—	0.1	16.6
4	0.6	40.5	66.0	107.1	—	—	—	—	0.1	13.2
5	0.6	40.6	48.5	89.7	—	—	—	—	0.1	9.7
6	0.6	38.1	40.5	79.2	—	—	—	—	0.1	8.1
7	0.6	74.0	127.0	201.6	10.9	32.9	9.4	53.2	0.1	25.4
8	0.6	51.8	198.5	250.9	13.6	53.6	15.3	82.5	0.1	39.7
9	0.6	50.8	208.5	259.9	15.3	67.0	19.0	101.3	0.1	41.7
10	0.6	50.8	225.5	276.9	16.4	75.4	21.5	113.3	0.1	45.1
11	0.6	50.8	229.0	280.4	16.9	79.7	22.7	119.3	0.1	45.8
12	0.6	58.7	242.0	301.3	17.6	85.0	24.2	126.8	0.1	48.4
13	0.6	58.7	244.5	303.8	18.3	90.3	25.8	134.4	0.1	48.9
14	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
15	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
16	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
17	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
18	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
19	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
20	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
21	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
22	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
23	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
24	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
25	0.6	58.7	250.0	309.3	19.0	95.6	27.2	141.8	0.1	50.0
Total	144.4	1,351.2	5,000.5	6,496.1	337.0	1,631.1	464.3	2,432.4	25.7	1,001.1
N.P.V. at 10%	135.4	504.9	1,614.5	2,254.9	87.0	406.4	115.7	609.2	24.2	322.9

TABLE IX.5 COCOA YIELDS AND RETURNS (per acre)

Year (from planting)	Road Based Improvement	
	Yield tons	FOB/ Gross Sales Value \$
4	0.19	212.8
5	0.38	424.5
6 and onwards	0.57	637.4

TABLE IX.6 COCOA COSTS AND LABOUR REQUIREMENTS FOR ROAD BASED DEVELOPMENT SCHEMES

Year	On-farm Costs (\$ per acre)				Ex-farm Costs (\$ per acre)				Labour Requirements (man-days per acre)	
	Development Cost Including Labour	Production Materials	Production Labour at \$5	Total On-farm	Transport	Processing	Distribution	Total Ex-farm	Development	Production
0	60.0	—	—	60.0	—	—	—	—	11.4	—
1	125.0	81.6	63.5	270.1	—	—	—	—	14.9	12.7
2	10.0	70.9	186.0	266.9	—	—	—	—	0.6	36.6
3	10.0	81.5	153.0	244.5	—	—	—	—	0.6	30.0
4	10.0	71.7	113.5	195.2	1.7	14.9	7.0	23.6	0.6	22.1
5	10.0	99.3	121.0	230.3	3.3	29.8	13.9	47.0	0.6	23.6
6	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
7	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
8	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
9	10.0	127.1	131.5	268.6	5.0	44.6	20.9	70.5	0.6	25.7
10	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
11	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
12	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
13	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
14	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
15	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
16	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
17	10.0	127.1	131.5	268.6	5.0	44.6	20.9	70.5	0.6	25.7
18	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
19	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
20	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
21	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
22	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
23	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
24	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
25	10.0	117.7	131.5	259.2	5.0	44.6	20.9	70.5	0.6	25.7
Total	425.0	2,777.8	3,267.0	6,469.0	105.0	936.7	438.9	1,480.6	40.7	639.0
N.P.V. at 10%	274.9	1,026.4	1,291.5	2,593.4	32.6	290.9	136.2	458.1	31.7	252.9

TABLE IX.7 PEPPER YIELDS AND RETURNS⁽¹⁾ (per acre)

Year	AVERAGE YIELD SITUATION					LOWER YIELD SITUATION								
	Green Berries		Made Pepper(2)		FOB Value \$	Export Duty \$	Gross Sales Value \$	Green Berries		Made Pepper		FOB Value \$	Export Duty \$	Gross Sales Value \$
	Per Vine lbs	Per Acre tons	White tons	Black tons				Per Vine lbs	Per Acre tons	White tons	Black tons			
3	17	4.58	0.49	0.90	2,562.8	61.8	2,501.0	13	3.63	0.39	0.71	2,029.5	48.9	1,980.6
4	29	7.97	0.86	1.57	4,461.8	107.6	4,354.2	23	6.36	0.68	1.26	3,561.7	85.9	2,475.8
5	33	9.16	0.98	1.81	5,127.7	123.6	5,004.1	27	7.32	0.79	1.44	4,095.0	98.7	3,996.3
6	33	9.16	0.98	1.81	5,127.7	123.6	5,004.1	27	7.32	0.79	1.44	4,095.0	98.7	3,996.3
7	30	8.15	0.88	1.61	4,560.8	101.0	4,459.8	23	6.36	0.68	1.26	3,561.8	85.9	3,475.9
8	25	6.84	0.73	1.35	3,829.5	92.3	3,737.2	20	5.47	0.59	1.08	3,062.2	74.8	2,987.4
9	22	5.89	0.63	1.16	3,296.3	79.5	3,216.8	17	4.64	0.50	0.91	2,596.5	52.6	2,543.9
10	19	5.29	0.57	1.04	2,962.2	71.4	2,890.8	16	4.16	0.45	0.82	2,331.0	56.2	2,274.8
11	18	4.82	0.52	0.95	2,695.5	65.0	2,630.5	14	3.80	0.41	0.75	2,130.8	51.4	2,079.4
12	17	4.58	0.49	0.90	2,562.8	61.8	2,501.0	13	3.63	0.39	0.71	2,029.5	48.9	1,980.6

(1) Assuming 615 vines planted per acre.

(2) Conversion rates from green berries to made pepper:

Black — 33 per cent.

White — 27 per cent.

TABLE IX.8 PEPPER COSTS AND LABOUR REQUIREMENTS

Year	On-farm Costs (\$ per acre)			Ex-farm Costs (\$ per acre)				Labour Requirements (man-days per acre)		
	Development Including Labour	Production Materials	Production Labour at \$5	Total On-farm	Transport	Processing	Distribution	Total Ex-farm	Development	Production
0	195.0	—	—	195.0	—	—	—	—	7.0	—
1	225.0	1,626.3	893.5	2,744.8	—	—	—	—	13.0	178.7
2	1.5	436.9	338.5	776.9	—	—	—	—	0.3	67.7
3	1.5	668.2	815.5	1,485.2	—	94.7	396.3	491.0	0.3	163.1
4	1.5	624.1	1,165.5	1,791.1	—	164.7	690.1	854.8	0.3	233.1
5	1.5	668.2	1,288.5	1,958.2	—	189.3	793.1	982.4	0.3	257.7
6	1.5	636.7	1,288.5	1,926.7	—	189.3	793.1	982.4	0.3	257.7
7	1.5	668.2	1,184.0	1,853.7	—	168.4	705.4	873.8	0.3	236.8
8	1.5	624.1	1,049.0	1,674.6	—	141.4	592.3	733.7	0.3	209.8
9	1.5	794.2	950.2	1,746.2	—	121.7	509.8	631.5	0.3	190.1
10	1.5	624.1	889.0	1,514.6	—	109.4	458.1	567.5	0.3	177.8
11	1.5	680.8	840.0	1,522.3	—	99.6	416.9	516.5	0.3	168.0
12	1.5	624.1	815.5	1,441.1	—	94.7	396.4	491.1	0.3	163.1
13	195.0	72.8	—	267.8	—	—	—	—	10.0	—
14	30.0	499.6	893.5	1,423.1	—	—	—	—	6.0	178.7
15	1.5	481.0	338.5	821.0	—	—	—	—	0.3	67.7
16	1.5	636.7	815.5	1,453.7	—	94.7	396.3	491.0	0.3	163.1
17	1.5	794.2	1,165.5	1,961.2	—	164.7	690.1	854.8	0.3	233.1
18	1.5	624.1	1,288.5	1,914.1	—	189.3	793.1	982.4	0.3	257.7
19	1.5	668.2	1,288.5	1,958.2	—	189.3	793.1	982.4	0.3	257.7
20	1.5	624.1	1,184.0	1,809.6	—	168.4	705.4	873.8	0.3	236.8
21	1.5	668.2	1,049.0	1,718.7	—	141.4	592.3	733.7	0.3	209.8
22	1.5	636.7	950.5	1,588.7	—	131.7	509.8	631.5	0.3	190.1
23	1.5	668.2	889.0	1,558.7	—	109.4	458.1	567.5	0.3	177.8
24	1.5	624.1	840.0	1,465.6	—	99.6	416.9	516.5	0.3	168.0
25	1.5	794.2	815.5	1,611.2	—	94.7	396.4	491.1	0.3	163.1
Total	678.0	16,468.0	23,036.0	40,182.0	—	2,746.4	11,503.0	14,249.4	42.6	4,607.2
N.P.V. at 10%	503.4	7,096.2	9,118.5	16,718.1	—	1,020.8	4,276.0	5,296.9	26.8	1,823.7

TABLE IX.9 RICE YIELDS AND RETURNS (per acre)

Year	Yield tons	Gross Sales Value \$
2	0.78	247.3
3	0.89	282.1
4	1.07	339.2
5 and onwards	1.23	389.9

TABLE IX.10 ESTIMATED RICE COSTS AND LABOUR REQUIREMENTS

Year	On-farm Costs (\$ per acre)				Labour Requirements (man-days per acre)	
	Land Development Including Labour	Production Materials	Production Labour at \$5 per Day	Total On-farm	Development	Production
0	93	nil	nil	93	5.7	nil
1	573	nil	nil	573	21.5	nil
2	383	65	200	648	24.4	40
3	33	65	215	313	nil	43
4	33	65	210	308	nil	42
5 and onwards	33	65	220	318	nil	44
Total for 25 years	1,797	1,560	5,245	8,601	62	1,049
N.P.V. at 10%	1,277	584	1,946	3,806	49	389

Roundoff

	1997	1998	1999	2000	2001	2002
10,400.4	5,361.3	5,486.4	5,711.9	5,700.7	5,579	5,711.9
	860.8	846.9	831.5	730.6	800	831.5
	2,448.7	2,440.3	2,667.3	2,956.6	2,900	2,667.3
	15,931.4	16,381.3	18,075.8	18,288.0	18,279	18,075.8
	1,310.5	1,310.3	1,296.3	1,282.0	1,280	1,296.3
	1,541.5	1,542.5	1,542.5	1,542.5	1,540	1,542.5
	27,624.0	27,998.8	28,274.8	28,278.8	28,279	28,274.8

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APPENDIX X

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909.2

2,150.7

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1,231.3

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1,262.0

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2,311.4

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5,18,170.2

2,000

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APPENDIX X

ECONOMIC AND FINANCIAL ANALYSIS TABLES

TABLE X.1 ECONOMIC ANALYSIS OF ROAD BASED IMPROVEMENT SCHEMES AT MARKET PRICES (\$ thousand)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
GROSS SALES REVENUE (Excluding duty)																									
PALM OIL	—	—	—	29.2	253.6	688.9	1,276.2	1,938.1	2,660.1	3,495.2	4,457.6	5,120.0	5,489.6	5,640.8	5,688.9	5,681.9	5,628.0	5,561.5	5,469.4	5,372.9	5,276.7	5,276.7	5,276.7	5,276.7	5,276.7
PALM KERNELS	—	—	—	3.3	34.1	98.3	194.3	300.5	412.5	541.3	668.7	792.1	849.4	873.0	880.3	879.3	871.0	860.8	846.6	831.6	816.8	816.8	816.8	816.8	816.8
COCOA	—	—	—	—	40.3	181.4	448.0	800.8	1,189.4	1,580.3	2,000.3	2,287.0	2,448.3	2,448.3	2,448.3	2,448.3	2,448.4	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3
RUBBER	—	—	—	—	—	—	—	246.8	1,163.5	2,687.9	4,684.4	6,818.3	9,110.1	11,643.4	13,313.0	14,523.2	15,355.9	15,930.4	16,381.5	16,670.8	16,845.0	16,845.0	16,845.0	16,845.0	16,845.0
RICE	—	—	37.4	143.9	295.4	479.3	686.0	896.3	1,133.0	1,214.7	1,277.8	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5
OTHER CROPS	—	—	23.0	90.0	198.0	360.5	563.0	808.5	1,085.0	1,263.5	1,458.7	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5
TOTAL REVENUE	—	—	60.4	266.4	821.4	1,808.4	3,167.5	4,991.0	7,643.5	10,782.9	14,547.5	17,870.4	20,750.4	23,458.5	25,183.6	26,385.7	27,156.2	27,654.0	27,998.8	28,176.6	28,239.8	28,239.8	28,239.8	28,239.8	28,239.8
FARM COSTS																									
LAND DEVELOPMENT(1)	15.9	140.1	348.5	485.5	541.0	570.2	595.3	615.1	276.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7
PRODUCTION MATERIALS(1)	—	176.7	492.0	821.3	1,183.1	1,628.7	2,116.1	2,805.9	2,939.9	3,351.3	3,781.4	4,117.3	4,364.9	4,648.2	4,675.2	4,771.3	4,839.0	4,896.8	4,951.1	4,959.3	4,960.9	4,950.6	4,939.3	4,931.1	4,931.1
FARMERS SUBSISTENCE INCOME	75.0	292.5	637.5	1,096.3	1,658.8	2,300.8	3,004.5	3,467.5	3,819.3	4,063.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5
TOTAL FARM COSTS	90.9	609.3	1,478.3	2,403.1	3,382.9	4,499.7	5,715.9	6,888.5	7,035.9	7,554.5	8,116.6	8,452.5	8,700.1	8,983.4	9,010.4	9,106.5	9,174.2	9,232.0	9,286.3	9,294.5	9,296.1	9,285.8	9,274.5	9,266.3	9,266.3
NET FARM REVENUE	-90.9	-609.3	-1,417.9	-2,136.7	-2,561.5	-2,691.3	-2,548.4	-1,897.5	+607.6	+3,228.4	+6,400.9	+9,417.9	+12,050.3	+14,475.1	+16,173.2	+17,279.2	+17,982.0	+18,422.0	+18,712.5	+18,882.1	+18,943.7	+18,954.0	+18,965.3	+18,973.5	+18,973.5
PROJECT COSTS																									
PROCESSING COSTS																									
OIL FARM	—	—	—	4.1	37.4	103.8	195.8	302.0	423.3	565.3	728.7	837.0	897.4	922.2	930.1	928.9	920.1	909.2	894.1	878.4	862.7	850.3	838.8	827.4	816.6
RUBBER	—	—	—	—	—	—	—	33.3	157.1	362.9	625.7	920.5	1,229.9	1,571.9	1,797.3	1,960.7	2,073.1	2,150.7	2,211.6	2,250.6	2,274.2	2,274.2	2,274.2	2,274.2	2,274.2
COCOA	—	—	—	—	2.8	12.7	31.4	56.1	83.3	110.6	140.0	160.1	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4	171.4
TOTAL PROCESSING COSTS	—	—	—	4.1	40.2	116.5	227.2	391.4	663.7	1,038.8	1,494.4	1,917.6	2,298.7	2,665.5	2,898.8	3,061.0	3,164.6	3,231.3	3,277.1	3,300.4	3,308.3	3,295.9	3,284.4	3,273.0	3,262.2
ADU MANAGEMENT COSTS																									
MANAGEMENT	562.5	1,307.6	1,236.1	1,502.8	1,453.3	1,446.6	1,790.3	1,170.2	1,162.4	1,173.7	1,198.2	1,294.9	1,304.8	1,253.7	1,283.2	1,247.7	1,291.0	1,175.4	1,165.2	1,173.0	1,227.8	1,200.0	1,200.0	1,200.0	1,200.0
HQ COSTS	365.9	86.6	86.6	86.6	86.6	86.6	119.0	86.6	86.6	86.6	86.6	86.6	119.0	86.6	86.6	86.6	86.6	86.6	119.0	86.6	86.6	86.6	86.6	86.6	86.6
TRAINING	154.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL ADU COSTS	1,082.4	1,494.2	1,422.7	1,689.4	1,639.2	1,633.2	2,009.3	1,356.8	1,249.0	1,260.3	1,284.8	1,381.5	1,423.8	1,340.3	1,369.8	1,334.3	1,377.6	1,262.0	1,284.2	1,259.6	1,314.4	1,286.6	1,286.6	1,286.6	1,286.6
TOTAL PROJECT COSTS	1,082.4	1,494.2	1,422.7	1,693.5	1,680.1	1,749.7	2,236.5	1,748.2	1,912.7	2,299.1	2,779.2	3,299.1	3,722.5	4,005.8	4,268.6	4,395.3	4,542.2	4,493.3	4,561.3	4,560.0	4,622.7	4,582.5	4,571.0	4,559.6	4,548.8
NET CASH FLOW	-1,173.3	-2,103.5	-2,840.6	-3,830.2	-4,241.6	-4,441.0	-4,784.9	-3,645.7	-1,305.1	+929.3	+3,621.7	+6,118.8	+8,327.8	+10,469.3	+11,904.6	+12,883.9	+13,439.8	+13,928.7	+14,151.2	+14,322.1	+14,321.0	+14,371.5	+14,394.3	+14,431.9	+14,424.7

NOTE: (1) Land Development and production materials excluding labour.

TABLE X.2 ECONOMIC ANALYSES OF ROAD BASED IMPROVEMENT SCHEMES—AT SOCIAL PRICES

(\$ thousand)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1996	1998	1999	
GROSS REVENUE (fob prices)																										
PALM OIL	—	—	—	31.7	274.7	746.1	1,380.7	2,099.2	2,885.9	3,787.2	4,834.1	5,552.5	5,953.3	6,117.3	6,169.4	6,161.8	6,103.3	6,103.3	5,931.4	5,826.7	5,722.4	5,722.4	5,722.4	5,722.4	5,722.4	5,722.4
PALM KERNELS	—	—	—	3.3	34.1	98.3	194.3	300.5	412.5	541.3	688.1	792.1	849.4	873.0	880.4	879.3	871.3	871.8	846.6	831.8	816.8	816.8	816.8	816.8	816.8	816.8
RUBBER	—	—	—	—	—	—	—	261.3	1,232.0	2,846.0	4,907.0	7,219.4	9,645.9	12,328.3	14,096.1	15,377.5	16,259.2	16,867.5	17,345.1	17,651.5	17,835.9	17,835.9	17,835.9	17,835.9	17,835.9	17,835.9
COCOA	—	—	—	—	40.3	181.3	448.0	800.8	1,189.4	1,580.3	2,000.3	2,287.0	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3	2,448.3
RICE	—	—	37.4	143.9	295.4	479.3	686.0	896.3	1,133.0	1,214.7	1,277.8	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5	1,310.5
OTHER CROPS	—	—	23.0	90.0	198.0	360.5	563.0	808.5	1,085.0	1,263.5	1,458.7	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5	1,542.5
TOTAL REVENUE	—	—	60.4	268.9	842.5	1,865.6	3,272.0	5,166.6	7,937.8	11,233.0	15,166.6	8,704.0	21,749.9	24,619.9	26,447.2	27,719.9	28,534.8	29,060.9	29,424.4	29,611.1	29,676.4	29,676.4	29,676.4	29,676.4	29,676.4	29,676.4
FARM COSTS																										
LAND DEVELOPMENT(1) ...	15.9	140.1	348.8	485.5	541.0	570.2	595.3	615.1	276.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7	139.7
PRODUCTION MATERIALS(1) ...	—	176.7	492.0	821.3	1,183.1	1,628.7	2,116.1	2,805.9	2,939.9	3,351.3	3,781.4	4,117.3	4,364.9	4,648.2	4,675.2	4,771.3	4,839.0	4,896.8	4,951.1	4,959.3	4,960.9	4,939.1	4,931.1	4,931.1	4,931.1	4,931.1
FARMERS LABOUR(2) ...	49.5	193.1	420.8	723.6	1,094.8	1,518.5	1,983.0	2,288.6	2,520.7	2,681.9	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0	2,769.0
TOTAL FARM COSTS	65.4	509.9	1,261.6	2,030.4	2,818.9	3,717.4	4,694.4	5,709.6	5,737.3	6,172.9	6,690.1	7,026.0	7,273.6	7,556.9	7,583.9	7,680.0	7,747.7	7,805.5	7,859.8	7,868.0	7,869.6	7,859.3	7,848.0	7,839.8	7,839.8	7,839.8
NET FARM REVENUE	-65.4	-509.9	-1,201.2	-1,761.5	-1,976.4	-1,851.8	-1,422.4	-543.0	+2,200.5	+5,060.1	+8,476.5	1,678.0	14,476.3	+17,063.0	+18,863.3	+20,039.9	+20,787.1	+2,125.4	+21,564.6	+21,743.1	+21,806.8	+21,817.1	+21,828.4	+21,836.6	+21,836.6	+21,836.6
PROJECT COSTS																										
PROCESSING COSTS	—	—	—	4.1	40.2	116.5	227.2	391.4	663.7	1,038.8	1,494.4	1,917.6	2,298.7	2,665.6	2,898.8	3,061.0	3,164.6	3,231.3	3,277.1	3,300.4	3,308.3	3,295.9	3,284.4	3,273.0	3,262.2	
ADU CoSTS	1,082.4	1,494.2	1,422.7	1,693.5	1,680.1	1,749.7	2,236.5	1,748.2	1,912.7	2,299.1	2,779.1	2,779.2	3,299.1	3,722.5	4,005.8	4,395.3	4,542.2	4,493.3	4,561.3	4,560.0	4,622.7	4,582.5	4,571.0	4,559.6	4,548.8	
TOTAL PROJECT COSTS	1,082.4	1,494.2	1,422.7	1,697.6	1,720.3	1,866.2	2,463.7	2,139.6	2,576.4	3,337.9	4,273.6	5,216.7	6,021.2	6,671.3	7,167.4	7,456.3	7,706.8	7,724.6	7,838.4	7,860.4	7,931.0	7,878.4	7,855.4	7,832.6	7,811.6	
NET CASH FLOW	-1,147.8	-2,004.1	-2,623.9	-3,459.1	-3,696.7	-3,718.0	-3,886.1	-2,682.6	-375.9	+1,722.2	+4,202.9	+6,461.3	+8,455.1	+10,391.7	+11,695.9	+12,583.6	+13,080.3	+13,530.8	+13,530.8	+13,726.2	+13,882.7	+13,875.8	+13,973.0	+14,004.0	+14,025.6	

NOTE: (1) 'Land development' and 'Production material' costs excluding labour.
(2) Opportunity cost of farmers family labour assessed at net value of subsistence production replaced, \$330 increasing over five years to \$1,000 per family per annum.

TABLE X.3 FINANCIAL ANALYSIS OF ROAD BASED IMPROVEMENT SCHEMES (\$ thousand)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
GROSS SALES REVENUE (Market prices excl. duty) ...	—	—	60.4	266.4	821.4	1,808.4	3,167.5	4,991.0	7,643.5	10,782.9	14,517.5	17,870.4	20,750.4	23,458.5	25,183.6	26,385.7	27,156.2	27,654.0	27,998.8	28,176.6	28,239.8	28,239.8	28,239.8	28,239.8	28,239.8	28,239.8
FARM COSTS (including labour)	15.9	316.8	840.8	1,306.8	1,724.1	2,198.9	2,711.4	3,421.0	3,216.6	3,491.0	3,921.1	4,257.0	4,504.6	4,787.9	4,814.9	4,911.0	4,978.7	5,036.5	5,090.8	5,099.0	5,100.6	5,090.3	5,079.0	5,079.8	5,079.8	
FARMERS SUBSISTENCE INCOME	75.0	292.5	637.5	1,096.3	1,658.8	2,300.8	3,004.5	3,467.5	3,819.3	4,063.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	4,195.5	
PROCESSING COSTS	—	—	—	4.1	40.2	116.5	227.2	391.4	663.7	1,038.8	1,494.4	1,917.6	2,298.7	2,665.5	2,898.8	3,061.0	3,164.6	3,231.3	3,277.1	3,300.4	3,308.2	3,295.9	3,284.4	3,273.0	3,262.2	
TOTAL COSTS	90.9	609.3	1,478.3	2,407.2	3,423.1	4,616.2	5,943.1	7,279.9	7,699.6	8,593.3	9,611.0	10,370.1	10,998.8	11,648.9	11,909.2	12,167.5	12,338.8	12,463.3	12,563.4	12,594.9	12,604.3	12,581.7	12,558.9	12,539.3	12,528.5	
NET CASH FLOW (NCF)	-90.9	-609.3	-1,417.9	-2,140.8	-2,601.7	-2,807.8	-2,775.6	-2,288.9	-56.1	+2,189.6	+4,906.5	+7,500.3	+9,751.6	+11,809.6	+13,274.4	+14,218.2	+14,817.4	+15,190.7	+15,435.4	+15,581.7	+15,635.5	+15,658.1	+15,680.9	+15,700.5	+15,711.3	
REPAYMENT CAPACITY																										
CUMULATIVE BALANCE	-90.9	-706.6	-2,174.0	-4,467.0	-7,381.4	-10,705.9	-14,230.9	-17,516.0	-18,798.2	-17,924.5	-14,272.7	-7,771.5	+1,436.1	+13,346.2	+27,554.8	+43,701.8	+61,578.3	+81,079.5	+102,190.5	+124,925.5	+149,305.8	+175,415.3	+203,375.3	+233,312.1	+265,355.2	
INTEREST AT 7 PER CENT	6.4	49.5	152.2	312.7	516.7	749.4	996.2	1,226.1	1,315.9	1,254.7	999.1	544.0	100.5	934.2	1,928.8	3,059.1	4,310.5	5,675.6	7,153.3	8,744.8	10,451.4	12,279.1	14,236.3	16,331.8	18,574.9	
NET BALANCE	-97.3	-756.1	-2,326.2	-4,779.7	-7,898.1	-11,455.3	-15,227.1	-18,742.1	-20,114.1	-19,179.2	-15,271.8	-8,315.5	+1,536.6	+14,280.4	+29,483.6	+46,760.9	+65,888.8	+86,755.1	+109,343.8	+133,670.3	+159,757.2	+187,694.4	+217,611.6	+249,643.9	+283,930.1	

ESTABLISHMENT OF A FOUNDATION HERD OF BELF CATTLE

SUMMARY OF RECOMMENDATIONS AND IMPORTANT ASPECTS

1. The overall objective of the proposed beef project is the establishment of a base for the development of a commercial beef industry in Sarawak and this report covers the requirements for primary development, the possibilities and requirements for secondary development and the requirements of an economic feasibility investigation programme.
2. A commercial beef production unit, approximately 5,000 acres in extent, should be established on unencumbered land at Sungai Karabungan adjacent to the Sarawak Land Development Board's (SLDB) oil palm plantation.
3. The National Livestock Corporation (NLC) should be the authority charged with responsibility for developing a Sarawak beef production programme.
4. The NLC should sub-contract clearing of the land for the project to the SLDB.
5. The Department of Agriculture in Sarawak should conduct economic feasibility investigations on the Livestock Production and Animal Husbandry Training Centre which the Department of Agriculture proposes to establish adjacent to the commercial ranch.
6. A strategy of creating a fully stratified beef industry should be accepted as the ultimate goal for Sarawak.
7. The proposed project should last 20 years and be phased. Phase 1 would last five years and Phase 2 the remaining 15 years.

PART THREE

DURING PHASE 1:

- The commercial unit at Sungai Karabungan would be developed to include cote and commercial breeding herds, and growing-out and fattening operations.
- The Department of Agriculture would organise feasibility trials to ascertain amongst other problems the most viable and economic pasture and animal husbandry methods to be employed on the commercial unit, whether the adjacent SLDB oil palm estate could be used for the growing-out of young cattle using the cover crops planted between the oil palms, and whether cattle could be economically entered in feedlots.
- The NLC would initiate the organisation of new slaughter and marketing facilities.

ESTABLISHMENT OF A FOUNDATION HERD OF BEEF CATTLE

SUMMARY OF RECOMMENDATIONS AND IMPORTANT ASPECTS

1. The overall objective of the proposed beef project is the establishment of a base for the development of a commercial beef industry in Sarawak and this report covers the requirements for primary development, the possibilities and requirements for secondary development and the requirements of an economic feasibility investigational programme.
2. A commercial beef production unit, approximately 5,000 acres in extent, should be established on unencumbered land at Sungai Karabungan adjacent to the Sarawak Land Development Board's (SLDB) oil palm plantation.
3. The National Livestock Corporation (NLC) should be the authority charged with responsibility for initiating the project as part of a long-term programme for developing a cattle industry in Sarawak.
4. The NLC should sub-contract clearing of the land for the project to the SLDB.
5. The Department of Agriculture in Sarawak should conduct economic feasibility investigations, on the Livestock Production and Animal Husbandry Training Centre which the Department of Agriculture proposes to establish adjacent to the commercial ranch.
6. A strategy of creating a fully stratified beef industry should be accepted as the ultimate goal for Sarawak.
7. The proposed project should last 20 years and be phased. Phase 1 would last five years and Phase 2 the remaining 15 years.

DURING PHASE 1:

- The commercial unit at Sungai Karabungan would be developed to include elite and commercial breeding herds, and growing-out and fattening operations.
- The Department of Agriculture would organise feasibility trials to ascertain amongst other problems the most viable and economic pasture and animal husbandry methods to be employed on the commercial unit; whether the adjacent SLDB oil palm estate could be used for the growing-out of young cattle using the cover crops planted between the oil palms; and whether cattle could be economically fattened in feedlots.
- The NLC would initiate the organisation of new slaughter and marketing facilities.

DURING PHASE 2:

- Associated growing-out and fattening operations would be developed on estates, private farms and smallholdings.
 - Development of the Sungai Karabungan unit would continue with increasing emphasis being placed on its utilisation as a base for the production of breeding cattle and in conjunction with the Livestock Production and Animal Husbandry Training Centre act as a centre for the dissemination of information and services to smallholders and to other associated producers.
8. The rate of all development of the project should be based on the schedule shown in Figure 3.1 (in Chapter 3 of this Part).
 9. During the first year of operations two different clearing methods should be assessed: partial destumping and clean clearing. Some clean clearing will always be necessary, particularly along the proposed fence lines and where forage grasses are to be planted. The most suitable method, however, by which the major part of the area can be most economically cleared and planted can only be determined by practice.
 10. Whatever method of clearing is used, a belt of forest should be left unfelled on either side of streams and on steep slopes. This will act as an anti-erosion measure and will help to solve the problem of providing shade for the cattle during the first years of development.
 11. It is concluded from the available evidence that some or all of the following grasses and legumes could be utilised either in pastures or as fodder:
 - *Brachiaria mutica* (para) and *Lersia hexandra* (rice grass) on low and wet soils.
 - *Digitaria decumbens* (pangola), *Brachiaria brizantha*, *Brachiaria decumbens* and *Cynodon plectostachyum* (African (Naivasha) star grass) on well drained, medium to deep soils.
 - *Panicum maximum* (guinea) and the indigenous grasses *Paspalum conjugatum* (sour) and *Ischaemum spp.* on the drier elevated and shallower soils.
 - *Pennisetum purpureum* (Napier or elephant) as a fodder grass on the deeper, well drained soils.
 - *Centrosema pubescens* (centro) and *Stylosanthes guyanensis* (stylo) on all reasonably well drained soils.
 12. The most suitable and economic methods of pasture establishment can only be ascertained by practice and feasibility trials. Species ecologically adapted to the soil type and topography must be utilised and no effort made to establish only one pasture species in topographically variable paddocks. At least during the first phase, some fodder grass should be grown as an insurance against inadequate pasture supplies during the infrequent drought periods. There will be major differences in the fertiliser requirement of different species and the degree of weed infestation during establishment will greatly affect costs. Managerial methods must be utilised that ensure the rapid cover of cleared land by pasture species.

13. The breed for the commercial unit should be the Brahman. Two-year old, pregnancy tested, in-calf, low grade ($\frac{1}{2}$ to $\frac{3}{8}$) cross-bred heifers should be imported from Australia. Pure-bred, high genetic merit Brahman bulls should be imported either from Australia or the United States. In addition, at least 50 pure-bred, pregnancy tested, in-calf Brahman heifers should be imported from Australia to form the nucleus of an elite breeding herd that would provide the commercial unit with second and subsequent generation breeding bulls.
14. Technical assumptions have been made with regard to the performance of the cattle during the next 20 years. They are conservative and it is quite possible that overall performance will be better than assumed.
15. The commercial unit will require a somewhat larger managerial component than would be normal in established ranching areas. Expatriate management will be required during the initial period. Management during the first five years should consist of an expatriate manager, a local understudy manager and the part-time services of a veterinarian and a pasture agronomist. Once the expatriate manager is replaced the managerial component should consist of a manager and an assistant manager, together with the part-time assistance of two technical officers.
16. The recruitment of suitable stockmen will be difficult and some expatriates will be required temporarily. Local recruits should be sought from among the Kelabits and/or Muruts and be trained for about one year by expatriate stockmen. The recruitment of other labour should present no difficulties.
17. It would probably be economically advantageous for the NLC to contract with an Australian consultancy group for a package deal that could include the selection, purchase and transport of cattle, the provision of expatriate staff and overseas training of Sarawak staff.
18. Details are given of fixed and other equipment requirements and estimated development and operational assumptions and costs.
19. The Miri quarantine station should be completed rapidly so that it can be used for quarantining cattle imported for the Sungai Karabungan project.
20. During the first year 400 acres of natural pastures plus stylo and centro and 400 acres of guinea plus stylo and centro should be established on partially destumped and cleared land; 100 acres of pangola, 50 acres of Napier for fodder and 40 acres of *Brachiaria decumbens*, and/or para if low-lying land is available, should be established on clean cleared and cultivated land. The decision as to the areas to be established in subsequent years should await practical experience during the first year and the early results of the economic feasibility trial programme.
21. 1,000, 3,000 and 5,000 acres of pasture should be established by the end of the first, second and third years, respectively.
22. Details are given of the estimated growth of the cattle population, the numbers that will be available for sale, and how the estimated availability of grazings will match up with the estimated grazing requirements for three periods; year one to year six, year seven to year 10, and year 11 to year 20.

23. Short and long-term economic feasibility investigational programmes should be initiated on the Livestock Production and Animal Husbandry Training Centre with priority given to the short-term programme. The investigations that should be included in these programmes have been listed.
24. Secondary development should be encouraged. This should include the encouragement of beef production outside the ranch area, the training of extension workers and farmers, the organisation of a new marketing and processing system and new agro-industries.
25. Capital development costs are estimated at \$6.8 mn and operating expenses before income equals annual expenditure, accounts for a further \$2.2 mn. The commercial rate of return on the project is 8.9 per cent.

CHAPTER 1

BACKGROUND AND JUSTIFICATION OF PROJECT

1.1 INTRODUCTION

The agricultural economy of Sarawak is heavily dependent on subsistence based agriculture and a limited number of cash crops mainly rubber, coconuts and pepper. Heavy reliance on a few crops for which prices have tended to fluctuate widely or decline, and which are subject to competition from other producers on the markets where they are sold, has prompted the Sarawak Government to explore possibilities for diversification. Large-scale oil palm plantings in the Fourth Division are the first projects in this programme and other activities which are receiving attention are cocoa, coffee, spices, various fruits and vegetables. The favourable production environment, the availability of suitable land combined with local research experience has recently led to attention also being focussed on the possibilities for large-scale beef operations.

Livestock production is of limited importance in Sarawak at present. Domestic production of pigs and poultry adequately supply the demand for these products. There has been no apparent change in the population of cattle and buffaloes over the past decade, but significant quantities of beef have been imported either as live animals for slaughter or as frozen meat. There would thus appear to be an established local market for beef which combined with the favourable production potential mentioned above justifies further investigation and development.

On a world-wide basis FAO (1961) has indicated that there will be increasing pressure on meat supplies and that demand is likely to exceed supplies. This situation will undoubtedly lead to hardening beef prices and would enable a local beef industry to enter export markets.

1.2 THE MARKET POTENTIAL FOR BEEF

1.2.1 Internal Market

Sarawak is currently importing about \$1.3 mn worth of chilled and frozen beef and live cattle and buffaloes each year largely to supply the needs of urban complexes. Total consumption for the country as a whole cannot be ascertained with accuracy since the data available on animals slaughtered for domestic consumption are limited. Few cattle and buffaloes slaughtered outside the main slaughter houses are recorded, but the numbers are considered to be relatively insignificant. All races in Sarawak are potential beef consumers and so global estimates are assumed.

The actual slaughter weight of domestically killed animals is not known but observation and experience suggest that cattle are slaughtered at 300 pounds dead-weight and buffaloes at 400 pounds dead-weight. Using these assumptions and the slaughter house data available, Table 1.1 shows the estimate of total beef consumed in Sarawak between 1967 and 1970.

TABLE 1.1 TOTAL BEEF CONSUMPTION AND CONSUMPTION PER CAPITA 1967-1970 IN SARAWAK

Year	Total quantity consumed—thousand pounds				Per capita consumption pounds
	Imported chilled or frozen beef	Domestic cattle	Slaughter buffaloes	Total	
1967	393.1	333.9	559.2	1,286.2	1.42
1968	335.7	409.2	426.4	1,171.3	1.27
1969	338.9	334.5	488.0	1,211.4	1.28
1970	540.3	357.9	424.4	1,322.6	1.36

Thus the average consumption over the period 1967 to 1970 was around 1.33 pounds of beef per head. In 1970 and 1971 the average retail price for better quality lean, boneless beef was \$3.60 per kati or \$2.70 per pound. Lower quality meat and bones sold for \$1.80 per kati or \$1.35 per pound.

In Peninsular Malaysia, where beef is generally graded into six grades, the average retail price is lower—around \$2.10 per kati or \$1.60 per pound. Per capita consumption there is around four pounds per year at the same per capita income level as in Sarawak. There seems to be no reason to suppose that given Peninsular Malaysia prices for beef, consumption should not rise to West Malaysian levels. These appear to be three times higher than the Sarawak level.

In making projections of the demand for beef the following assumptions are made:

- (a) The population will grow at an average of 2.5 per cent per year.
- (b) That income per capita will grow at 3 per cent per year.
- (c) That price changes will occur and that these will tend to be downwards. Price elasticity could be in the region of 3.0.
- (d) That the income elasticity of demand for beef will be between 0.5 and 1.0.

Various estimates for income elasticity of demand for meat and beef have been made. FAO estimates (1967) used for agricultural commodity projections to 1975 and 1985 were 1.07 for all meats and 1.2 for beef. In the Indicative World Plan for Agriculture (FAO, 1961) the estimate for all meats was lowered to 0.9. Purvis (1965) estimating in Malaya for 1957/58 data suggested a value of 1.26 for all meats. Thus a value in the range 1.0 to 1.4 could be appropriate under normal circumstances. However, it is felt that if the high price of meat is maintained in Sarawak, a lower value of say 0.5 should be used for income elasticity of demand.

Assuming an income elasticity of demand of 0.5 at the current retail market price, per capita consumption is projected to be 1.93 pounds per annum by 1995. The country-wide consumption of beef would then be 3.5 mn pounds compared to the current 1.6 mn pounds. In terms of cattle slaughtered the former figure would be equivalent to 7,000 carcasses. The projected consumption of beef and the number of animals required to produce this amount of meat are shown in Table 1.2.

**TABLE 1.2 PROJECTED BEEF CONSUMPTION IN SARAWAK 1975-1995
AT CURRENT PRICE LEVELS**

Year	Beef consumption		Equivalent No. carcasses @ 400 lb. each	Total animals required*
	Per capita pounds	Total thousand pounds		
1975	1.43	1,567.0	3,917	19,625
1980	1.54	1,910.0	4,775	23,750
1985	1.66	2,329.0	5,822	29,000
1990	1.79	2,843.0	7,107	35,500
1995	1.93	3,466.0	8,665	43,250

NOTE: *Total number of animals required in a herd to produce the number of slaughter animals shown.

The possible effect of an increase in local beef supplies in Sarawak would be a decrease in retail prices which, if brought to the levels prevailing in Peninsular Malaysia of \$1.60 per pound, would increase consumption to an estimated 4.3 pounds per capita and projections based on these consumptions are shown in Table 1.3. By 1995 per capita consumption might be 9.0 pounds and the total quantity of meat demanded would be 16.1 mn pounds, equivalent to 40,000 carcasses per annum.

**TABLE 1.3 PROJECTED BEEF CONSUMPTION IN SARAWAK 1975-1995
AT LOWER PRICE LEVELS**

Year	Beef consumption		Equivalent No. carcasses @ 400 lb. each	Total animals required*
	Per capita pounds	Total thousand pounds		
1975	5.0	5,480.0	13,700	63,125
1980	5.8	7,192.0	17,940	89,875
1985	6.7	9,400.0	23,500	117,500
1990	7.8	12,386.0	37,212	150,500
1995	9.0	16,164.0	40,412	208,250

NOTE: *Total number of animals required in a herd to produce the number of slaughter animals shown.

1.2.2 External Market

The main markets to which Sarawak beef might be exported are Singapore, Hong Kong, Japan and Brunei. All are already supplied live animals and/or meat by large-scale, well established organisations in Australia, New Zealand, China, Thailand and Indonesia. To compete with these traditional suppliers will require efficient production methods and high veterinary standards.

Few statistics of beef imports into the above countries are available in Sarawak. However, the Singapore market is currently estimated to require 12,000 live animals and 7 mn pounds of frozen beef annually and by 1990 demand will treble even at a conservative rate of growth. Medium quality curry meat accounts for a large proportion of the market but nevertheless there is an increasing demand for better quality carcasses. Sarawak is well positioned to supply this market.

Hong Kong is a large importer of live animals, and Japanese imports of chilled and frozen beef increased from 13.5 thousand metric tons in 1968 to 23.2 thousand metric tons in 1970. These markets provide prospects for future development.

Since the export of chilled or frozen meat would require costly slaughter house and refrigeration plant, which would not be worth establishing for less than 25,000 head per annum, initial developments should be based on live animal exports. Whichever course is pursued continued freedom from diseases, particularly foot and mouth, is a prerequisite for export trade. Considerable care should, therefore, be taken over quarantine facilities and regulations during the development phase of a beef industry when breeding stock is being imported. Similarly the importation of fresh or chilled meat should be subject to veterinary regulations.

1.3 OBJECTIVES OF THE PROPOSED PROJECT

The overall objective would be the establishment of a substantial base for the future development of a commercial beef industry in Sarawak.

Within this overall objective the primary objectives would be:

- (a) The establishment and subsequent development of a 5,000-acre commercial beef cattle breeding and production unit.
- (b) The identification of production problems generated during the development of this unit.

Secondary objectives would be:

- (a) To establish the base and the production parameters for the future organisation of a stratified beef industry in Sarawak, incorporating breeding, growing-out and fattening sectors.
- (b) In conjunction with the Livestock Production and Animal Husbandry Training Centre to train local staff and labour, at all levels, in large-scale beef production methods and provide facilities for the further training of Department of Agriculture livestock extension staff.
- (c) To provide highly productive breeding stock for the future expansion of the beef industry.
- (d) The development of an efficient marketing system for live animals and beef.
- (e) The development of agro-industries, such as an abattoir and a hides preservation unit, based on the beef industry.

CHAPTER 2

DESCRIPTION OF THE PROJECT

2.1 CHOICE OF PROJECT AREA

There are a number of possible sites within the Study Area that could be suitable for an initial scheme but a site at Sungai Karabungan (Figure 2.1), adjacent to the SLDB's oil palm plantation has been chosen for the following reasons:

- (a) About 18,000 acres of unencumbered, logged, State Land are available in a single block. This area could provide sufficient land for the initial scheme and for future expansion, either in large or smallholdings.
- (b) On account of the generally shallow soils the area is not suitable for the development of oil palm based development.
- (c) Access to the proposed site is reasonably good from the main Miri-Bintulu road, and part of the cost of access road up-keep would be provided by adjacent SLDB oil plantation. Access could also be provided quite easily to the Sibuti river system.
- (d) Several small streams in the area together with the undulating topography and the adequate total rainfall make it possible to provide water supplies for cattle quite cheaply by the construction of a number of small dams.
- (e) A site adjacent to an SLDB oil palm plantation has obvious advantages for assessing the possibilities for the integration of cattle and oil palm production.
- (f) A new quarantine station, the largest potential market for beef within the Study Area and port facilities are or will be available at Miri, some 50 miles distance from the proposed site.

The Sungai Karabungan area of 19,964 acres was covered by semi-detailed soil surveys as described in Supporting Report 1, Part II. Some of the area surveyed is unoccupied, logged State Land but is still currently under licence. Salvage logging should be carried out prior to land clearing operations, and this is planned for in Supporting Report 3, Part I.

On the basis of the land use potential classification an area of 5,700 gross acres in extent was selected for the project as shown on Figure 2.2. The area chosen consists mainly of soils which are derived from calcareous parent materials and having a clay or silty clay texture; there is a relatively small area of soils derived from non-calcareous materials in the north western section of the project. On the whole soil depths are shallow, between 25 and 75 cm in the northern half but deeper in the southern section. The topography of the area is generally gently undulating with average slopes of under 10 degrees. The north western section tends to be somewhat more broken and a small area enclosed within the project boundary should remain as a forest enclave.

The effects of grazing animals on the generally heavy-textured soils is an aspect which will require careful observation and management because it is not known to what extent poaching or compaction might occur.

2.2 CHOICE OF ORGANISATIONAL STRUCTURE

So little is known as to some of the basic technical requirements of an economic beef cattle industry that it would undoubtedly be desirable to organise economic feasibility trials concurrently with the effort to create a commercially viable beef production unit. The proposal by Government to establish the Livestock Production and Animal Husbandry Training Centre adjacent to the proposed ranch is supported by the Consultants (Chua T.K., Lim C.P., 1973).

It is important that the commercial and investigation aspects should be conducted at the same location and under similar environmental conditions. The NLC should be the authority charged with responsibility for developing the cattle industry in Sarawak. The powers of this authority have recently been enlarged so that in addition to its development functions it can now regulate the marketing of livestock and livestock products.

Already NLC has contracted the clearing of land and planting of pastures or cover crops to the SLDB. The plans for further development are not known but in view of the present heavy commitments of the NLC in Peninsular Malaysia it is recommended that development of the ranch is undertaken as a joint venture with some international organisation which could supply appropriate management experience; examples are, the Commonwealth Development Corporation (CDC), Livestock Management Firms or expatriate ranching groups from wet tropical climates.

To join with the Department of Agriculture in Sarawak is not recommended because the Department of Agriculture is not organised for participation in commercial development work and will be fully committed developing the nearby Livestock Production and Animal Husbandry Training Centre. The Department of Agriculture is the only organisation in Sarawak that could properly conduct feasibility investigations. It is therefore suggested that the Department of Agriculture conduct the necessary feasibility studies utilising funds voted specifically for this purpose. Once the commercial beef unit is properly established it is expected that the local beef industry will be rapidly expanded to include at first, smallholder and other private enterprise growing-out and fattening units and, at a later stage, new breeding units. This expansion will require a major effort on the part of the livestock extension services of the Department of Agriculture and these services will have to be expanded. It is also visualised that training courses for Department of Agriculture livestock extension staff and for potential beef farmers will be organised in association with, and using the facilities of, the NLC commercial beef unit.

Although the existing managerial resources of the SLDB are more or less fully committed with development of land for crop agriculture it may be possible in the future for them to participate in the livestock development. This expansion could take the form of the inclusion of beef enterprises on existing oil palm estates and, possibly, the establishment of beef ranches.

2.3 CHOICE OF PRODUCTION SYSTEM

There are several alternate production systems that could form the base for the development of a beef industry. The most important of these are—

- (a) A conventional large-scale ranch-type industry, based on the utilisation of land not required or unsuitable for other purposes, which would incorporate breeding, growing-out and fattening operations within one unit.
- (b) A large-scale industry integrated as far as possible with tree crop production, particularly the oil palm industry.
- (c) A smallholder beef industry based on intensive pastures, separate or within an alternate husbandry rotation, and/or on integration with tree crops.

- (d) A fully stratified industry incorporating:

For breeding purposes—ranch-type husbandry using extensive pastures.

For growing-out purposes—estate and/or smaller private farms incorporating pastoral, oil palm and possibly coconut operations. Even forestry operations might be integrated with this type of cattle husbandry.

For fattening purposes—estates, private farmers and/or smallholders using intensive, highly fertilised pastures and/or specialised feedlot operators utilising fodder and by-product feeds.

A fully stratified beef industry is considered to be the production system best suited to Sarawak conditions and likely to be most productive and geared to provide maximum employment and stability. It could only be developed slowly as a phased operation and at all stages there would be many technical and economic problems requiring solution.

It is therefore recommended that:

- (a) The strategy of creating a fully stratified beef industry should be accepted as the ultimate goal for Sarawak and that its solid foundation is created during the next twenty years.
- (b) Phase 1 of this strategy, which should last five years, would include:

The establishment of a 5,000 acre cattle ranch at Sungai Karabungan, adjacent to the SLDB oil palm plantation. This should be considered as the major base for the development of the State's future cattle population; one important special task being the gradual establishment of an elite herd of breeding cattle. In addition, during this phase, the ranch would have to undertake the growing-out and fattening of most of its slaughter stock.

The simultaneous organisation of feasibility trials to ascertain:

- the most viable and economic pasture and animal husbandry methods to be employed on the ranch or on associated enterprises;
- whether the adjacent SLDB oil palm estate could be used for the growing-out of cattle grazed on special pastures planted between the oil palms; and

— whether cattle could be fattened in feedlots using fodder and local by-product feeds.

The organisation of new slaughter and marketing facilities; the existing ones would be completely inadequate.

(c) During Phase 2, which would last 15 years:

Associated growing-out and fattening operations would be slowly developed on estates, private farms and smallholdings using managerial methods based on the information and techniques acquired during the Phase 1 feasibility trials.

Development of the Sungai Karabungan ranch would continue with increasing emphasis being placed on its utilisation as a base for the production of breeding cattle and in conjunction with the Department of Agriculture as a centre for the dissemination of information and services to smallholders and other associated producers.

CHAPTER 3

PRIMARY DEVELOPMENT

The existing cattle industry is so small and so fragmented that the development of one 5,000 acre unit will determine the future of the State's cattle industry for at least the next two decades. Under these circumstances it is essential that the correct basic decisions should be taken as to the scheduling of initial operations, the choice of pasture(s), the choice of breed and the methods of management.

3.1 PROPOSED SCHEDULE OF OPERATIONS

Realistic scheduling is an essential prerequisite of development planning and in this project scheduling is required for the field operations, the purchase and management of the cattle, the recruitment and training of management and labour and the provision at the appropriate time of the fixed equipment.

It has been Government's wish to initiate operations as soon as possible and SLDB, under contract to NLC, started under-brushing of the first 750 acres in November 1973. A schedule of initial operations (Figure 3.1) has been prepared on the assumption that development will proceed as a continuous process. This schedule, considered as a whole, can be altered in a time scale by moving all operations backwards or forwards to accommodate changes in development phasing, but individual items are interlocking, one depending upon the other and their timing cannot be radically altered without endangering the ultimate success of the project. Figure 3.1 clearly shows the importance of careful planning and completion of many operations before the cattle arrive on the ranch.

Clearing:

It would be a major mistake to clear a larger area of land than can be immediately planted with pasture and grazed. Thus the area cleared in the first place must depend upon the number of cattle available.

Pastures:

The grass and legume seeds and legume inoculants must be ordered and delivery guaranteed before the first land becomes available for planting. Light grazing may commence as early as six weeks after planting, depending on weather conditions, etc. It is unlikely that it would be delayed more than three months from planting.

Cattle:

Breeding cattle for the proposed ranch must be imported. Not only are the local stock not beef-type animals, but the size of the national herd is such that even under the most favourable circumstances there could only be 200 to 300 surplus breeding heifers available annually. The arrangements for importing cattle will have to be made far in advance. These arrangements should include inspection and purchase, collection within the exporting country, transport to Sarawak, quarantine within Sarawak and transport to the ranch. The first shipment of cattle could be quarantined on the ranch, but it would be better to have the quarantine station at Miri ready for this.

Subsequent shipments would have to be quarantined either in Kuching or Miri. Whether the cattle go direct to Miri or Kuching will require careful consideration. At Miri the off-loading of the cattle from a large ship will have to be in barges. This could be hazardous to in-calf animals especially if the weather is rough as it may well be during the October to January monsoon season. It would appear better for the animals to go first to Kuching where they can be quietly unloaded directly to shore. Subsequently they could be transported to Miri in smaller ships or barges that can sail into the harbour.

Management and Labour:

The problems of recruiting and training managers and labour are discussed in a later Section but it is recommended that expatriate management skills should be employed in the first instance because of the severe shortage of qualified and experienced local people in the whole of Malaysia. An expatriate manager should be recruited at an early stage in the operations, preferably from the country of origin of the cattle, so that he can help select the cattle before his arrival in Sarawak.

Fixed Equipment:

Roads must be developed during land clearing and fencing wire delivered before the first pastures are planted. Belian, a local forest tree (*Eusideroxylon zwageri*) which produces rot-resistant timber, can be used for posts and obtained from the forests before they are felled and burned. The first cattle yard must also be completed before grazing commences. Belian timber should be used for this. Water supplies for the cattle must also be made available by the time of first grazing. It is essential that managers and labour should live on the ranch and therefore plans for housing must be prepared and the building contracts let well before the main labour force is expected to arrive.

3.2 CHOICE OF CLEARING METHODS

There are likely to be major differences in cost between different methods of clearing and establishment of pastures. Two methods should be considered:

- (i) Partial destumping where grass and/or legume seeds would have to be planted or oversown by hand.
- (ii) Clean clearing where seeds could be drilled and/or vegetative material planted by hand or machine.

The first method would be similar to that employed for oil palm planting and would include under-brushing, felling, uprooting the smaller stumps, stacking, burning, weed spraying and planting or sowing seeds in the ashes. The second method would include under-brushing, felling or bulldozing the trees, complete derooting, stacking, burning, cultivating and sowing the seeds or planting vegetative material in the prepared land. Table 3.1 shows the approximate calculated costs of the two methods but only practice will finally establish their advantages or disadvantages.

Whatever method of clearing is used a belt of forest 50 feet wide should be left unfelled on either side of creeks and streams and steep slopes should also remain uncleared. The SLDB calculate that on their present estates 10 per cent of the land is unusable for oil palm planting after clearing. On the proposed ranch site most of this type of land should not be cleared in the first instance.

TABLE 3.1 DIFFERENCES IN THE ESTIMATED COST PER ACRE OF TWO DIFFERENT METHODS OF ESTABLISHING GUINEA GRASS PASTURE

Operations	Method 1 Partial destumping \$ per acre	Method 2 Clean clearing \$ per acre
Initial clearing ⁽¹⁾	275	350
Cultivation and seeding ⁽²⁾	—	150
Spot spraying weeds, behind clearing ⁽¹⁾ ...	3	—
Seeding in ashes ⁽¹⁾	8	—
Seeds: guinea, stylo, centro and inoculant ⁽²⁾	23	23
Initial fertiliser application 140 pounds per acre of 40 per cent superphosphate ⁽²⁾ ...	27	27
Total Costs	\$336	\$550

(1) SLDB estimate.

(2) Asian New Zealand Development Consultants Ltd. estimate (1971).

The problem of providing natural shade for cattle will be partially solved if some forest remains unfelled and fences are located so that cattle have access to the unfelled areas. Large rain forest trees are unsuitable as shade trees but small trees could be left standing for shade purposes along projected fence lines or in isolated clumps. Probably these would eventually have to be replaced by suitable planted shade trees.

3.3 CHOICE OF PASTURE SPECIES

Although some experimental studies have been made by the Department of Agriculture, at Semongok and Tarat in the First Division, as to the most suitable grass and legume species to use in the country, there are at present virtually no commercially established and managed pastures. Thus any proposals as to the most suitable species to use on the commercial ranch must depend primarily on experience gained in somewhat similar environments outside Sarawak. It should be emphasised, however, that very limited differences between environments can markedly influence the growth of both grass and legume species so that overseas experience is no real substitute for local feasibility trials.

Within the proposed ranch area the choice of adaptable species will depend upon the slope and drainage of the land, the depth of soil and inherent soil fertility. Sufficient information is available to suggest that some or all of the species discussed below might be utilised. Generally a grass/legume mixture would be preferred and should be tried wherever there is a chance of success. The only two legume species that appear to be worth consideration are *Centrosema pubescens* (centro) and *Stylosanthes guyanensis* (stylo). The most productive strain of the latter appears to be Q8558. Seeds of both legumes are readily available and seeding rates are suggested. However, all the seeding and fertiliser rates quoted are tentative and subject to revision after experience and investigation.

Grass species for the low and wet soils:

Brachiaria mutica (para)—This grass is not particularly recommended by the authorities at Semongok but it was seen to be growing well in damp localities in other parts of the State. Some para seed is available from Australia and the seeding rate is two pounds per acre. It is, however; usually propagated vegetatively.

Leersia hexandra (rice grass)—This is found in local swamps and is known, from overseas experience, to be a useful grass for beef cattle. No commercial supplies of seed are available. The grass will have to be propagated vegetatively or by collecting seed locally. It seeds prolifically in the Study Area.

Both grasses could be planted vegetatively from cuttings and disced in, or from slips planted 30 inches apart and 24 inches within the row. Centro will mix with either grass and should be seeded at a rate of no less than seven pounds per acre. Phosphatic fertilisers should be used at establishment and nitrogenous fertilisers later with discretion.

Grass species for better drained, medium and deep soils:

Digitaria decumbens (pangola)—According to the Semongok authorities this grass is only competitive with the indigenous grasses when it is very heavily fertilised. It has to be propagated vegetatively. Cuttings should be spread and disced in. At Semongok 400 pounds per acre per annum of a complete fertiliser are used. An initial application of 200 pounds per acre of an 18 : 11 : 5 compound fertiliser could be used, followed by alternate applications of complete fertiliser and nitrogenous fertiliser.

Brachiaria brizantha (signal)—This grass appears quite promising under trial at Semongok and in Brunei. Planting and fertiliser applications should be the same as for pangola grass.

Brachiaria decumbens—This is a promising grass at Semongok. It is normally planted vegetatively but seed is available overseas. To obtain a good germination the seed coat must be removed by acid treatment before planting. The treatment is to soak the seed in commercial quality sulphuric acid for 10 to 15 minutes, then thoroughly wash the seed and sow immediately. Fertiliser application should be the same as for pangola grass.

Cynodon plectostachyum (African (Naivasha) star grass)—This grass has done well in West Malaysia under somewhat similar environmental conditions. It has to be propagated vegetatively and should be managed in the same way as pangola.

Grass species for the well drained elevated soils:

Panicum maximum (guinea)—This grass is known to perform well in slightly drier climates but some evidence suggests that some strains of guinea might be suitable. It can be propagated from seed or vegetatively. The seeding rate should be four pounds per acre. If it is sown without legumes managerial treatment should be approximately the same as that for pangola. When planted with legumes the seeding rate for a stylo-centro mixture should be two pounds of stylo plus five pounds of centro per acre. The legumes seeds should be inoculated and planted approximately 0.5 inch deep in hand-made drill lines 36 inches apart.

Single 18 per cent superphosphate should be applied in a band alongside or preferably beneath the seed at the rate of 336 pounds per acre. The equivalent of triple-superphosphate could also be used. After establishment phosphatic fertiliser should be used annually and Christmas Island rock phosphate could be used at this stage. The seeds should not be mixed with the fertiliser because of the danger of destroying the legume inoculant. Nitrogenous and/or complete fertilisers should be applied with discretion when the grass appears to need it, taking care not to cause major damage to the legume component of the pasture.

Indigenous grasses:

Paspalum conjugatum (sour grass) is a common grass which pioneers cleared areas. It is palatable when young but it is not a heavy producer.

Ischaemum spp. appear to be secondary invaders of cleared areas. They are palatable when young. A stylo-centro legume mixture should be planted in the indigenous grasses in the same way as it is planted in guinea. Indigenous grass-legume pastures should also be managed in the same way as guinea-legume pastures.

Fodder grasses:

Pennisetum purpureum (elephant or Napier)—This is considered by the authorities at Semongok to be the most productive fodder grass in the local environment. It must be planted on cultivated land. Establishment could be by planting stem cuttings approximately 18 inches long containing two nodes at 18 by 18 inches spacing, or by laying long mature stalks in furrows 24 inches apart and then covering them with soil. A legume such as centro should be drilled between the rows at the rate of five pounds per acre. When elephant grass is planted without a legume it should be heavily fertilised. Initially at least 224 pounds per acre of an 18 : 11 : 5 compound fertiliser should be used. When it is planted with a legume a fertiliser mixture much higher in phosphatic fertiliser rates should be used.

Tentative estimated carrying capacities of the above pastures during the first years after establishment are as follows:

Indigenous grasses plus legumes	0.5 + l.s.u.'s per acre
Guinea grass plus legumes	0.75 l.s.u.'s per acre
Planted pastures	1.00 l.s.u.'s per acre

3.4 METHODS OF PASTURE ESTABLISHMENT

The basic requirement is that establishment should be at minimum cost. No effort should be made to attempt the establishment of one species in paddocks where the topography is markedly varied. In general, para or rice grass should be planted in the lower swampy areas of paddocks and guinea should be planted, or indigenous grasses be allowed to establish themselves, on the higher well drained areas. It would also be a mistake to depend entirely on one grass or even entirely on grazings. Different grasses demonstrate somewhat different growth cycles so that the use of several grass species would provide a more even production throughout the year. Some fodder, preferably Napier, should also be grown, especially in the early experimental years, as an insurance policy against failure to establish a particular pasture and against the infrequent drought periods.

There could be major differences in fertiliser requirements according to the type of pasture established. Experimental work of Semongok has established that a planted pasture such as pangola requires up to 400 pounds per acre per annum of a complete fertiliser if it is to compete successfully with the indigenous grasses. It is believed, though there is no experimental proof, that guinea, para and rice grass pastures would also require fairly large fertiliser applications. On the other hand it is thought that the indigenous grass pastures with introduced legumes will only require a large initial application of phosphatic fertiliser, followed by smaller applications of phosphatic fertilisers at specific intervals and perhaps some small application of nitrogenous fertilisers from time to time. Differences in the calculated cost of fertilising some of these different pastures, together with assumed carrying capacities and yield of liveweight gain per acre, are shown in Table 3.2. It is suggested that the cheapest method of application of fertilisers to unstumped pastures would be by air. It will be essential to conduct feasibility trials on fertiliser requirements for different types of pasture.

Another factor that could greatly influence costs is the degree of weed infestation during establishment. Sowing or planting of seeds should therefore take place immediately after the burn, and seeding rates should be sufficient to ensure rapid cover of bare land.

TABLE 3.2 DIFFERENCES IN THE CALCULATED COST PER ACRE OF FERTILISING PASTURES, ASSUMED CARRYING CAPACITIES, YIELD OF LIVELWEIGHT PER ACRE AND TOTAL RETURN PER ACRE OVER THE FIRST FIVE YEARS

	<i>Indigenous Grass plus legumes</i>	<i>Guinea grass plus legumes</i>	<i>Planted pangola grass</i>
	Dollars per acre		
First Year			
140 lb. per acre of 40 per cent super-phosphate	27	27	—
400 lb. per acre of complete 18 : 11 : 5 compound (Semongok)	—	—	64
120 lb. per acre of complete 18 : 11 : 5 compound	—	19	—
Second Year			
45 lb. per acre of Christmas Island Rock Phosphate	4	4	—
400 lb. per acre of complete 18 : 11 : 5 compound	—	—	64
120 lb. per acre of complete 18 : 11 : 5 compound	—	19	—
Third to Fifth Year as Year Two			
	12	69	192
Total for 5 years	43	138	320
Cost per year	8.6	27.6	64
Assumed carrying capacity l.s.u.'s acre ...	0.5	0.75	1.0
Assumed l.w.g. lb./day	0.5	0.75	1.0
Assumed l.w.g. lb./year	182.5	273.8	365
Assumed l.w.g. lb./acre/year	91.3	205.4	365
Assumed return dollar per acre/year ...	45.7	102.7	183.5

3.5 CHOICE OF BREED

Experimental work and commercial practice in Malaysia offers no guide at present as to the most suitable breed(s) to import, but an assessment of the situation suggests that there are five possible importation policies. The correct policy could be one or a combination of two or more. The alternative policies are as follows:

- (a) The importation of pure-bred bulls and breeding females. This is a practical policy based on experience elsewhere. It would be very expensive to import many pure-bred Brahman cattle for example but there are other breeds that might be considered, such as the Indonesian Ongole, the Madagascar Zebu and the Bali.
- (b) The importation of two or more pure breeds of cattle and their utilisation in a cross-breeding programme. This could be less expensive than the previous programme if cattle from one breed could be purchased very cheaply and upgraded using bulls or semen from the other more expensive breed. One example would be the importation and upgrading of Madagascar Zebu heifers using Brahman bulls. It is well established that cross-breeds are generally the most productive of all beef cattle in the humid tropics but cross-breeding is a system that is difficult to sustain. Another alternative possible for the Study Area is that it should be ultimately possible to maintain *Bos taurus* beef-type breeds at higher altitudes of Bario and use them to produce bulls and/or semen for cross-breeding with *Bos indicus* females at the lower altitudes where the future beef industry will be mainly established.
- (c) The importation of animals of an established *Bos taurus* x *Bos indicus* breed, such as the Santa Gertrudis, the Beefmaster, the Brangus and the Charbray from the United States, the Droughtmaster from Australia and the Bonsmara from South Africa. Given high standards of feeding and management there is no doubt that animals of some of these breeds would thrive in Sarawak, but such standards cannot be guaranteed during the first phase of the project. In addition cattle of these breeds would be expensive to purchase.
- (d) The importation of cross-bred ($1/2$ to $5/8$ *Bos indicus*) heifers and the use of pure-bred Brahman bulls to upgrade them. The advantages of this policy are that cross-bred heifers of this type can be purchased relatively cheaply in Australia and when they are upgraded, using pure-bred Brahman bulls, the first generation of calves bred and born in Sarawak should exhibit some degree of hybrid vigour.

It is recommended that the breed for the commercial unit should be the Brahman and that the initial importation and breeding policy should be as follows—

- (a) Importation of approximately two-year old, pregnancy tested in-calf, low grade ($1/2$ to $5/8$ Zebu) cross-bred heifers from Australia. Although in-calf heifers will be more expensive to purchase than younger non-pregnant heifers, they are likely to be more economic in the long-term (Table 3.3), also the commercial herd can be expanded more rapidly and imports of bulls will not be required immediately. In addition, if the offspring of the in-calf heifers are generally unrelated this should provide a broad genetic base for breeding operations within the commercial herd.

(b) An importation of at least 50 pure-bred pregnancy tested; in-calf Brahman heifers from Australia. The heifers and their offspring should be unrelated to any bulls that may be purchased and, if possible, to bulls that served the imported in-calf cross-bred heifers. These heifers would form the nucleus of an elite breeding herd and a selection would be made from their first crop of bull calves for the second and subsequent generation ranch bulls.

(c) The importation of a sufficient number of pure-bred, high genetic merit Brahman bulls for use as the first generation of ranch bulls. It is recommended that these bulls be imported from the United States because of the greater choice and higher genetic merit available there than in Australia. The advantages of the overall importation policy are that—

- it would be the least expensive import policy;
- low grade cross-bred zebu heifers are much more easily obtainable in Australia than higher grade zebu heifers;
- the first generations of calves bred in Sarawak would exhibit some degree of hybrid vigour.

TABLE 3.3 DIFFERENCES IN THE LIVESTOCK INVENTORY AND THE TOTAL ESTIMATED VALUE AFTER FIVE YEARS BETWEEN IMPORTING 1,000 IN-CALF HEIFERS AND 1,000 14-18 MONTH OLD HEIFERS

	<i>Importing 1,000 in-calf heifers</i>	<i>Importing 1,000 14-18 month old heifers</i>
<i>Livestock Inventory (Year 5)</i>		
Heifers and cows	1,265	800
Female calves	411	260
Male calves	411	260
Female yearlings	329	264
Male yearlings	329	264
Female two year olds	222	278
Male two year olds	222	278
Male three year olds	251	—
<i>Sold Between First and Fifth Year</i>		
Cull cows	300	200
Steers	427	—
Estimated value dollars	1,208,350	690,300

- Assumptions:*
- All imported in-calf heifers in calf.
 - Calving percentage in Sarawak 65.
 - Mortality percentage in Sarawak 10 until weaning and five thereafter.
 - 10 per cent culling of breeding cows.
 - Value estimated at \$0.50 per pound liveweight.

3.6 TECHNICAL ASSUMPTIONS AS TO THE LIKELY PERFORMANCE OF THE CATTLE

Details of the assumptions that have been made as to the likely performance of the imported and Sarawak bred cattle are given in Table 3.4. These assumptions are deliberately conservative because the performance of cattle in the Sarawak environment has not been well established.

TABLE 3.4 TECHNICAL ASSUMPTIONS AS TO THE PERFORMANCE OF THE CATTLE

	Years of project		
	1-5	6-10	11-20
Calving per cent	1st year* 90	76-80	80
	years 2-5 65-75		
Mortality per cent: pre-weaning	5	3	3
: post-weaning	2	1	1
: breeding cows	2	2	2
Culling per cent (heifers and cows)†	1st year Nil		
	years 2-5 10-11	12-15	15
Average age at first calving of heifers (months)	30	30	30
Age of bulls at first service (months)		24 to 36	
Ratio of breeding females to bulls	15:1	20:1	20:1
Average age of steers at slaughter (months)	30	24	24
Average weight of steers at slaughter (lb)	700	800	900
Average killing-out per cent of steers	54	55	56
Average weight of culled cows (lb)	800	850	900
Average killing-out per cent of culled cows	50	50	50
Average weight of culled heifers (lb)	700	725	750

Notes: *Only in-calf heifers imported during the first year.

†All non-breeding heifers to be culled. All cows that do not breed but have produced a calf in the previous year to be given a second chance.

3.7 MANAGEMENT AND LABOUR

A high standard of management will be a crucial factor in assuring the success of this project. Initially expatriate management will be required to provide the high standard because there are no local cattle men with the necessary experience of large-scale beef cattle farming. Thus the questions to be faced are:

- what type of managerial structure is needed by an enterprise of this type?
- for what period will expatriate management be required?
- by what method should the expatriate management be recruited?

In a country where the cattle industry is well established, an enterprise of this type would require only one manager, six experienced stockmen and a well staffed and experienced extension and investigational organisations for technical advice and services. The situation will be quite different within the proposed project. Here the expatriate manager will be required to teach an understudy, who will replace him after a certain period. Also the manager will need special technical assistance until such time as the State extension and investigation services have been expanded and have gained essential experience. It is recommended that the manager is provided with at least the part-time services of a pasture and forage agronomist and of a veterinarian. These technical personnel could also assist in the economic feasibility trial programme on the nearby Government station.

It is obviously difficult to estimate the length of time that expatriate management will be required. It will depend on the problems encountered, how quickly they are solved, and on the calibre of the understudy manager and other staff. For planning purposes a period of five years has been taken.

For calculation purposes it is suggested that an initial period of three years with the option to continue on an annual basis might satisfy the requirements of the project and the personal needs of the manager recruited. After approximately three years a second trainee manager is assumed to be recruited. He would become the assistant manager as soon as the expatriate manager was replaced by a local manager.

There are two major methods by which an expatriate manager could be recruited. Either directly by the authority operating the project or as part of an overall contract by which a consultancy firm provided expatriate management, overseas training of the local understudy manager and other services, such as the purchase of cattle.

Other managerial functions apart from the technical ones are finance and accounts. If the authority operating the project is the SLDB then the management of finance and accounts would present no problems as suitable administrative arrangements already exist.

The recruitment of suitable livestock labour will present many problems. Only the Kelabits and the Muruts among the indigenous Sarawak people have any long experience of cattle husbandry but they have no practical experience of a large scale operation. Therefore, it is recommended that two or three expatriate stockmen are recruited for a short period. The major duty would be to instruct locally recruited labour in the practical aspects of large scale cattle husbandry. They could be recruited for one year with an option for a further period, if this was thought to be required. The recruitment of other labour such as a clerk/accountant, drivers and a mechanic should present no difficulties.

It is further recommended that the NLC should contract with an Australian consultancy group to select, purchase and transport the cattle to be imported from Australia, provide the expatriate management and stockmen and arrange for overseas training of local managers.

3.8 FIXED AND OTHER EQUIPMENT

Roads:

A good all weather road, leading from the main Miri-Bintulu road to the administrative centre of the ranch, will be required together with lower standard internal roads leading to all paddocks. A bulldozed road constructed immediately inside the perimeter fence is recommended because it would provide easy access for inspection and maintenance of the perimeter fence and act as a firebreak. All internal roads could be maintained by use of a grader blade attachment on a wheeled tractor.

Fences and paddock size:

Fence lines should be demarcated at the time of forest clearing. All stumps should be cleared from along the fence lines and the route smoothed out by use of a bulldozer in order to eliminate small humps and hollows, thus facilitating fence construction and reducing its cost. In order to ensure complete

control of the grazings and the cattle the maximum size of paddocks should be 100 acres. At least 30 smaller paddocks of 20-acres will also be required. There are several fencing methods that could be employed; three are considered suitable for the project:

- (i) — ordinary belian posts with barbed wire and droppers;
- (ii) — belian posts with smooth high-tensile wire and droppers;
- (iii) — live posts with barbed wire and droppers. Possible live post species that could be used are: *Dellinia* spp. and particularly *D. suffruticosa* (local name simpok ayer) *Oncosperma filamentosa* (local name nibong), *Pithecolobium* spp., *Pterocarpus indicus* (local name yemane) and *Gliricidia sepium*.

The choice between (i) and (ii) will depend on the relative cost and availability of the wire. It is recommended that the perimeter fence should be constructed by either of these methods and that the cheaper live post method is attempted for sub-division fencing. A fencing master-plan must be prepared, the perimeter fence erected and the remainder as they are required in accordance with the master plan.

Cattle Working Yards:

Two working yards will ultimately be required able to accommodate up to 300 head of cattle at any one time. They should incorporate a spray race or dip, crush and head bail, weighing scales, drafting gates, a veterinary gate for pregnancy diagnosis and a loading and unloading ramp. Detailed construction plans for different types of working yards are readily available in many livestock text books and could be provided if necessary by the Consultants. Construction of the yards should be phased, one being required immediately the first cattle are introduced onto the ranch.

Shade:

Some form of shade for the cattle is desirable. If the forest is cleared according to the suggested procedure shade will be immediately available in the majority of paddocks.

Water:

Water must be made available both for domestic use and for the cattle. Water for cattle must be available in every paddock and it can be assumed that consumption will be on average ten gallons per head per day. In the Karabungan area water for the cattle can be provided easily from small dams constructed on several semi-permanent streams. At present there are numerous permanent dams formed by the blocking of the drainage lines during forest logging operations. It is recommended that water should be piped from the dams to conveniently situated troughs because the surrounds of the dams are likely to become very soft and at times it could be difficult for the cattle to reach the water. Domestic water can also be supplied from dams.

Machinery:

Even if the major part of the ranch is not clean cleared, some areas will have to be cultivated for the production of forage. Also in the other parts once the stumps have rotted pasture renovation and improvement can be partially achieved by cultivation. Thus machinery will be required for cultivation purposes, for forage harvesting and for pasture renovation. Equipment will also be required for the transport of men, material and cattle. Landrovers and light motorcycles have been proposed for use by the staff for internal

transport. Horses too could be used but because there are so few in Sarawak this possibility has been disregarded for planning purposes. Additional equipment required are: an electrical generating set, the equipment for a workshop and for spray races, weighing machines in the cattle working yards and tractors. Details of these are given in the cost estimates.

Buildings and houses:

Details are given under estimated development costs. (4.10).

3.9 ESTABLISHMENT AND MAINTENANCE OF PASTURES

3.9.1 Pasture Establishment

Much of the terrain in the proposed ranch area is quite steeply undulating and complete destumping to provide areas suitable for mechanical cultivation will only be possible on a limited scale. Thus most pastures will have to be established by other methods. These could include:

- (a) Sowing grass and/or legume seeds in the ashes after the first burn;
- (b) Sowing seed or planting cuttings in manually drawn traces as at present practised by the SLDB in the sowing of cover crops for oil palm plantations;
- (c) overseeding legumes from vehicles or by air on natural or hand seeded pastures;
- (d) feeding hard shelled legume seeds to stock who would then spread them over the grazings through their faeces;
- (e) sod-seeding grasses in areas of established legumes.

3.9.2 Pasture Maintenance

There are two aspects of pasture maintenance; annual and periodic renovation. Properly managed pastures could last indefinitely but the correct techniques have yet to be worked out in Sarawak. Some suggestions and principles are discussed below.

The length of life of a pasture depends upon proper grazing management. This helps to ensure that desirable species are encouraged and that a proper balance is retained between the grass and legume components of the pasture. Proper grazing management depends upon:

- (a) Size of paddock—in the wet tropics paddocks size should be small as pasture growth is rapid and uncontrollable in large paddocks, but some balance has to be held between desirable and economic practice. The absolute maximum paddock size should be 100 acres.
- (b) Carrying capacity—this is more often under than over-estimated on large holdings in the wet tropics.
- (c) The number of cattle grazed on a paddock at any one time—it is desirable to rotate rather than set-stock in the wet tropics and the rotation should be as rapid as possible as the pasture species mature quickly. Under these circumstances the maximum number of cattle should be grazed in any one paddock at any one time for as short a period as possible. Different grasses exhibit different reactions to heavy grazing. Guinea should be grazed at three week intervals for no more than two days at a time for most of the year. During the dormant period of growth this grazing cycle should be extended. Pangola and para probably need monthly intervals to recover from grazing.

- (d) Proper weeding of the pasture—weeding should be continuous and always carried out before the weeds seed. The pastures should also be slashed once a year, before the period of maximum growth, to remove excessive old, dry material. They should not be slashed too low. This maxim particularly applies to guinea and para pastures.
- (e) Proper fertilisation according to the requirements of the species comprising the pasture.
- (f) Water and shade being available in all paddocks—the water supply should be on a slightly elevated site to prevent a morass being formed around it. There should be sufficient scattered shade to prevent the cattle pugging any specific section of the paddock.

Annual maintenance of pasture should include weeding, fertilising and at least one slashing. Weeding can be by hand or by spot spraying using herbicides. It might be necessary to weed many times during the first and second years but gradually the number of weedings required per year should decrease. On average one or two weedings per annum should be sufficient.

Fertiliser requirements will depend on several factors, principally the type of species fertilised and the stocking rate. As stocking rates improve it is likely that fertiliser rates will have to be increased. It is impossible at the present time to make very definite recommendations with regard to fertiliser application. Economic feasibility trials on the relation of fertiliser requirements to species and stocking rate are urgently required and details of proposals are discussed in a later Section.

In general legume and grass mixture will require relatively large quantities of phosphatic fertiliser and small quantities of complete and nitrogenous fertiliser whilst pure grass stands such as Napier and pangola will require large quantities of complete fertiliser. Some information on estimated fertiliser requirements and their cost for legume-grass mixtures and pangola grass are given in Table 3.2 (Page 210).

Although annual application of the rather slowly acting and readily obtained Christmas Island Rock Phosphate may be used after establishment on grass-legume mixtures, the initial application of phosphatic fertiliser should be in the form of a quicker acting superphosphate. With regard to nitrogenous fertilisers there is information from Australia (Simpson, 1968) suggesting that urea is not a reliable source of nitrogen for pasture fertilisation owing to volatilisation and a high loss of ammonia, particularly on acid soils where soil temperatures are high. Sulphate of ammonia and nitrochalk are available and should be used as a source of nitrogenous fertiliser in the Study Area. An ICI compound (18: 11: 5 + Mg) is also available and could be a useful complete fertiliser.

The distribution of fertiliser on broken land, particularly where stumps have not been removed and have not yet rotted, could present difficulties and be an expensive operation. It is therefore suggested that the possibility of aerial application of fertilisers should be very carefully considered. Companies who could carry out the operation are:

- Borneo Skyways (Miri) Sdn. Bhd. who could use a Cessna 185 for which the necessary equipment is available.
- Malaysia Air Charter Co. Sdn. Bhd. who could use a Piper Pawnee.

CHAPTER 4

ESTIMATED DEVELOPMENT COSTS AND ASSUMPTIONS

Estimated costs have been calculated from data provided by the SLDB, the Department of Agriculture, local commercial firms and from assumptions based on experience elsewhere. They refer to the April-May period of 1973.

4.1 LAND CLEARING

Land clearing costs are related to the type of forest to be cleared, the method of clearing employed and the extent to which destumping is practised. The estimates provided are based on experience gained by the SLDB. This organisation fells manually and stacks mechanically. Complete destumping operations if required over a large area will necessitate purchase of more powerful machinery than is at present used by the SLDB.

It is assumed, from SLDB experience, that only 85 per cent of the total land available for clearing will be suitable and should be cleared.

Estimates of the cost of various types of clearing operations are as follows:

- (a) All clearing operations but no deliberate destumping; \$190 per acre.
- (b) All clearing operations with partial destumping; \$255 per acre. In this operation the larger stumps would be left in the ground. It is expected that most of these stumps will rot within three to five years. Belian stumps will not rot but can be burned.
- (c) All clearing operations with complete destumping; \$360 per acre.
- (d) Spot spraying weeds after partial destumping and before seeding or planting of the pasture species; \$3 per acre.

4.2 PASTURE ESTABLISHMENT

Estimates of the cost of various types of pasture establishment, seeds and inoculants are as follows:

- (a) Cultivations and seeding after complete destumping; \$160 per acre.
- (b) Seeding in the ashes after a burn on cleared and partially destumped land; \$71 per acre.
- (c) Planting vegetative cuttings in cleared land; \$180 per acre.
- (d) Cover crop (legume) establishment in oil palm plantations and maintenance until the third year; \$36 per acre.
- (e) The current cost of purchase of grass and legume seeds is given in Table 4.1.
- (f) Legume inoculants would have to be purchased from Australia. They can be imported from Tropical Inoculants, 1, Kneale St. Holland Park, Brisbane, Queensland 4121. Inoculant CB 1103 is needed for centro at the rate of three ounces per 30 pounds of seed. The inoculant for stylo is CB 1552, used at the rate of three ounces for every 15 pounds of seed.

Inoculants are sold in three, six or nine ounce packets costing A\$0.68, A\$0.95 and A\$1.48 respectively. They have a normal life of five to six months if they are stored in a refrigerator.

(g) Cost of initial application of 140 lb. triple superphosphate per acre \$27.

TABLE 4.1 INFORMATION ON GRASS AND LEGUME SEED COSTS

Supplier	Variety	Price A\$ per lb.	Price \$ per lb.
Wright Stephenson	Brachiaria decumbens	3.60	
Arthur Yates		no quote	
Wright Stephenson	Panicum maximum	Common	2.60
Arthur Yates		Common	1.79
		Coloniaio	1.91
		Hamil	1.91
Wright Stephenson	Centrosema pubescens	0.90	
Diethelm			0.76
Wright Stephenson	Stylosanthes guyanensis	Q8558	1.95
Diethelm		Endeavour	8.50
J. H. Williams		Q8558	1.95
Arthur Yates		Q8558	1.91
		Schofield	1.63
		Oxley	5.40

The addresses of the suppliers quoted are:

- * Wright Stephenson and Co. (Australia) Pty Ltd. 46, Reginald St., Rocklea, Brisbane, 4106, Australia.
- * Diethelm and Co. Ltd., Seed Department, P.O. Box 191, Singapore.
- * J. H. Williams and Sons, P.O. Box 102, Aurwillumbah, New South Wales 2484, Australia.
- * Arthur Yates and Co. Pty Ltd., P.O. Box 72, Revesby, New South Wales 2212, Australia.

4.3 PURCHASE OF CATTLE AND/OR SEMEN

4.3.1 Zebu and/or Crossbred Heifers

Widespread enquiries suggest that the only possible sources of relatively cheap, disease-free Zebu or crossbred heifers would be Madagascar or Australia. No information is at present available as to the cost of purchase and transport of heifers from Madagascar. Current prices in Australia are approximately as follows:

12 to 14 months old, 1/2 to 5/8 crossbred heifers; A\$115 to A\$120.

2-year old pregnancy tested, in-calf, crossbred heifers; A\$150 to A\$160.

2-year old pregnancy tested, in-calf, high grade Brahman heifers; A\$200 to A\$300.

4.3.2 Zebu and/or High Grade Zebu Bulls

Purebred Zebu or high grade Zebu bulls are available from both Australia and the United States. It is likely that better quality bulls could be obtained for

any specific price in the United States but transport costs would be higher. Current prices in Australia are approximately as follows:

2 to 3-year old high grade Brahman bulls ready for service: A\$500 to A\$700.

2 to 3-year old purebred Brahman bulls of high genetic merit ready for service; A\$3,000 to A\$5,000.

Current prices in Florida, U.S.A. are approximately as follows:

15 to 20-month old, purebred bulls; US\$1,500.

18 to 30-month old, purebred, top genetic merit bulls; US\$3,500.

4.3.3 Costs of Collection, Preshipment, Transport, etc.

Costs for cattle purchased in Australia would be:

- Veterinary expenses; health tests, dipping, ear-tags, etc; A\$8.50 per head.
- Pregnancy testing: \$0.50 per head.
- Freight (farm to port); A\$5.00 per head.
- Quarantine charges (14 days); A\$1.00 per head.
- Fodder for voyage and two days prior to shipping; A\$4.00 per head.
- Insurance, ramp fees, etc. A\$3.00 per head.

The most suitable cattle boat available is the MV *Ida Clausen* that has a capacity to carry 320 yearling heifers or 290 two-year old bulls or in-calf heifers. The cost would be A\$50,000 per voyage and bookings would have to be confirmed four to five months in advance. Air freighting the cattle would be a possible alternative but no costs are available.

Costs for cattle purchased in Florida would be:

- Quarantine, insurance and air transport by DC-8; approximately US\$600 per head.

A DC-8 cannot land at Miri. It would have to land at Kuching and the animals subsequently be transported to Miri. An alternative could be for the cattle to be flown to Bandar Seri Begawan in Brunei from where the cattle could be transported by road to Miri, but it is not known if Brunei would permit this because of quarantine regulations.

The estimates for Australian costs have been provided by, Gunn Rural Management Pty. Ltd., Box 449 G.P.O. Brisbane, Queensland 4001, who have experience of purchasing cattle for the authorities in Sabah. They would charge a flat five per cent of the total fob cost of the shipment or direct costs plus professional time at appropriate rates.

The Australian prices are fob Sydney or Brisbane, whilst Diethelm's prices are cif Miri. Sea freight charges for seeds from Australia are A\$54 per long ton with a minimum charge of A\$20, whilst air freight charges from Sydney are A\$1.10 per pound for quantities under 100 pounds and A\$0.83 per pound for quantities over 100 pound of seed. In addition, within Australia there will be quarantine charges including a phytosanitary certificate costing A\$3.50 for each consignment.

The Florida estimates have been provided by G. T. Stack, Suit 306, 308 Tampa St., Tampa, Florida, who has recently exported cattle to Kuala Lumpur

and Kota Kinabalu. There would be no additional charge over and above those quoted.

From the data provided by these two firms it is calculated that the average landed cost of high genetic quality Brahman bulls would be A\$3,400 to A\$5,500 from Australia and US\$4,100 from Florida.

4.3.4 Importation of Deep Frozen Semen

Liquid nitrogen could be made available in Sarawak. It is imported in bulk into Brunei by Shell from ICI Malaysia Senderian Berhad, P.O. Box 284, Kuala Lumpur. The importation and utilisation of deep frozen, Brahman semen is therefore a practical possibility and an alternative to the importation of high grade, quality Brahman bulls.

If deep frozen semen is imported it should be obtained from the United States. The approximate cost would be US\$2.00 to US\$6.00 per dose. It would be necessary to purchase some specialised equipment and to train at least two local staff in insemination techniques.

The essential equipment requirements would be:

- (a) one or more large liquid nitrogen containers (a 600-straw capacity container would cost approximately US\$600);
- (b) smaller containers for transport purposes;
- (c) a supply of rubber gloves;
- (d) insemination guns;
- (e) throw-away plastic sheaths;
- (f) ear-tags; and
- (g) an assumed supply of liquid nitrogen.

The estimated initial cost of equipment would be US\$2,500.

Training in the techniques of artificial insemination is available at many centres. The most suitable would be at the Dairy Training and Research Institute, Los Banos, Philippines or at a centre in Australia.

Estimates of the cost of semen have been obtained from:

- Agripure International Ltd., P.O. Box 342, Seymour Conn, 06483, U.S.A.
- Curtiss Breeding Service, Gary Ill, U.S.A.

4.4 ROADS

An all-weather road leading from the main road to the administrative centre of the ranch would cost approximately \$20,000 per mile. For part of the distance the road has already been built by SLDB. The remainder is estimated to cost \$20,000. Internal roads are estimated to cost \$14 per acre, or a total of \$72,000.

4.5 PADDOCK SIZE AND FENCES

For calculation purposes it is assumed that all fences are constructed using four strands of barbed wire and five, six foot six inch belian posts per chain, with droppers of bush timber; posts are set 31 inches into the ground and the wires fixed at 11, 22, 33 and 44 inches above ground level, respectively; corner and gate posts are strainer assemblies and the gates 15 feet wide, constructed of Number 8 gauge wire and light timber. Such fencing is estimated to cost \$2,000 per mile.

Assuming the ranch is ultimately subdivided into approximately 44 100-acre paddocks and 30 paddocks of 20 acres each as shown in Figure 4.1 then the total length of fencing required will be approximately 80 miles and the approximate total cost \$160,000 or £32 per acre. This fencing need only be erected gradually as the land is cleared and subdivisions are required. The costs could be reduced by utilising hardwoods other than belian as posts for the wire fences, live fences where these are practical and ranch employees for erection purposes. Costs of wire and staples too could be reduced by the importation of bulk supplies.

4.6 CATTLE WORKING YARDS

These yards should be constructed mainly of locally cut timber. The estimated cost is \$25,000 each.

4.7 SHADE

If artificial shades have to be built, they should be no less than 10 to 12 feet high and constructed from bush materials at a cost of no more than \$1,000 each. The number of artificial shades required will not be known until clearing is completed. Shade trees species will ultimately have to be planted in some paddocks but this can be carried out gradually, using available labour that has already been costed. Suitable shade trees would be *Albizia chinensis*, *Pithecolobium saman* (the rain tree), *Pterocarpus indicus* (sena), *Acacia auriculiformis*, *Erythrina spp* and *Parkia javanica*. Coconuts could also be planted along the fence lines for future shade purposes. They will provide shade and nuts but will require protective fencing while they are young to prevent the cattle from damaging them.

4.8 WATER

The cost of water for domestic purposes is accounted for in the estimated cost of housing and buildings.

It is assumed that small dams can be constructed in most paddocks. These should be fenced off and the water piped to cattle troughs. Pre-cast concrete troughs measuring 12 feet by 32 inches by 18 inches are estimated to cost approximately \$150 each.

For calculation purposes it is assumed that there will be 74 paddocks and that each dam will supply two 100-acre or four 20-acre paddocks; thus 30 dams are required together with 150 troughs. It is also assumed that the small dams together with their piped outlets can be constructed at a cost of \$600 each. The total capital cost of supplying water from dams will be:

30 dams at \$600 each	...	...	...	...	\$18,000
150 troughs at \$150 each	...	...	...	...	\$22,500
					<hr/>
				Total cost	\$40,500
					<hr/>

Average cost per acre \$8.

Alternatively the total capital cost of supplying pumped, piped water would be M\$31,100 plus a charge for the water of M\$1.10 per animal per year.

4.9 MACHINERY

The estimated total cost of necessary machinery is about \$222,000. Details of the type of equipment on which this estimate is based are as shown in Table 4.2

TABLE 4.2 ESTIMATED MACHINERY COSTS

<i>Requirements</i>	<i>Estimated cost M\$</i>	<i>Total cost M\$</i>
FIELD MACHINERY		
2 tractors with front and back axle drives and trip-trailers	36,000	
2 slasher tractor attachments	6,000	
1 forage harvester	8,000	
1 fertilizer spreader	5,500	
2 ploughs	6,000	
1 disc harrow	4,000	
1 grader blade	5,500	
1 post-hole digger	5,000	
Miscellaneous cultivation equipment	5,000	
	<hr/>	
	81,000	81,000
TRANSPORT EQUIPMENT		
2 landrovers	36,000	
1 lorry equipped with a cattle crate	27,000	
4 motorcycles	8,800	
	<hr/>	
	71,800	152,800
MISCELLANEOUS EQUIPMENT		
Generator	35,000	
Workshop equipment and miscellaneous workshop and ranch tools	15,000	
	<hr/>	
	50,000	202,800
EQUIPMENT FOR CATTLE WORKING YARDS		
2 spray races	4,000	
2 weighing machines	12,000	
Miscellaneous equipment and spares	3,000	
	<hr/>	
	19,000	221,800

4.10 BUILDINGS

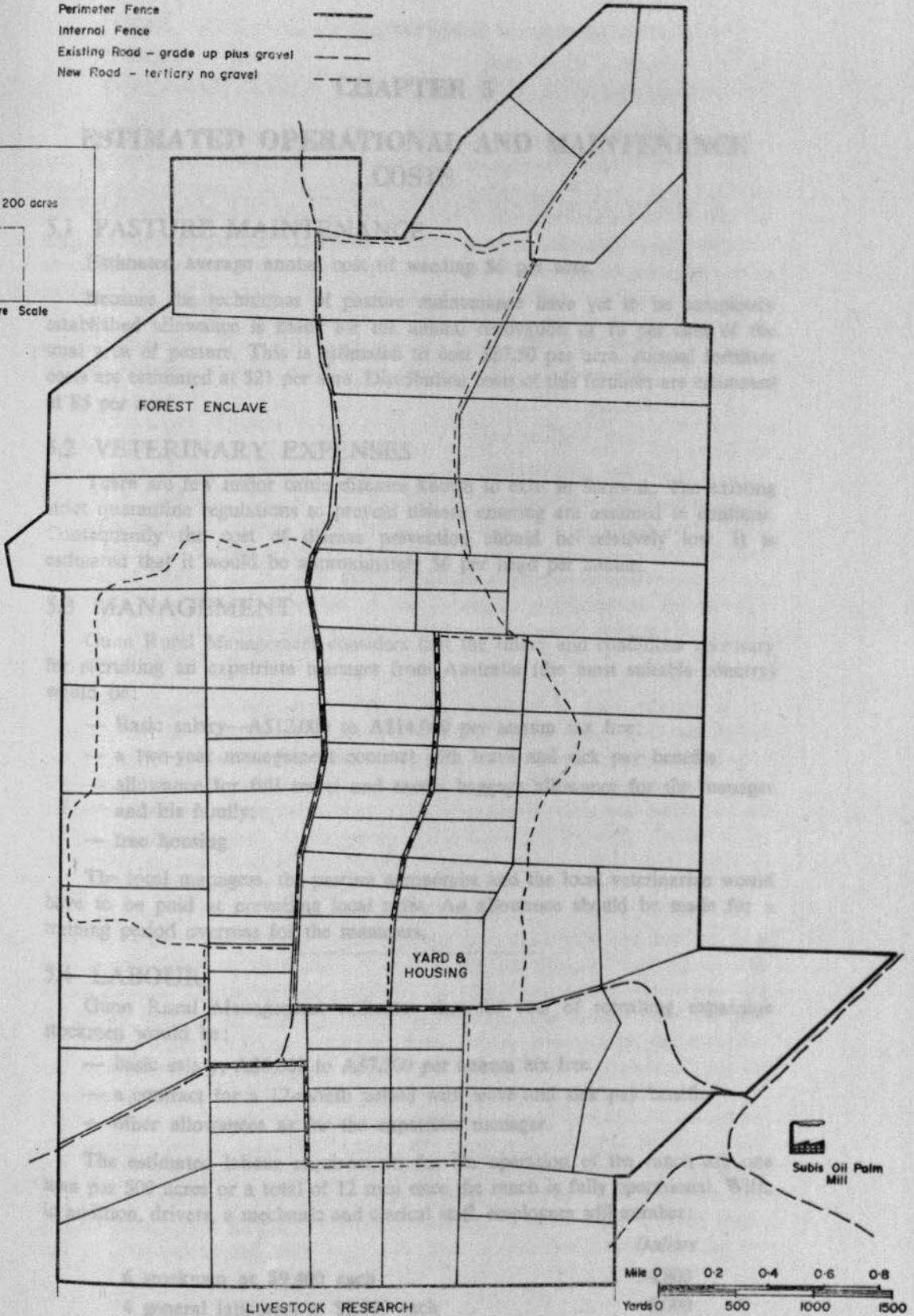
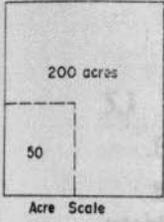
Essential buildings required at the ranch administrative centre include an office and store with one cool room for the storage of seeds and a refrigerator for the storage of inoculants, a generator shed, a workshop and an implement shed. The buildings should be of simple construction; bush timber could be used in the construction of the generator shed; workshop and implement shed. The estimated cost of these buildings is \$40,000. The cost of individual buildings is estimated as follows:

	<i>Dollars</i>
Office and store	30,000
Generator shed	1,000
Workshop	5,000
Implement shed	4,000
Two managerial houses	70,000
Five stockmen houses	75,000
Housing for clerical staff, labour and their families	42,500

SUNGAI KARABUNGAN BEEF RANCH SCHEMATIC FENCE & ROAD LAYOUT

FIGURE 4.1

- Perimeter Fence —————
- Internal Fence ———
- Existing Road - grade up plus gravel - - - - -
- New Road - tertiary no gravel - · - · -



CHAPTER 5

ESTIMATED OPERATIONAL AND MAINTENANCE COSTS

5.1 PASTURE MAINTENANCE

Estimated average annual cost of weeding \$6 per acre.

Because the techniques of pasture maintenance have yet to be completely established allowance is made for the annual renovation of 10 per cent of the total area of pasture. This is estimated to cost \$87.50 per acre. Annual fertiliser costs are estimated at \$21 per acre. Distribution costs of this fertiliser are estimated at \$5 per acre.

5.2 VETERINARY EXPENSES

There are few major cattle diseases known to exist in Sarawak. The existing strict quarantine regulations to prevent disease entering are assumed to continue. Consequently the cost of disease prevention should be relatively low. It is estimated that it would be approximately \$6 per head per annum.

5.3 MANAGEMENT

Gunn Rural Management considers that the salary and conditions necessary for recruiting an expatriate manager from Australia (the most suitable country) would be:

- Basic salary—A\$12,000 to A\$14,000 per annum tax free;
- a two-year management contract with leave and sick pay benefits;
- allowance for full travel and excess baggage allowance for the manager and his family;
- free housing.

The local managers, the pasture agronomist and the local veterinarian would have to be paid at prevailing local rates. An allowance should be made for a training period overseas for the managers.

5.4 LABOUR

Gunn Rural Management estimates that the cost of recruiting expatriate stockmen would be:

- basic salary, A\$6,000 to A\$7,500 per annum tax free
- a contract for a 12-month period with leave and sick pay benefits
- other allowances as for the expatriate manager.

The estimated labour requirements for the operation of the ranch are one man per 500 acres or a total of 12 men once the ranch is fully operational. With, in addition, drivers, a mechanic and clerical staff, employees will number:

	Dollars
6 stockmen at \$9,400 each	54,800
4 general labourers at \$1,500 each	6,000

2 general labourers at \$1,900 each	...	...	...	3,800
3 drivers at \$3,500 each	...	...	...	10,500
1 mechanic	...	...	...	4,400
1 accountant	...	...	...	9,400
1 secretary/clerk	...	...	...	4,400

5.5 MAINTENANCE OF FIXED ASSETS AND MACHINERY

The annual maintenance costs of fixed assets and machinery are estimated on the following basis:

	<i>Per cent</i>
Metalled roads	10
Dirt roads	15
Fencing	7.5
Cattle working yards	5
Water installations	5
Farm machinery	10
Buildings	3

General running costs are \$17,800.

5.3 MANAGEMENT

Great Rural Management considers that the salary and conditions necessary for retaining an expatriate manager from Australia (the most suitable country) would be:

- Basic salary—A\$12,000 to A\$14,000 per annum tax free.
- a two-year management contract with leave and sick pay benefits;
- allowance for full travel and excess baggage allowances for the manager and his family;
- free housing.

The local manager, the pasture agronomist and the local veterinarian would have to be paid at prevailing local rates. An allowance should be made for a training period overseas for the manager.

5.4 LABOUR

Great Rural Management estimates that the cost of recruiting expatriate stockmen would be:

- basic salary, A\$6,000 to A\$7,500 per annum tax free
- a contract for a 12-month period with leave and sick pay benefits
- other allowances as for the expatriate manager.

The estimated labour requirements for the operation of the ranch are one man per 500 acres or a total of 12 men once the ranch is fully operational. With 4 general labourers at \$1,900 each and 3 stockmen at \$3,400 each, the total cost is \$24,800.

CHAPTER 6

DEVELOPMENT PHASING AND PROCEDURE

The rate at which the project can be developed depends upon both economic and technical considerations. The proposed managerial structure would justify a total breeding herd of at least 3,000 cows and heifers and it is obviously desirable to attain this target as quickly as possible. Important considerations will be whether the breeding herd and their followers can be maintained on 5,000 acres, whether the pastures can be established sufficiently quickly and whether surplus stock can be readily sold. The assessment of the market potential presented in Chapter 1 shows that the Sarawak market will be able to absorb all of the slaughter animals produced. The questions concerning the balance between the number of animals and the available grazing are discussed below.

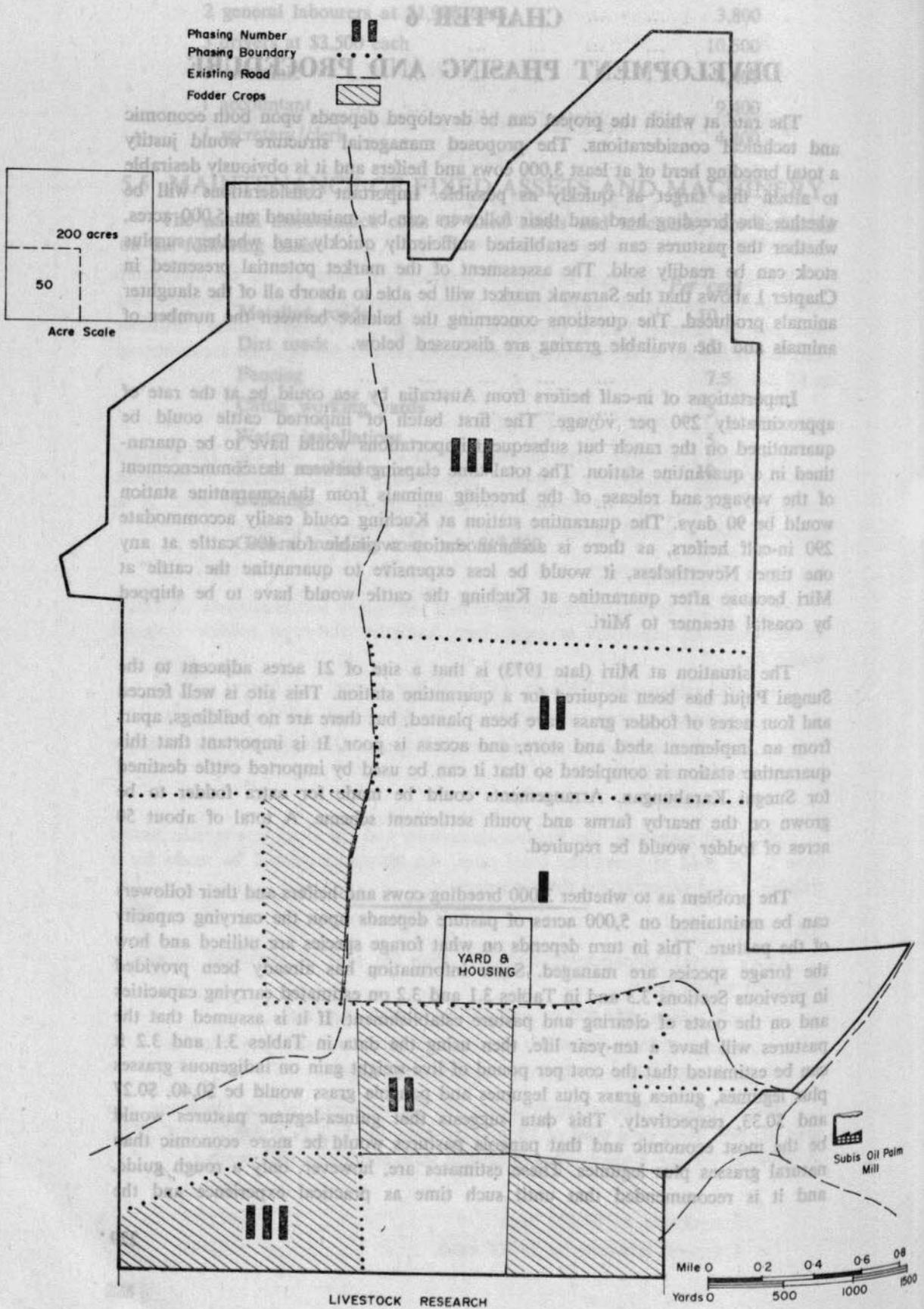
Importations of in-calf heifers from Australia by sea could be at the rate of approximately 290 per voyage. The first batch of imported cattle could be quarantined on the ranch but subsequent importations would have to be quarantined in a quarantine station. The total time elapsing between the commencement of the voyage and release of the breeding animals from the quarantine station would be 90 days. The quarantine station at Kuching could easily accommodate 290 in-calf heifers, as there is accommodation available for 400 cattle at any one time. Nevertheless, it would be less expensive to quarantine the cattle at Miri because after quarantine at Kuching the cattle would have to be shipped by coastal steamer to Miri.

The situation at Miri (late 1973) is that a site of 21 acres adjacent to the Sungai Pujut has been acquired for a quarantine station. This site is well fenced and four acres of fodder grass have been planted, but there are no buildings, apart from an implement shed and store, and access is poor. It is important that this quarantine station is completed so that it can be used by imported cattle destined for Sungai Karabungan. Arrangements could be made for extra fodder to be grown on the nearby farms and youth settlement scheme. A total of about 50 acres of fodder would be required.

The problem as to whether 3,000 breeding cows and heifers and their followers can be maintained on 5,000 acres of pasture depends upon the carrying capacity of the pasture. This in turn depends on what forage species are utilised and how the forage species are managed. Some information has already been provided in previous Sections 3.3 and in Tables 3.1 and 3.2 on estimated carrying capacities and on the costs of clearing and pasture establishment. If it is assumed that the pastures will have a ten-year life, then using the data in Tables 3.1 and 3.2 it can be estimated that the cost per pound of live-weight gain on indigenous grasses plus legumes, guinea grass plus legumes and pangola grass would be \$0.40, \$0.27 and \$0.33, respectively. This data suggests that guinea-legume pastures would be the most economic and that pangola pastures would be more economic than natural grasses plus legumes. These estimates are, however, only a rough guide, and it is recommended that until such time as practical experience and the

SUNGAI KARABUNGAN BEEF SCHEME PHASING

FIGURE 6.1



economic feasibility trial programme has provided definite information on required husbandry and productivity of the forage species available for utilisation, the planting programme suggested in Table 6.1 should be followed. A schematic illustration of the possible scheme planning is shown in Figure 6.1.

For purposes of estimating what number of cattle can be grazed on these pastures it is assumed that the overall carrying capacity will be 0.75 live-stock units (lsu's) per acre until 1977 and that it will slowly rise with improvement in the management of the operation to 1.00 lsu's by 1980. This assumption is not over optimistic and should be easily achieved. As the project develops further progress should be made in live-stock carrying capacity and it is assumed that after 20 years it could be as high as 1.5 lsu's per acre. The lsu used in this paper is equivalent to one adult breeding cow weighing 900 pounds. The various classes of cattle to be used in this project, with performance assumptions as detailed in Table 3.4, are assigned the following lsu values:

<i>Class of cattle</i>	<i>lsu</i>
Calves (0-12 months)	0.15
Yearlings (13-24 months)	0.50
Heifers (30 months) 1-5 years of project ...	0.78
6-10 " " " ...	0.81
11-20 " " " ...	0.83
Steers (30 months) 1-5 " " " ...	0.78
Steers (24 months) 6-10 " " " ...	0.81
11-20 " " " ...	0.83
Breeding cows	1.00
Service bulls	1.33

SLDB management has stated that it would be possible to clear the 5,000 acres at a rate of 1,000 acres in 1974, 2,000 acres in 1975 and 2,000 acres in 1976. This would correlate with the ability of the project's management to import and quarantine cattle and develop the grazings.

If the tentative forage planting programme is followed it will be necessary to time the importation of animals to coincide with it. Eight shiploads each of 290 in-calf heifers would be required. Shipment 1 should be timed to arrive when the first 670 acres of pasture and fodder are ready for grazing. This is taken as the beginning of year 1 in the calculations carried out to estimate the numbers of animals in the herd, the number of live-stock units concerned and the carrying capacity of the pastures. The results of the calculation are given in Tables 6.2, 6.3, 6.4 and 6.5. The subsequent shiploads of animals should be timed to arrive as follows:

- Shipment 2 in the second quarter of year 1.
- Shipments 3 and 4 in the last two quarters of year 1.
- Shipments 5 and 6 in the first two quarters of year 2.
- Shipments 7 and 8 in the last two quarters of year 3.

Breeding bulls would also have to be imported at the following rates; 39 early in year 1, 39 at the end of year 1 and a further 39 in year 2. No further importations of bulls should be required as locally reared bulls would become available by year 3.

Given the parameters outlined previously and the assumptions for productivity given, (Table 3.4) it is shown in Table 6.2 how estimated cattle

numbers would build up during the first six years of the project. Table 6.3 shows how during the first six years the estimated number of lsu in the herd would match up with the grazing expected to be available. In Appendix I tables are given which show the build-up of animals from the various shipments.

Within six years the total number of breeding females would approach 3,000 and sale of breeding heifers could commence. During years 1, 2 and 3 there would be some excess of grazing, but this would be desirable as the project would be in the initial stages and an additional allowance of grazings has to be made for the small elite herd.

Sales of culled cows will begin in the second year and of steers in the third year (Table 6.2). Sales of breeding bulls could begin from the commercial herd in year 4 if some of the young bulls from the most productive cows were now castrated. The data in Table 6.2 simply signify under the heading 'steers' the total number of males available. Sales of breeding bulls from the elite herd could certainly commence on a small scale in year 5. If the Government will accept the practice of selling bull beef then no bull need be castrated.

The estimated herd composition between the seventh and the tenth year are given in Table 6.4. About 1,800 slaughter cattle and 1,000 in-calf heifers will be available for sale annually from year 8. The estimated herd composition would represent approximately 5,930 lsu's and if by the tenth year the pasture carrying capacity was raised to 1.2 lsu's per acre, and this should be possible, then 6,000 lsu's could be carried on the project.

On the assumption that the carrying capacity of pastures rises to 1.5 lsu's per acre between the tenth and the twentieth year a breeding herd of almost 3,700 females could be managed on the 5,000 acres. By the twentieth year the annual out turn of the project would be about 3,920 animals based on 4,230 breeding cows. The approximate composition and out turn of the herd over this period is given in Table 6.5.

TABLE 6.1 A TENTATIVE FORAGE PLANTING PROGRAMME

Timing	Area to be cleared and planted (acres)	Species to be used	Estimated carrying capacity (lsu's per acre)
Before cattle arrive	1,000	400 acres cleared as for oil palm planting	Overall 0.75
		200 acres stylo plus centro with natural grasses	
		200 acres stylo plus centro with guinea	
		400 acres partially destumped	
		200 acres stylo plus centro with natural grasses	
		200 acres stylo plus centro with guinea	
		200 acres clean cleared	
		100 acres clean cleared	
		50 acres Napier for fodder	
		10 acres for cattle yards, buildings, etc.	
	40 acres to be planted with <i>Brachiaria decumbens</i> and/or para if a low lying area is available		
First year after cattle arrive	2,000	To await the results of the first year's planting experience	Overall 0.75
Second year after cattle arrive	2,000	To await the results of the first two years planting experience and the economic feasibility trials	Overall 0.75

TABLE 6.2 HERD BUILD-UP YEAR 1-6

Year	Opening Inventory			Changes during Year												Sales			
	Breeding Cows	Breeding Bulls*	Calves 0-12 months F M	Stock 12-24 months	Purchases or Addition		New Calves Born		Cows Dying	Bulls Dying	New Calves Dying		Last year's Calves Dying		Last bull one year's Calves Dying		Steers	Culls Cows	Culls Bulls
					Breeding Cows	Breeding Bulls	F	M			F	M	F	M	F	M				F	M
1	580	39	—	—	580	39	522	522	18	1	18	18	—	—	—	—	—	—	—
2	1,142	77	504	504	580	38	631	633	34	2	26	26	13	13	—	—	56	—	—
3	1,632	113	605	491	580	43	917	918	43	2	32	32	13	14	5	5	200	162	14
4	2,250	140	885	835	—	66	1,018	1,018	58	4	37	37	26	26	3	4	592	185	20
5	2,665	182	981	1,033	—	61	1,225	1,224	65	5	45	45	26	27	8	9	541	287	26
6	2,914	212	1,124	1,122	—	70	1,466	1,467	78	4	33	31	22	21	4	4	1,375	350	30
7	3,430	180	1,433	1,436	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Provision has been made for breeding bulls by reducing the number of steers sold.

† of which 430 are between two years and two-half years old and are assumed in Table 6.4, to be sold in-calf for creating new breeding herds.

Note: Imported heifers assumed to arrive at farm without casualties, but only 90 per cent assumed to give birth to living calves. Other production parameters given in Table 3.4.

TABLE 6.3 ESTIMATED CATTLE NUMBERS, ACREAGE OF PASTURE AVAILABLE AND CARRYING CAPACITY

Start of Year	Opening Inventory			Yearlings 12-24 months	Total I s u	Number of acres available for grazing	Around Stocking Rate	
	Breeding Cows	Breeding Bulls	Calves 0-12 months				I s u per acre	Total carrying capacity I s u
1	580	39	—	—	504	670	.75	500
2	1,142	77	1,008	—	1,395	3,000	.75	2,250
3	1,632	113	1,212	982	2,210	5,000	.75	3,750
4	2,250	140	1,770	1,671	3,673	5,000	.75	3,750
5	2,665	182	1,962	2,067	4,332	5,000	.9	4,500
6	2,914	212	2,246	2,756	5,149	5,000	1.0	5,000

TABLE 6.4 HERD BUILD-UP YEARS 7-10 IF PASTURE CARRYING CAPACITY REACHES 1.2 1 S U PER ACRE

Year	Transfers, Births, Deaths, Sales during year												Closing Inventory													
	Opening Inventory						Deaths						Sales													
	Breeding Herd		Calves 0-12 m		Stock 12-24 m		Transfers to Breeding Herd		Calves Born		Last Year's Calves		Breeding Herd		Breeding Steers		Culls		Breeding Herd		Calves 0-12 m		Stock 12-24 m			
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M			
6	3,430	180	1,433	1,436	1,158	1,158	20	1,543	1,544	46	47	14	14	80	4	579	1,106	412	28	3,517	168	1,497	1,419	1,422		
7	3,517	168	1,497	1,497	1,419	1,422	422	30	1,536	1,536	46	46	15	15	79	4	1,000	1,364	457	24	3,403	170	1,490	1,482	1,482	
8	3,403	170	1,490	1,482	1,482	1,482	482	25	1,534	1,535	46	46	15	15	78	4	1,000	1,429	475	24	3,331	167	1,488	1,489	1,475	1,475
9	3,331	167	1,488	1,489	1,475	1,475	475	23	1,522	1,523	46	46	15	15	76	4	1,000	1,424	500	24	3,230	162	1,476	1,477	1,473	1,474
10 and following																										

NOTE: * 430 heifers 2-24 years old are assumed sold to form other breeding herds.

TABLE 6.5 ESTIMATED AVERAGE COMPOSITION AND OUT TURN OF THE HERD FROM THE TENTH TO THE TWENTIETH YEARS IF PASTURE CARRYING CAPACITY INCREASES TO 1.5 Isu PER ACRE

Category	Years 11 to 19	Year 20 and onwards
Breeding Stock and followers:		
Breeding cows	3,680	4,230
Breeding bulls	145	169
Calves (0-12 months):		
females	1,710	2,023
males	1,710	2,023
Yearlings (13-23 months)		
females	1,620	2,003
males	1,620	2,003
Estimated Sales of Stock per year:		
Steers (at 24 months)	1,595	1,973
Heifers for breeding or slaughter	900	1,072
Culled breeding cows	645	846
Culled breeding bulls	22	25

OTE: Breeding bulls could also be sold if the best of the young steers were not castrated.

7.2 SOCIAL ECONOMIC EVALUATION

For the social economic evaluation of the scheme adjustments are made to the cost of labour and material expended on the project and the income stream is account for the following:

- The shadow wage of unskilled labour is assessed at \$3 per man day.
- Taxes on materials, vehicles and equipment used on the scheme.
- The value of breeding heifers sold off the ranch is related to a value equivalent to their future production potential. This is assessed on the basis of seven calves worth \$540 each, produced over eight years, the cull value of the cow at \$100, total costs of \$1,360 and annual costs of \$100. If these costs and returns are discounted a net present value of \$1,100 per breeding heifer is arrived at.

The net cash flows for the scheme are shown in Table 7.2 from which the following economic returns are calculated:

- Internal rate of return 12.3 per cent.
- Return to land \$41 per acre.
- Return to labour \$11 per man day.

There are also benefits to this project which cannot easily be expressed in specific financial or economic terms and which will not be felt until the scheme has run for some years.

CHAPTER 7

FINANCIAL AND ECONOMIC ANALYSIS

7.1 FINANCIAL ANALYSIS

The scheme is evaluated at market prices on the basis of the costs and returns outlined in the preceding chapters of the report, and in Appendix II, over a 25 year period. Capital development costs of the 5,000 acre ranch are estimated to amount to \$6.8 mn and operating costs to \$2.2 mn before a positive cash flow situation is reached, thus the net cash outflow of the project from 1974 to 1979 is expected to be \$8.1 mn.

The summary cash flow of the scheme is given in Table 7.1 from which the commercial rate of return is calculated as 8.6 per cent and the present value of the net cash flow at 10 per cent is minus \$1,503 mn.

If interest is charged at 7 per cent and the annual cash surplus is assumed to repay initial development costs the payback period of the scheme would be 20 years. Thereafter there would be a surplus of about \$1.1 mn per annum.

In the above calculation a terminal herd valuation of \$4.7 mn has been included in the income stream of the project, but no residual value has been attributed to the land occupied by the ranch. The above returns are therefore slightly on the conservative side.

7.2 SOCIAL ECONOMIC EVALUATION

For the social economic evaluation of the scheme adjustments are made to the cost of labour and materials expended on the project and the income stream to account for the following:

- (a) The shadow wage of unskilled labour is assessed at \$3 per man day.
- (b) Taxes on materials, vehicles and equipment used on the scheme.
- (c) The value of breeding heifers sold off the ranch is related to a value equivalent to their future production potential. This is assessed on the basis of seven calves worth \$540 each, produced over eight years, the cull value of the cow at \$450, capital costs of \$1,360, and annual costs of \$100. If these costs and returns are discounted a net present value of \$1,100 per breeding heifer is arrived at.

The net cash flows for the scheme are shown in Table 7.2 from which the following economic returns are calculated:

Internal rate of return 12.3 per cent.

Return to land \$41 per acre.

Return to labour \$11 per man day.

There are also benefits to this project which cannot easily be expressed in specific financial or economic terms and which will not be felt until the scheme has run for some years.

TABLE 7.1 SUMMARY CASH FLOW OF THE BEEF RANCH SCHEME AT MARKET PRICES

Year	Costs			Total Costs	Total Income	Net Cash Flow
	Development	Operating	Management			
<i>Thousand Dollars</i>						
1974	682.0	15.0	113.8	810.8	—	— 810.8
1975	3,284.2	77.5	217.6	3,579.3	—	— 3,579.3
1976	2,038.5	181.1	177.3	2,396.9	22.4	— 2,374.5
1977	798.6	284.3	165.5	1,248.4	155.8	— 1,092.6
1978	—	293.2	173.8	467.0	332.6	— 134.4
1979	—	337.5	173.8	511.3	355.0	— 156.3
1980	—	342.4	189.9	532.3	1,066.8	+ 534.5
1981	—	347.0	169.4	516.4	1,067.4	+ 551.0
1982	—	349.5	272.8	622.3	1,460.9	+ 838.6
1983	—	348.9	173.8	522.7	1,500.2	+ 977.5
1984	—	348.2	169.4	517.6	1,508.0	+ 990.4
1985	—	353.8	228.9	582.7	1,701.6	+ 1,118.9
1986	—	—	205.3	559.1	1,701.6	+ 1,142.5
1987	—	—	173.8	527.6	—	+ 1,174.0
1988	—	—	169.4	523.2	—	+ 1,178.4
1989	—	—	169.4	523.2	—	+ 1,178.4
1990	—	—	272.8	626.6	—	+ 1,075.0
1991	—	—	173.8	527.6	—	+ 1,174.0
1992	—	—	189.9	543.7	—	+ 1,157.9
1993	—	—	169.4	523.2	—	+ 1,178.4
1994	—	—	173.8	527.6	—	+ 1,174.0
1995	—	—	173.8	527.6	—	+ 1,174.0
1996	—	—	228.9	582.7	—	+ 1,118.9
1997	—	—	180.4	534.2	—	+ 1,167.4
1998	—	—	272.8	626.6	—	+ 1,075.0
1999	—	—	169.4	523.2	6,389.6(1)	+ 5,866.4
Total	6,803.3	8,231.6	4,948.9	19,983.8	37,681.1	17,697.3
N.P.V. at 10 per cent	6,468.5	2,981.9	2,021.7	11,474.1	9,961.7	— 1,503.3

NOTE: (1) Includes terminal herd valuation of dollars.

Firstly the project will provide a secure internal supply of beef for Sarawak which could have the effect of stabilising meat prices and possibly even lowering them. Better supplies at more reasonable prices will bring beef within the means of a much larger number of consumers with consequent nutritional benefits. There would also be the saving in foreign exchange through reduced imports.

The scheme will promote technological improvements and progress in production know-how in parts of Sarawak where development problems exist at the moment. The establishment of a nucleus national herd from which beef production can be expanded in the future could be of considerable importance to national development.

In addition to providing livestock for future development programmes the project will be a training ground for livestock workers particularly at the stockmen level. A new class of worker and a new approach to livestock husbandry could thus be developed with far reaching consequences.

Beef cattle, whether developed on large ranches or on smallholdings, would make a valuable contribution to the diversification of the agricultural economy. Pasture production can itself take several forms ranging from purely breeding orientated operations to growing and finishing of slaughter stock. Furthermore grassland can easily be converted to an alternative crop at minimum cost.

7.3 EXPANSION OF BEEF PRODUCTION

It is too early to make firm projections of how beef production may be expanded in Sarawak because much will depend on the outcome of this first scheme. However it is obvious that future schemes will not have the burden of high initial costs attributed to the following:

- (a) Importing breeding stock with associated high procurement costs.
- (b) Employing expatriate management staff during the establishment period until locally trained staff gain sufficient experience and management expertise.

In order to gauge the effect of relieving future projects of the burden of these costs an alternative economic analysis was carried out in which it was assumed that breeding stock would be purchased from the established herd and locally trained management staff would be employed from the start of the scheme while all animals would be sold as slaughter stock.

The summary cash flow of the alternative is given in Tables 7.3 and 7.4 from which the following economic returns are derived:

- (a) The capital development costs of the scheme would be \$4.1 mn and operating costs before a positive cash flow position is reached would amount to \$2.0 mn; the net outflow of funds would be \$5.3 mn.
- (b) The commercial rate of return to the project is 11.9 per cent and the payback period 17 years.
- (c) At social prices the internal rate of return is 13.2 per cent while the return to land is \$36 per acre and to labour \$10 per man day.

TABLE 7.2 SUMMARY CASH FLOW OF THE BEEF RANCH SCHEME AT SOCIAL PRICES

Year	Total Costs	Total Income	Net Cash flow
Thousand Dollars			
1974	731.4	—	- 731.4
1975	3,474.1	—	- 3,474.1
1976	2,279.1	22.4	- 2,256.7
1977	1,208.9	155.8	- 1,053.1
1978	425.8	332.6	- 93.2
1979	464.6	355.0	- 109.6
1980	486.0	1,281.8	+ 795.8
1981	470.9	1,356.9	+ 886.0
1982	549.7	1,960.9	+ 1,411.2
1983	475.5	2,000.2	+ 1,524.7
1984	472.0	2,008.0	+ 1,536.0
1985	534.3	2,152.1	+ 1,617.8
1986	510.4	2,152.1	+ 1,641.7
1987	480.4		+ 1,671.7
1988	477.6		+ 1,674.5
1989	477.6		+ 1,674.5
1990	554.1		+ 1,598.0
1991	480.4		+ 1,671.7
1992	497.2		+ 1,654.9
1993	477.6		+ 1,674.5
1994	480.4		+ 1,671.7
1995	480.4		+ 1,671.7
1996	534.3		+ 1,617.8
1997	488.1		+ 1,664.0
1998	554.1		+ 1,598.0
1999	479.7	6,840.1	+ 6,360.4
Total	18,544.6	46,443.1	27,898.5
N.P.V. at 10 per cent	10,793.1	12,413.4	+ 1,591.8

(a) At social prices the internal rate of return is 13.5 per cent while the return to land is 236 per cent and to labour 210 per cent day.
 (b) The commercial rate of return to the project is 11.9 per cent and the payback period 11 years.
 (c) The commercial rate of return to the project is 11.9 per cent and the payback period 11 years.

TABLE 7.3 SUMMARY CASH FLOW OF A BEEF RANCH ESTABLISHED UNDER AN EXPANSION PROGRAMME AT MARKET PRICES

Year	Costs			Total Costs	Total Income	Net Cash Flow
	Development	Operating	Management			
Thousand Dollars						
0	682.0	15.0	70.0	767.0	—	— 767.0
1	1,755.8	77.5	135.8	1,969.1	—	—1,969.1
2	1,298.1	181.1	147.8	1,627.0	22.4	—1,604.6
3	392.6	284.3	158.6	835.5	155.8	— 679.7
4	—	293.2	173.8	467.0	332.6	— 134.4
5	—	337.5	173.8	511.3	355.0	— 156.3
6	—	342.4	189.9	532.3	1,056.0	+ 523.7
7	—	347.0	169.4	516.4	1,032.6	+ 516.2
8	—	349.5	272.8	622.3	1,400.9	+ 778.6
9	—	348.9	173.8	522.7	1,440.2	+ 917.5
10	—	348.2	169.4	517.6	1,448.0	+ 930.4
11	—	353.8	228.9	582.7	1,647.6	+1,064.9
12	—	353.8	205.3	559.1	1,647.6	+1,088.5
13	—	—	173.8	527.6	—	+1,120.0
14	—	—	169.4	523.2	—	+1,124.4
15	—	—	169.4	523.2	—	+1,124.4
16	—	—	272.8	626.6	—	+1,021.0
17	—	—	173.8	527.6	—	+1,120.0
18	—	—	189.9	543.7	—	+1,103.9
19	—	—	169.4	523.2	—	+1,124.4
20	—	—	173.8	527.6	—	+1,120.0
21	—	—	173.8	527.6	—	+1,120.0
22	—	—	228.9	582.7	—	+1,064.9
23	—	—	180.4	534.2	—	+1,113.4
24	—	—	272.8	626.6	—	+1,021.0
25	—	—	169.4	523.2	—	+5,812.4
Total	4,128.5	8,251.6	4,786.9	17,147.0	36,645.5	+19,498.5
N.P.V. at 10 per cent	3,931.7	2,983.5	1,863.6	8,779.3	9,676.9	+ 906.6

The above results are regarded as satisfactory for commercial investment and are indicative of the need to explore the possibilities of joint venture or independent private investor schemes at a later date.

7.4 FOREIGN EXCHANGE COSTS OF THE PROJECT

Imported items involving foreign exchange costs are the following:

land clearing equipment;

pasture establishment and maintenance for seeds, fertilisers and herbicides;

imported stock;

fencing construction materials;

roads construction equipment;

vehicles and equipment;

veterinary expenses;

water supply fixtures.

The total foreign exchange component of the development capital costs are estimated at \$5.2 mn. Operational costs are estimated to involve varying amounts of foreign exchange over the life of the project averaging about \$207,000 per annum.

Year	Land clearing equipment	Pasture establishment and maintenance for seeds, fertilisers and herbicides	Imported stock	Fencing construction materials	Roads construction equipment	Vehicles and equipment	Veterinary expenses	Water supply fixtures	Total
1974	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1975	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1976	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1977	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1978	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1979	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1980	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1981	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1982	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1983	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1984	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1985	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1986	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1988	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1989	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1990	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1991	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1992	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1993	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1994	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1998	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
1999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2001	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2002	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2004	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2005	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2006	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2007	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2008	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2009	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2011	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2012	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2013	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2014	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2015	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2016	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2017	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2018	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2019	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2020	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2021	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2022	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2023	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2024	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2025	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2026	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2027	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2028	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2029	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
2030	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	8.000

CHAPTER 8

PROPOSED FEASIBILITY INVESTIGATIONAL PROGRAMME

Discussed below are the types and priorities of investigations that should be undertaken at the Government Livestock Multiplication and Pasture Research Station in connection with an economic feasibility investigational programme. Two separate programmes are required. A relatively short-term programme should be concerned with the husbandry of pasture and fodder species; the husbandry of cattle with particular reference to grazing management and disease control; the possibilities for integration of cattle and tree crop management with particular reference to the management of cattle in oil palm plantation; and the utilisation of fodder, crop by-products and other feeds for fattening cattle under Sarawak conditions.

The long-term investigations should be concerned with a search for the most productive forage plants for use in the Study Area environment; the most productive method of exploiting Sarawak soils for the production of cattle feeds; and a search for the most suitable cattle type to utilise in the Sarawak environment.

The short-term programme should at least incorporate the following investigations:

- The most economic method of clearing the forest and establishing pasture and/or forage crops.
- The most economic seeding or vegetative planting rates for the forage species that will be used in the commercial unit, that is guinea, pangola, *Brachiaria decumbens*, *Brachiaria brizantha*, *Cynodon plectostachyum*, para, rice grass, Napier, centro and stylo.
- The most economic methods of seeding and/or vegetative planting of the above species.
- The most economic fertilisers and fertiliser rates to use when establishing and maintaining the above species.
- The most economic grazing intervals and intensities of grazing to use with the above species.
- Whether the growing of fodder as opposed to pasture species is economic and/or a necessary insurance policy in the Study Area.
- A survey of cattle diseases and parasites likely to cause difficulties within the Study Area and what economic methods should be taken to control them.
- Whether cattle can utilise the forage grown between oil palms from the third to the eighth year from establishment of the palms, and whether it would be economic to include grasses with the legumes used as cover crops.
- What crop by-product feeds can be used in the economic fattening of cattle, with particular reference to the by-products of oil palm processing.
- Whether lot fattening is as economic as fattening on pasture under the Study Area environment conditions.

The long-term programme might incorporate some of the following investigations:

- The introduction and testing of forage plants that have not yet been introduced but might be productive in the Sarawak environment.
- The investigation and comparison of different agricultural systems designed to produce animal feed and incorporate ruminant livestock. These should include pasture grasses and legumes under legume browse trees planted at specific intervals; pasture grasses and legumes under oil palms, coconuts and varied types of fruit and nut trees; pure stands of heavily fertilised and highly productive forage grasses mechanically harvested for drying; and forage and/or pasture alternated with crops in a specific rotation.
- The importation of Bali cattle and investigation of their utility both as purebreds and for crossbreeding using artificial insemination techniques and deep frozen semen from a *Bos taurus* dual purpose breed, preferably the Red Poll. Unlike *Bos indicus* cows such as the Brahman, Bali cows appear to possess long heat periods and the use of artificial insemination for crossbreeding purposes is likely to be successful in this breed. The rationale for these proposals is that the Bali is likely to be completely acclimatised to the local environment and that this breed possesses several very advantageous characteristics. These are:
 - that their calving percentage under peasant managerial conditions is 80 per cent or 20 per cent better than that of zebu cattle of the Brahman type in Indonesia;
 - they possess a higher killing-out per cent than zebu cattle;
 - there is very little fat in their carcass and their meat commands a premium in the Chinese market;
 - they are very resistant to internal and external parasites;
 - and they are easily trained for work, are docile and appear to be more efficient converters of feed into meat than are zebu cattle.
- The great disadvantage of these cattle is that they possess a very poor milk supply and as a consequence their calves grow slowly, though they eventually attain mature weights of 1,000 pounds or more. It is possible that this disadvantage might be overcome by crossbreeding them with a dual-purpose type of beef animal, such as the Red Poll.
- The establishment of a *Bos taurus* beef breed such as the Red Poll at medium altitude in Kelabit country. Semen and bulls from this herd would then be used for crossbreeding with the Bali and for other feasibility trials such as crossbreeding with the Brahman. There is known to be considerable merit in the second type of crossbreeding as one of the most productive beef breeds in the tropics—the Jamaican Red—is a more or less stabilised crossbred between the Brahman and the Red Poll. The possibilities for establishing a *Bos taurus* beef-type breed in Kelabit country should be explored, particularly as it is known that the Kelabits were a cattle rearing people in the past.

8.1 POSSIBLE SECONDARY DEVELOPMENT

Secondary development proposals should include:

- The encouragement of beef production on smallholdings, medium size private farms, estates and additional ranches.
- The training of extension workers, smallholders, private farmers and estate managers in beef production techniques.
- The organisation of a new marketing and processing system for beef animals and meat.
- The development of new agro-industries.

8.1.1 Smallholder, Estate and Satellite Ranch Beef Production

Breeding bulls and surplus in-calf heifers will become available in small numbers in the sixth year from the commencement of the project and by the tenth year approximately 500 surplus in-calf heifers will become available each year. It would be extremely wasteful to slaughter these surplus breeding animals. The aim should be that the new marketing organisation created should lease or agist weaners (a system whereby a farmer is loaned an animal at valuation for fattening after the animal is sold but the farmer received an agreed share of the difference in price as his fattening fee) to smallholders, private farmers and estates for growing-out and fattening operations.

Possible methods of encouraging beef production outside the Sungai Karabungan project are:

Cattle on Oil Palm Estates

Oil palms are planted at roughly 60 to the acre and on the estates the establishment system is that legume cover crops (stylo and centro) are grown between the palms as erosion and weed control measures. It appears possible that if palatable legumes were planted (stylo and centro) cattle could graze the cover crops from the third to at least the eighth year after planting. The life of a plantation is 25 to 30 years. Thus at any one time approximately 20 per cent of the total estates land is under cover crops that could be made available for cattle grazing. It is estimated that during the period from the third to the eighth year the carrying capacity is approximately one-half to one-third of the carrying capacity that might be expected on similar open land.

If the recommended trials to investigate the possibility of managing beef on the cover crops are successful, then changes could be envisaged in present husbandry practices that would increase the number of lsu's that the land could carry. The changes could include the introduction of grass species into the cover crops and heavier applications of fertiliser.

There could ultimately be at least 100,000 acres of oil palm in the Study Area. If 20 per cent of this area was used for cattle grazing at any time then 20,000 acres would be available for grazing. At a carrying capacity as low as 0.3 lsu's per acre this area could carry about 7,000 lsu's per annum.

This capacity could be utilised either by agisting growing cattle to graze in oil palm plantations or, on large estates, breeding herds could be established.

Cattle on Medium Size Private Holdings

It is considered unlikely that private individuals with medium sized farms or estates will establish breeding ranches. It is far more likely that these farmers would undertake agisting and/or fattening enterprises provided there was a guaranteed market for the beef animals.

Cattle on Smallholdings

The breeding of cattle on smallholdings, as envisaged in the present PAWAH schemes, is unlikely to be economic because the number of animals for sale is always so low. However, the smallholder could play an important role in a fully stratified beef industry as a 'grower' and/or finisher. The system envisaged is that smallholders would graze and/or finish a few beef cattle in a scheme whereby they would receive limited subsidies for the establishment of pasture and fencing, (as in the PAWAH schemes), free training in the management of pastures and cattle and be provided with young cattle by the proposed marketing authority on an agistment basis. The authority would provide the cattle at no cost, the smallholder would graze them and/or finish them and the authority would then market the cattle. Financial gains produced by an increase in liveweight while the cattle were on the smallholding would be split fairly between the authority and the smallholder in a proportion to be determined on the basis of the experimental results.

Expansion of the beef industry in this way should be started only after the economic feasibility of the techniques have been established by the proposed trials on the Livestock Production and Animal Husbandry Training Centre. When it is started it should be a closely controlled operation. Not only should the smallholders be specially selected and trained but the whole undertaking should be concentrated into defined areas so that intensive advice and assistance can be given by the staff of the Agricultural Development Unit (see Supporting Report 2, Part III).

8.1.2 The Training of Extension Workers, Smallholders, Private Farmers and Estate Managers in Beef Production Techniques

Training courses should be organised by the Department of Agriculture at the Government Livestock Production and Animal Husbandry Training Centre and practical training could be organised in co-operation with the NLC on the commercial ranch.

8.1.3 The Organisation of a New Beef Animal and Meat Marketing Organisation

The present marketing organisation and the municipal slaughter-houses within the Study Area will be unable to cope with the number of animals that will become available for sale and for slaughter from the project. Furthermore, the marketing and processing requirements should be so organised that they assist in the development of the beef industry.

Fortunately the NLC now possesses the legal powers to regulate the marketing of livestock and to license wholesalers, retailers, processors, importers and exporters.

It is recommended that the NLC should be given the responsibility to create, by 1978, a marketing organisation that would:

- (a) Organise either directly or through licensed buyers the farm gate purchase of all beef cattle produced as a result of the activities at Karabungan. In addition any other cattle and buffaloes offered by producers should be accepted. Initially there will be only a few animals for sale, and purchase will probably have to be on the basis of a controlled fixed price per pound liveweight. But later, as the number of animals increases and the industry develops, the introduction of regular auction markets should be considered.
- (b) Own and operate, either directly or by licensed contractors, new slaughter-house facilities at appropriate places in the Study Area. The facilities at Miri and Bintulu should receive priority and should be planned so that capacity can be expanded as the supply of slaughter cattle and buffaloes increases. Once an adequate regular supply of good quality local meat is assured the cancelling of existing meat import privileges should be considered.

It is expected that the local Study Area demand for meat will be satisfied by about 1978 if the Karabungan project is started in 1974 and export of meat to Kuching and other parts of Sarawak could commence. It is considered that there should be one central slaughter-house, planned so that capacity can be increased as production expands. Whether this centre should be sited within the main area of production (involving transport of meat in refrigerated containers) or in the main area of consumption (entailing transport of live animals) is an economic decision that must be made later, taking into account the state of development of port and road facilities and the costs of transport.

Eventually the new facilities should include a packing plant to produce pre-packed refrigerated meat for the slaughter by-products.

- (c) License wholesalers and retailers of meat and establish and control hygienic handling standards.
- (d) Organise the agistment of cattle to smallholders and other producers so as to encourage the stratification and further development of the industry. It is envisaged that yearling steers could be purchased from the commercial ranch and agisted, under contract, with selected smallholders. When the animals are ready for slaughter or for moving to fattening lots the appropriate arrangements for payment and transport would be made by the marketing organisation.

8.1.4 The Development of Other New Agro-Industries

These would include the tanning of hides, possibly the drying of fodder grass for feed, the production of crop by-product feeds and the possible establishment of fattening lots based on the feeding of by-products feeds.

MANUFACTURING INDUSTRIES

CHAPTER I

GENERAL INTRODUCTION

Manufacturing is a sector, but not a class, of the economy. It is a sector because a comparison forestry is made between the different sectors of the economy on the basis of undertaking large scale production, and a class because it is a sector of production. Although it is a sector of production, the scope of expansion is not unlimited. It is a sector of production which is limited to fit within the scope. When the scope is limited, the growth will find its base in the development of new methods and the development of new products.

In order to identify some enterprises in the manufacturing sector, a study of the economic prospects of the manufacturing sector is necessary. This study is a study of the economic prospects of the manufacturing sector. It is a study of the economic prospects of the manufacturing sector. It is a study of the economic prospects of the manufacturing sector.

PART FOUR

1. Glass container factory

2. Glass

3. Glass bricks

4. Glass bottle plant

5. Glass impregnating plant

6. Glass fabricated housing plant

7. Glass foundry

In this part the principal specifications of the glass industry are discussed in summary form.

MANUFACTURING INDUSTRIES

INDUSTRIAL CHAPTER 1 POLICY

GENERAL INTRODUCTION

Manufacturing is a sector, like agriculture, is well suited to future development; in comparison forestry is resource limited and the local service sectors are incapable of undertaking large scale basic development without income formation from foreign sources. Although it is outside the scope of work to investigate the possibilities of expansion in manufacturing, a major share of future development is envisaged to lie within this sector. When the proposed development of agriculture comes to an end as all the agriculturally suitable land is fully utilized, future economic growth will find its base in the processing of existing crops, the introduction of new methods and the development of other production sectors.

In order to identify some enterprises in the manufacturing sector a brief investigation of the economic prospects for selected industries was carried out. The industries analysed in this context were chosen as representative of different types of manufacturing suitable for Sarawak. Some examples have been analysed in more detail than others, depending on the need to provide basic data for immediate private investment. In Supporting Report 8, the market and a technical and economic appraisal is presented for each of the following industrial possibilities:

A glass container factory

A sawmill

Drying kilns

A moulding plant

A timber impregnating plant

A prefabricated housing plant

An iron foundry

In this part the principal specifications and financial results for each of these are presented in summary form.

CHAPTER 2

INDUSTRIAL SUPPORT POLICY

3.1 The projections of future development in the Study Area indicate the increasing growth that will take place in the manufacturing and service industries. Development in these industries can neither be planned nor forecast in the same detail as it can with agriculture. Although an analysis of certain specific possibilities has been carried out a total projection, even within the Action Programme period, must necessarily be based on macro-economic calculations.

Throughout the economic planning it was anticipated that serious barriers to accelerated development would exist—for instance poor transport facilities and a scarcity of trained manpower. Although the plan provides for improvements in basic infrastructural needs, it would be unrealistic to suppose that the rapid expansion of the manufacturing and service industries will occur spontaneously. Certain preliminary conditions and incentives must be established, which will include:

- the right political and socio-economic climate must be created, including a positive attitude towards projects which will be beneficial to the local economy, and a tax policy which promotes positive investment. This condition is already partly fulfilled.
- sufficient training facilities must be made available to educate and provide staff with the necessary skills. Training centres, vocational schools and on-the-job training will be basic requirements if industrial development is to be based on local labour.
- the establishment of new industries which could become models for further industrial development must be supported.
- the establishment of a new common marketing organisation for Sarawak which can facilitate existing production and trade and which can create new possibilities for the pioneering trades.

3.3 EQUIPMENT, SIZE AND LOCATION

The principal items of equipment for a glass plant are a water storage tank, boiler, air compressors, vacuum pump, diesel generator, stock and weighting equipment, glass melting tank, bottle forming machine, shop equipment, controls and transport equipment. Apart from the building most of the principal items must be imported; only water tanks could be manufactured locally. The furnace must be built on site but special bricks and steel structures for construction would have to be imported.

The future market for different glass products in Sarawak, Sabah and Brunei is estimated to amount to 16 tons per day in 1975 and 22 tons per day in 1980. Allowing a margin for error and wastage, the capacity requirements in 1975

CHAPTER 3

GLASS CONTAINER FACTORY

3.1 OBJECTIVES

The object of the pre-investment study has been to identify the possibility of establishing a glass manufacturing industry in Sarawak based on local raw materials. The basis for analysis was the bulk production of container glass—mainly bottles. This production should be sufficient to achieve economies of scale in a medium-sized glass producing industrial unit.

Based on bottles and other containers supplementary production could be added, including fancy glass ware and products for the construction industry (e.g. glass tiles and mosaics). The enterprise should be operated along normal commercial lines and should consequently satisfy commercial investment criteria. A pioneer industry status, however, during the first years of operation would be a desirable and probably necessary arrangement, perhaps including temporary protection from competing industries outside the State.

3.2 PRESENT STATE OF THE INDUSTRY

There is at present no glass industry in Sarawak, Sabah or Brunei. Although silica-sand, which is a raw-material in glass production, is available in both the First and Fourth Divisions of Sarawak and at certain locations in Brunei and Sabah, no effort has been made so far to utilise this resource. Container glass manufacturing, however, is a well established industry in Peninsular Malaysia; four establishments are producing or will be producing before the end of 1973/74. The total capacity of these units by that time will be approximately 290 tons daily of glass ware, which will probably be considerably more than the demand within Peninsular Malaysia.

It is clear that capacity consideration alone within the national context cannot justify a glass manufacturing plant in Sabah or Sarawak. Nevertheless, competitive production costs in the form of cheaper labour, abundant energy and raw materials and reduced freight rates would make a plant in Sarawak worthwhile.

3.3 EQUIPMENT, SIZE AND LOCATION

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The future market for different glass products in Sarawak, Sabah and Brunei is estimated to amount to 16 tons per day in 1975 and 22 tons per day in 1980. Allowing a margin for error and wastage, the capacity requirements in 1975

would probably be close to 20 tons/day and in 1980 28 tons/day; this indicates the need for a 30-ton capacity furnace and corresponding machinery. While some of this machinery could be installed in relation to increased production, 30-ton furnace should be constructed at the beginning.

With rational plant design the land requirements for the factory would be approximately four acres. To allow for future extension probably six acres in total should be enough. An additional area should be available for storage of glass-sand scraped during site preparation work for other development in the same area.

The location of a glass industry within the Bintulu area depends on the location of the sand and the future town plan. A mining lease was issued in 1969 to the Glass Sand Company covering the A, D, E and parts of the B fields shown in Figure 2.1 of Supporting Report 8. If other areas become available, (and an approximate calculation indicates that there might be sufficient resources of suitable silica sand in the C and F fields for a future manufacturing industry) a factory could be more easily established there.

3.4 COSTS

An automatic glass container factory is recommended and the machinery is designed and costed on the basis of a 30-ton/day capacity.

For the plant a building of 25,000 square feet (2,300 square meters) would be necessary with an additional 5,000 square feet (465 square meters) for office facilities.

The costs of buildings and equipment are shown in Table 3.1 in summary form. More detailed specifications are given in Supporting Report 8.

TABLE 3.1 PLANT COSTS FOR GLASS CONTAINER FACTORY

	Cost (000 M\$)
Raw materials department	800
Melting	975
Forehearth and feeder	375
Forming	800
Annealing	250
Sorting	75
Machine shop	400
Utilities	375
Laboratory	125
Total plant cost	4,175
Manufacturing building	350
Administration building	90
Interiors	125
Tanks and piping	10
Total buildings cost	575
TOTAL COST	4,750

3.5 ECONOMIC EVALUATION

The economic analysis of the glass-plant project has been carried through on an IBM 370/145 computer with a new programme derived from the COBE programme which is the property of the Economic Planning Unit in Kuala Lumpur. The programme includes a long series of calculations based on the estimated costs and benefits of the project. These calculations are presented in Supporting Report 8.

Table 3.2 shows the present values of the various cash flow items.

TABLE 3.2 PRESENT VALUES OF MAIN CASH FLOW ITEMS IN THE GLASS CONTAINER FACTORY

(Thousand Dollars)			
<i>Benefits</i>	<i>Rate of discount (per cent)</i>		
	7	10	14
Sales of soft drink bottles	24,500	18,300	12,800
Sales of beer bottles	6,500	4,875	3,725
Sales of other containers	5,900	4,525	3,275
Total benefits ...	36,900	27,700	19,800
<i>Costs</i>			
Process equipment (plant)	4,175	4,175	4,175
Buildings	575	575	575
Working capital	125	125	125
Raw materials (local)	525	375	275
Raw materials (import)	1,800	1,350	950
Fuel, power	3,650	2,750	1,975
Wages	4,325	3,350	2,475
Maintenance	3,175	2,450	1,775
Administration, miscellaneous	1,900	1,400	1,000
Total costs ...	20,250	16,550	13,325

The discounted difference between benefits and cost is:

	<i>per cent</i>	<i>\$mn</i>
Total benefits — costs	at 7	16.65
	at 10	11.15
	at 14	6.775

The ratio between the discounted benefits and cost is:

	<i>per cent</i>	<i>ratio</i>
Benefit — cost ratio	at 7	1.82 to 1
	at 10	1.76 to 1
	at 14	1.49 to 1

The calculations based on the cash flows result in an internal rate of return of 25.2 per cent.

The life expectancy of the plant and its facilities are assumed to be 20 years after the beginning of production.

The terminal value of the assets are estimated in 1994 to be:

Plant	:	\$ 0.—	(Scrap value)
Building	:	\$ 0.—	(Scrap value)
Working capital	:	\$200 000	

The land has not been included in the construction costs and no site value is thus included in the terminal value. This together with the complete write-down to scrap values add to the security margin of the project. Taxes have not been included in the feasibility calculations as its status as a pioneer industry and the duration of a tax exemption period is unknown. Any taxation of profits from this operation will, of course, reduce the returns to capital from the viewpoint of a private investor, but not from a social point of view.

Besides the commercial aspects, the value of establishing an industrial unit with 70 workers directly employed is evident. The possibilities for developing a diversified industrial community in the Bintulu area will depend on the promotion of new product lines in feasible industries.

3.6 FINANCIAL ASPECTS

The project could be constructed, operated and administered by a joint venture of Sarawak entrepreneurs and representatives of outside companies with sufficient expertise. The foreign expertise necessary would be responsible construction/management advisors for an initial period of two to five years. Thus no external financial interest would necessarily be anticipated. As most equipment suppliers are engaged in glass manufacturing, however, a joint venture could be advisable as long as a local controlling position could be maintained. In this connection it could be expected that Peninsular Malaysian glass manufacturers would have a positive interest in a Sarawak plant as the development of a local industry would interfere with their market expectations.

If the Sarawak Economic Development Corporation participated in a corporation established to develop local glass, this solution could be desirable as the public sector would then maintain, indirectly, a control in the exploitation of the national resources.

To illustrate a possible financing of the glass manufacturing an example of a corporate structure and its outside financing has been worked out and is detailed in Supporting Report 8.

CHAPTER 4

WOODBASED INDUSTRIES

Recent efforts to stimulate forestry and timber industries in Sarawak include the work of the UNDP/FAO Forestry and Forest Industry Development Project, the establishment of the Sarawak Timber Industry Development Corporation (STIDC), and the agreement with selected forest industry groups to carry out specific commercial feasibility studies in the hill forest areas of Sarawak. All this has contributed to the present policy, that the concentrated effort to promote wood based industry, already initiated, must continue.

Large forest areas within and outside the Study Area have already been delineated and a number of proposed timber industry complexes based on large licence areas are in the preliminary planning stage. The FAO/UNDP team has described the first step in such a timber complex development, namely the logging and the sawmilling in the Mixed Hill Dipterocarp forest areas north of Bintulu. These are the same areas which are being appraised for investment by commercial investors. No attempt has been made to assess the economic effects of the planned timber industry complexes which might or might not include kilns, mouldings, plywood, veneer, particleboard or parquet. Instead means have been considered whereby wood manufacturing units could be attached either to existing or to future licence areas as a complementary industry which would not reach the high volume and investment level anticipated for the timber complexes.

The manufacturing industries considered in this context are a medium sized sawmill, drying kiln, moulding plant, impregnation plant and pre-fabricated housing industry. They are presented here as a package for a small timber complex, but they could also be wholly or partly attached to an existing licence area; one or more licence areas, within or bordering the Study Area, might be suitable for the proposed manufacturing units. In that case the sawmill unit would exist and its establishment cost paid. But as each unit is intended to be independent and would only benefit to a limited extent from internal economies, one or more links could be excluded from the total package.

4.1 SAWMILL

There are within and bordering the Study Area present and future licence areas where a medium size sawmill could be established. The sawmill described here could either replace existing outdated sawmill equipment or offer an alternative for new investment outside the FAO Forest Industry Unit areas. The sawmill and the attached industries could be based on both Mixed Hill Dipterocarp species wood and swamp timbers.

The specific markets for the products of the sawmill would depend on the composition of timber sawn, but in this analysis it is considered that some of the production will be sold as sawn timber for export or domestic use and that the price structure will be standardized.

The log input to the sawmill is assumed to be the total production from the logging license. Thus all the extracted logs would be converted into sawn timber. This assumption is, however, allied to the character and size of the logging area.

The main concern is to make the sawmill operate as close to its maximum capacity as possible and for this purpose a maximum intake from the logging area is anticipated. If the logging output is higher than the capacity of the planned sawmill a certain percentage of suitable peeler logs will be exported or converted into plywood veneers in local mills. This would probably mean reduced average prices on the log intake of the sawmill.

The capacity of the sawmill has been designed according to the standards of a medium size sawmill with a monthly log intake of 2,500 tons. This would require an annually logged area of some 1,500 to 2,000 acres. Employing the 25 year cycle recommended by FAO for Mixed Hill Dipterocarp forest a total licence area of 40,000 to 50,000 acres would be required.

The sawmill is designed to operate on an annual log intake of 30,000 tons but by the introduction of a double shift, production could increase to almost 60,000 tons per year. The costs of the mill are given in Table 4.1.

TABLE 4.1 SAWMILL COSTS AT 1973 PRICES

Item	Cost (\$ 000)
72 inch headrig with 125 HP electric motor	60
Automatic log carriage	95
54 inch pony rig saw, with electrical 75 HP motor	50
Automatic log carriage for pony rig with set works	75
Two 48 inch resaws with roller feed and electrical set works	80
Green Chain, trim saws, dip tank	35
Roll cases, conveyor belts etc.	20
Saw doctors and maintenance shop (sharpeners, cutters, stretchers, presser etc.), chain saws	65
Handling equipment, winches, one fork lift truck	35
Waste disposal system	40
Total equipment	555
Site preparation, construction and installations	145
Office (1,000 square feet @ \$15 per square foot)	15
Cover sheds (20,000 square feet @ \$5 per square foot)	100
Vehicles (one 10 ton lorry)	30
Office equipment and miscellaneous	20
Total investment	865

The sawmill is designed for management and operation by Sarawak personnel who will require an intensive period of training during the running-in period of the sawmill to achieve the efficiency of production assumed in the economic agencies. It is recommended that a highly qualified sawmill expert be engaged together with other key personnel six months before production commences. Training by these supervising experts should continue for the first six months of operation after which the staff should be sufficiently qualified to operate up to the necessary standards of efficiency.

Staff requirements per year for one shift operation are as shown in Table 4.2.

TABLE 4.2 STAFF REQUIREMENTS FOR ONE SHIFT OPERATION OF THE SAWMILL

<i>Staff</i>	<i>Salary rate</i> (\$ per year)	<i>Total cost</i> (\$)
Superintendent	1 at 15,000	15,000
Foremen	2 at 11,000	22,000
Assistants	6 at 7,000	42,000
Skilled workers	16 at 5,000	80,000
Unskilled workers	30 at 3,000	90,000
Manager	1 at 22,000	22,000
Accountant	1 at 12,000	12,000
Clerks	2 at 3,000	6,000
Total staff —	59 —	289,000

Salary costs during full operation will be reduced after the training and construction period. In the six months prior to full operation personnel costs, including training staff, would be about \$100,000.

Total operating costs are shown in Table 4.3.

TABLE 4.3 TOTAL ANNUAL OPERATING COSTS ASSUMING ONE SHIFT OPERATION

<i>Item</i>	<i>Cost</i> (\$)
Labour	289,000
Power	60,000
Maintenance (12.5 per cent of equipment)	72,000
Insurance of plant (2.5 per cent of plant costs)	22,000
Labour insurance (5 per cent of Labour cost)	14,000
Total	457,000

The lifetime of the plant is calculated as 20 years, but after 10 years of operation 40 per cent of the equipment will have to be renewed. Transport should be replaced every five years.

The revenue of the sawmill depends on price developments, although a relationship normally exists between logs and sawn timber prices. If recent trends of rising wood prices continue, however, sawmilling will (if other production factors keep the same cost level) increase in profitability as the investment costs are constant compared to rising raw material costs and product prices. Table 4.4 shows the estimated prices of logs and sawn wood equivalent at 1971-73 prices.

TABLE 4.4 ESTIMATED REVENUE OF THE PROPOSED SAWMILL PER TON OF THROUGHPUT (\$ per ton)

<i>Species</i>	<i>Per cent of total intake</i>	<i>Log price</i>	<i>Sawn timber Price</i>	<i>Expected revenue net of raw material cost</i>
Meranti (red)	50	110	250	140
Kapor, Keruing	25	90	205	115
Selangan Batu	10	120	290	170
Meranti (white)	5	100	210	110
Others	10	70	150	80
Average	100	100	230	130

The cash flow shown in Supporting Report 8 shows a net present value over 20 years of \$3.19 mn at seven per cent discount rate, and \$2.01 mn at 10 per cent discount. The internal rate of return is approximately 22 per cent.

4.2 DRYING KILNS

The introduction of drying kilns in the Sarawak wood manufacturing industry has been limited in the past to moulding and plywood factories. Production of timber of a higher quality would require the establishment of drying kilns capable of drying sawn timber for export and remanufacturing such as moulding, parquetry, etc. The installation of kilns for drying export sawn timber would also add to the production of high, value-added, products to Sarawak industries.

The basic concept of kiln drying is to reduce the moisture content of the timber in a heated chamber instead of the traditional open air seasoning; the seasoning process is thus reduced to a few days instead of several months. Furthermore it is difficult in the Sarawak climate to reduce the moisture content of air-seasoned timber below 17 to 18 per cent, whereas furniture parts, panelling and woodwork for export to temperate climates would normally require to be less than 12 per cent moisture content. It is thus necessary to establish drying kilns if the demands of these markets are to be met. A drying kiln is usually a closed chamber, constructed of concrete, bricks or metal, in which equipment such as fans, heating coils and steam pipes are installed to circulate hot air and dry the timber.

The proposed drying kiln would be built in conjunction with a moulding plant and the sawmill discussed above.

Dependent on the types of timber produced by the sawmill and the capacity of the moulding plant, the intake of sawnwood for mouldings should be around 10,000 tons per year—corresponding to a drying kiln plant of 12,000-ton capacity. Integration of the sawn-timber/drying/moulding process would be advisable, especially if the aim is to export selected sawnwood species in dried condition. The dried timber export, associated with a full scale moulding operation, could amount to about 1,500 to 1,700 tons per year.

The drying kiln envisaged is designed to produce kiln dried sawnwood with a moisture content of 8 to 12 per cent. The rough sawn timber input might either be air seasoned, pre-dried or green. Costings and equipment are based on short time air-seasoned timber with a moisture content in excess of 50 per cent. The plant includes drying chambers, ventilators, compressors and a boiler, and would cost \$290,000.

Various types of machinery have been considered in the calculation of costs. The described plant is mainly based on Australian systems, which are already known in Sarawak, but both American and English plants could be established at similar cost. Gas would be a cheap available power source.

The total establishment cost would vary according to the location but the plant should be close to both the sawmill and the moulding plant thus minimising internal transport costs. Supply of electricity is assumed to be from SESCO and consequently no generators are included in the investment costs.

The total capital requirements are shown in Table 4.5.

TABLE 4.5 CAPITAL COSTS OF DRYING KILN

	\$
Four kiln chambers each 42 feet long (inside), construction, site, etc. ...	110,000
Kiln equipment for four kilns (including controls, spray and vents) ...	80,000
Compressor	7,000
Boiler plant	68,000
Rails, carriages	25,000
Buildings: Office 700 square feet at \$15	10,000
Covered sheds 8,000 square feet at \$5	40,000
Miscellaneous equipment	10,000
TOTAL	350,000

The drying kiln is designed for operation by Sarawak personnel. As control of the process is basically automatic no specific requirements are considered as far as staffing is concerned. No management is considered necessary, as production should be closely tied to the sawmill and the moulding factory; running-in costs are negligible. As construction and installation are estimated to be completed in less than two months pre-operation salaries will amount to only \$4,000. Other production costs include raw materials, power and maintenance. Export quality sawnwood could be produced for \$260 per ton and moulding sawnwood at \$230 per ton.

Table 4.6 summarises the operating costs of the plant.

TABLE 4.6 ANNUAL OPERATING COSTS OF THE DRYING KILN

	\$
Labour: * Superintendent	12,000
Two assistants	14,000
Three labourers	9,000
Power	40,000
Maintenance of equipment (7 per cent)	20,000
Insurance (2.5 per cent of plant cost)	9,000

* 24 hour operation.

The lifetime of the plant is calculated at 90 years, but after 10 years of operation 30 per cent of the equipment would need to be renewed e.g. compressors, ventilators, boiler improvements.

The economic feasibility of the drying kiln will depend on price and cost developments, but if a moulding plant is considered as an economically justified establishment the kiln plant would be a necessary link in production. Present price-cost structures indicate that the drying kiln is feasible as an isolated investment but changes might justify the consideration of the kilns as an integrated part of the moulding manufacturing complex.

As no actual administration overhead is calculated for the drying kilns this plant can be considered as part of a bigger industrial unit. The price of the kiln dried timber is assumed to be \$315 per ton for export sawnwood and \$260 per ton for sawn wood for moulding, giving margins of \$55 and \$30 per ton respectively. The output of the plant is assumed to be 15 per cent for export and 85 per cent for moulding, and on this basis a preliminary evaluation gives an internal rate of return of between 20 and 25 per cent.

4.3 MOULDING PLANT

The present capacity for manufacturing wood mouldings in Sarawak has been utilised completely during recent years. In isolated cases production has been below full capacity because of lack of raw materials, but not because of a lack of demand. Present producers of mouldings in Sibü and Kuching had several months delivery delay at the end of 1973. The market is entirely export oriented and concentrates on light coloured wood products, mainly Ramin. A development of the market to include non-ramin mouldings, however, can be anticipated.

The present export of mouldings and dowels from Sarawak amounts to more than 50,000 tons per year and, although a considerable increase of general moulding capacity can be expected within the next few years, the production volume of the plant described here (5,500 tons) could easily be absorbed by a small number of foreign buyers of components for the furniture and construction industries. About 500 tons of mouldings would also be supplied to the local construction industry, preferably to the prefabricated housing plant which would demand certain standard mouldings for windows and interior fittings.

The plant is designed to convert sawn kiln-dried timber (planks) into mouldings. These are produced by running the planks through moulding machines whereby the planks are shaped according to a set pattern; mouldings include profiles, frames, furniture parts (e.g. drawer sides) and tool handles. As the requirement for accuracy is usually very high, especially when furniture parts are produced, the machinery and personnel must be able to produce mouldings and dowels of very high quality. The plant includes saws, moulders, conveyors, transport and refuse systems and the total cost is shown in Table 4.7.

TABLE 4.7 CAPITAL COST OF MOULDING PLANT

	\$
Two moulders (six spindles)	70,000
One moulder (four spindles)	30,000
Three cross cut saws	20,000
Two Band resaws (36 inch)	25,000
Sanding equipment	8,000
Conveyors, belts	10,000
Waste conveyor	7,000
Grinding equipment, etc.	10,000
Transport equipment	60,000
Total equipment	240,000
Buildings: Office (1,000 square feet)	15,000
Factory and storage (8,000 square feet)	88,000
Office equipment	12,000
TOTAL	355,000

The moulding factory is designed for management and operation by Sarawak personnel. As there are already several highly efficient plants with good local technical management in Sarawak, supervisors should be available within the country. Training of machine setters and head-operators would be carried out during the construction period.

The lifetime of the plant is calculated at 20 years but after 10 years of operation 60 per cent of plant equipment would need to be renewed. This covers mainly moulding machinery.

Operating costs are shown in Table 4.8.

TABLE 4.8 ANNUAL OPERATING COSTS OF THE MOULDING PLANT

	\$
Labour: * Three superintendents	36,000
Three Mechanics	30,000
Six toolsetters	39,000
Thirty semi-skilled workers	135,000
Sixty female unskilled workers	150,000
Management: Manager	18,000
Accountant	12,000
Two clerks	6,000
Power	83,000
Maintenance (8 per cent of equipment costs)	19,000
Insurance (25 per cent of plant investment)	9,000
TOTAL	537,000

* Assumes three shifts.

The feasibility of moulding production depends on price and cost trends, but with an increasing global tendency towards restrictions on log exports from the raw material producing countries a remanufacturing plant should have good market and product price prospects. The moulding factory in this case has been assumed to have a separate administration but, as it has been kept to a low level, the management cost should not be much higher than in the case of full integration with kilns and sawmill.

The moulding plant, as in the previous analysis, has been evaluated under the assumption of constant price relations. The finished moulding products have been assumed to obtain selling prices ex factory at:

- mouldings for export (including packing) \$605 per ton
- mouldings for local market \$550 per ton.

Given an average sawn timber price of \$260 per ton this allows operating margins of \$345 per ton and \$290 per ton respectively. On this basis an initial evaluation gives an internal rate of return of over 25 per cent.

4.4 TIMBER IMPREGNATION PLANT

Preservation of timber has in the past not been very effective in Sarawak. One reason is that formerly only very resistant timbers were used for construction purposes and the durability of timbers such as belian and selangan batu made preservation measures unnecessary. When construction development increased unsatisfactory preservation methods were applied to the less durable timbers which now constitute the main materials for housebuilding. Although treatment with creosote and other wood preservatives is often prescribed in building specifications, the use of effective preservation is still very limited. Furthermore non-approved preservation liquids like waste oil are often used as a substitute for more expensive products. As it is of major importance to protect construction timber new ways should be introduced to improve the preservation treatment. This is especially important when lighter dimensions are introduced for low cost housing construction.

There are various methods of wood preservation which could be applied. The one mainly used in Sarawak (when applied as prescribed) is applying paint or some kind of preservation liquid but as the timber is usually insufficiently seasoned even a careful surface painting does not afford any long term protection against rot, insect or fungal attacks. The best means of preserving timber is by full impregnation with salt solutions and antifungal agents. The best known processes which are in use in Peninsular Malaysia, are the "Calcure" and the "Tanalith" processes. The preservation specifications include a vacuum pressure impregnation with a minimum dry salt retention of 0.35 pound per cubic foot of timber. This corresponds to the standards laid down by the Federal Land Development Authority for treatment of all timber, except heavy hardwoods, for housing construction on the Felda schemes.

The general market in Sarawak for pressure treated timber should be extensive but, only to undue savings by less responsible contractors and developers, the actual demand for impregnated timber is reduced. The timber impregnation plant described here is not intended to cover demand from the general market; production from the plant will be taken up mainly by the prefabricated housing

plant described in the next section. The only sales to the general market would be any surplus to the plant capacity of 5,000 tons of sawn construction timber annually which should be absorbed by the expected demand of the prefabricated housing plant.

The capacity of the plant is designed to be about 5,000 tons per year or about 400 to 450 tons per month. The plant would be designed to operate the "full cell" process whereby air is removed under vacuum and preservatives are forced into the wood under pressure. The required pressure to be applied is about 200 pounds per square inch. The annual output of 5,000 tons would require two retorts of six feet internal diameter by 30 feet long, each having a capacity of 400 cubic feet per charge. The total capital requirements, which include retorts, compressor, mixing tanks, storage and handling equipment are shown in Table 4.9.

TABLE 4.9 CAPITAL REQUIREMENTS FOR A TIMBER IMPREGNATING PLANT

	\$
Land (no cost calculated)	—
Buildings: Office 500 square feet at \$15	7,500
Workshop 2,500 square feet at \$10	25,000
Equipment, installation	150,000
Office, miscellaneous	10,000
Transport equipment	35,000
TOTAL	227,500

The timber impregnation plant would be operated by local personnel. The process is uncomplicated and no special skilled labour or training would be required. No management is considered necessary as production would be closely tied to the prefabricated housing plant.

Other production costs include raw materials, power, water and maintenance. The cost of wood preservation is estimated on the basis of a dry salt retention of 0.35 pound per cubic foot. Different impregnation chemicals can be used; the present calculations are based on the 'Tanalith' CT106 wood preservative which cif Miri costs about \$750 per drum (of 0.25 tons = 550 pounds). If a five per cent wastage of wood preservative is anticipated, the cost of chemicals per ton of treated timber would be \$24 or \$120,000 per year at full production.

The lifetime of the plant is calculated at 20 years, but after 10 years of operation 30 per cent of the equipment would need to be renewed.

Table 4.10 summarises the annual operating costs of the plant.

TABLE 4.10 ANNUAL OPERATING COSTS OF A TIMBER IMPREGNATING PLANT

	\$
Labour: Superintendent	12,000
Two assistants	14,000
Ten labourers	30,000
Chemicals	120,000
Power and water	8,000
Maintenance (2 per cent of equipment)	3,000
Insurance (2.2 per cent of plant)	5,000
TOTAL	192,000

For the economic evaluation the only basis available for valuing the work of impregnation carried out is the 1968 schedule of PWD which states the cost of impregnation to be:

- traditional creosote treatment (3 pounds per cubic foot) \$45 per ton;
- vacuum pressure treatment (0.35 pounds per cubic foot) \$60 per ton.

Considering the difference between the present and 1968 price levels a treatment price for this plant of \$60 per ton can be considered realistic. The selling price of the pressure impregnated timber would thus be \$280 per ton, given a purchase price of \$220 per ton. On this basis an evaluation gives an internal rate of return of approximately 22 per cent.

4.5 PREFABRICATED HOUSING PLANT

The concept of manufacturing housing components in a factory for later assembly on the building site is not new; most construction activity is divided (as it is in Sarawak) between workshop and on-site preparation. A prefabricated housing system is only a matter of the extent to which pre-construction is carried out in the workshop.

To make possible the prefabrication of components for houses in a factory a standardised production line must be planned. Standard building components and units should be designed to fit a module system in such a way that, even if different types of houses are produced in the plant, the basic parts will always be the same. It is by standardising production in this way that the costs can be reduced because of savings in materials and labour.

The demand for houses depends on the present number of acceptable houses, the need for additional housing facilities for present and future population and the need for replacement of old dwellings. The market for prefabricated houses depends on the same factors. A prefabricated housing plant based on the local timber industry should concentrate production for the lower income groups where houses made of wood based materials are generally accepted. As this is the socially most important part of the housing market cost reductions are relatively more important.

The above market considerations are based on the local market; the structure of the export market is entirely different. It is, however, assumed that the prefabricated housing plant should be based on the domestic market, and only when techniques and the ability to compete internationally has been ascertained should the plant be expanded to produce specific export types. This does not preclude the possibility of exporting the low cost types designed initially for the local market.

The total demand for new low-cost houses in Sarawak is estimated to be 6,000 to 6,500 units per year from 1975 to 1980. For the Study Area the demand should be between 800 and 1,000 units. The Study Area has been considered as the primary market for the prefabrication plant which, located in the Bintulu region, would be able to deliver the finished product up to a maximum road transport distance of 150 miles from Bintulu. The present capacity for house building in the Study Area is probably about 400 to 500 units per year, covering all types from low cost to luxury. With the expected increase in the construction of commercial and government building the total capacity of the existing contractors will probably not exceed 800 to 900 housing units per year of which 600 units will be demanded by the higher income groups. The contractor capacity left for low cost construction will thus be about 200 to 300 units. Out of the

estimated demand for low cost houses, 800 to 1,000 units, about 600 units will have to be provided either from outside contractor capacity or by an increase in the local capacity.

In addition to the normal demand, the construction of a LNG plant at Bintulu would require housing construction workers. During the peak construction period more than 3,500 workers will be employed at the LNG plant site, of whom at least 2,000 will be short-term immigrant labourers. If the labourers are settled in low cost houses providing sleeping and cooking facilities for six to eight workers per unit, the demand for low cost houses will be increased by 150 per year in 1976 and 1977.

Based on the market possibilities, a prefabricated housing plant should be established with a capacity of 800 units per year producing at about 70 per cent capacity in the first year of full operation and 95 per cent capacity thereafter.

According to known development plans a small number of big organisations will demand a large part of the total requirement for low cost houses from 1975 to 1980. If contracts can be secured with these organisations a substantial part of the total plant capacity could be covered. This should be possible as local contractors will find it difficult to meet the demand both for large numbers of settlers and other low cost houses.

The plant for prefabricated houses would manufacture housing elements to the stage of completion which is most feasible when all stages of the manufacturing process, the transport to site, and the assembly are considered. The entire process is planned to be carried out by the prefabrication factory including specialised assembly teams constantly employed on the housing sites.

The intake of raw materials will not have any important effect on the location of the plant because an efficient transport facility for finished products will be necessary. Location next to the impregnation plant, however, is envisaged, thus reducing transport costs of materials for raw materials.

The main components of the prefabrication plant are shown with their capital costs in Table 4.11.

TABLE 4.11 CAPITAL COST OF PREFABRICATION HOUSING PLANT

	\$
One cross cut	2,000
One circular saw	2,500
One multi rip saw	13,000
Two 16 inch jointers	8,000
One planer (3 side)	15,000
Two planers (1 side)	12,000
Two mortises	5,000
One band saw	4,500
15 working benches	3,000
Band tools, tool-shop	5,000
Handling equipment	30,000
Waste disposal system	15,000
Buildings: Office (1,000 square feet)	15,000
Factory (20,000 square feet)	200,000
Two lorries	60,000
Office equipment	15,000
TOTAL	405,000

The prefabricated plant is designed for local management and operation but as the manufacturing and assembly technique is new to Sarawak an intensive period of training during the running-in period of the production has been provided. At least two highly qualified experts would have to be engaged, together with the key personnel for the plant and assembly sections, six months before full production commences. The training under these supervising experts should continue for the first six months of operation. After this only one supervisor should be necessary in subsequent years of production to carry out the necessary adjustments based on time studies of the local work conditions. The permanent staffing requirements for a one shift operation is shown in Table 4.12 and other operating costs are shown in Table 4.13.

TABLE 4.12 PERMANENT STAFF REQUIREMENTS FOR PREFABRICATION PLANT

<i>Direct labour</i>		<i>Total</i>
		\$
PLANT		
Technical Manager	1 at 18,000	18,000
Assistant	1 at 12,000	12,000
Technicians (tool setters, mechanics)	3 at 10,000	30,000
Skilled workers	5 at 5,000	25,000
Assemblers (semi-skilled)	5 at 4,000	20,000
Labourers (unskilled workers)	10 at 3,000	30,000
Sub-total direct labour	25	135,000
<i>Site</i>		
Site Superintendent	1 at 8,000	8,000
Assembling labourers	20 at 3,000	60,000
Sub-total site labour	21	68,000
<i>Management</i>		
Technical Manager (same as Plant)	1 at 18,000	18,000
Office Manager	1 at 15,000	15,000
Accountant	1 at 10,000	10,000
Clerks, typists	3 at 3,000	9,000
Draftsman	1 at 3,000	3,000
Sub-total management	6	37,000
Total employment	52	240,000*

* In the six months prior to operation staff costs would be \$120,000.

TABLE 4.13 OTHER OPERATING COSTS FOR PREFABRICATION PLANT

<i>Item</i>	<i>\$</i>
Timber (800 units at \$1,680 per unit)	1,344,000
Other raw materials (at \$975 per unit)	780,000
Power	16,000
Maintenance (8 per cent of equipment)	9,000
Insurance (2.5 per cent of plant)	10,000
Labour insurance (5 per cent of direct labour)	9,500
TOTAL	2,168,500

The lifetime of the plant is calculated at 20 years but after 10 years of operation 50 per cent of plant equipment will need to be renewed. Transport equipment should be replaced after every five years of operation.

The evaluation of the prefabricated plant depends on the price trends of the production factors. As the raw materials will be produced locally and external changes in price relations might necessitate adjustments in the production process.

Price fluctuations of raw materials would necessarily have to be reflected immediately in the house-prices. To reach a secure base for contracting it is proposed to tie prefabricated building contracts to a construction-cost-index, which should be worked out, or controlled by, the Department of Statistics or other authorities. By basing the house price on an index unnecessary speculation in future price trends could be avoided.

The prefabricated house at a price of \$4,500 would be the best and cheapest solution to low cost housing available in Sarawak (March 1974)—the prefabricated house would thus be in a very strong competitive position. By attaching the house price to the proposed index, planning would be facilitated for both producers and consumers and the speculation in price trends avoided to the benefit of the social economy.

On the basis of the house price and the costs quoted above the initial evaluation shows an internal rate of return of more than 25 per cent.

The job product market would cover specific items for a wide range of industries:

— production

— maintaining

— public works contractors

— general construction (including LNG plant)

The market for cast iron soil pipes can be estimated from the future housing demand of the Study Area. The foundry is expected to cover local demand only. The standard range of soil pipes include:

6 feet pipes	approximate weight 36 lb.
sockets	approximate weight 7 lb.
T-pieces	approximate weight 14 lb.
elbow pieces	approximate weight 8 lb.

In low-cost housing with adequate sanitary installations the demand for soil pipes will probably amount to 250 pounds per unit. In higher income houses, especially in urban areas, 500 pounds per unit is estimated. The introduction of extended sewage systems in urban areas will increase these estimates considerably.

If the local foundry is to meet 75 per cent of the potential local market which includes about 900 low-cost and 500 other houses per year, and an annual periodic intermediate construction of 20 buildings/complexes and 50 housing units, the total capacity required for soil pipes would be approximately 450 to 500 tons per year.

The market for manhole covers, floor-traps and other sanitary cast iron installation wares is estimated to be 50 tons per year in the five-year period from 1975 to 1980.

CHAPTER 5

IRON FOUNDRY

5.1 THE MARKET

Experience from Europe and America shows that in almost every urban area of 35,000 inhabitants or more an iron foundry has been established. There is reason to believe therefore that sufficient scope exists for a similar industry in the Study Area and that a future iron foundry would contribute to the formation of the industrial environment required for development.

The market for different cast iron wares and the mixed machinery is decisive for the projection of foundry capacity. The foundry recommended would be a combined jobbing and line-product foundry where both custom-ordered iron castings and standard items would be manufactured. The range of line products is assumed to cover:

- cast iron soil pipes
- floor traps, manhole covers etc
- cooking utensils i.e. frying pans

The job product market would cover specific items for a wide range of industries:

- oil production
- shipbuilding
- public works contractors
- general construction (including LNG plant)

The market for cast iron soil pipes can be estimated from the future housing demand of the Study Area. The foundry is expected to cover local demand only. The standard range of soil pipes include:

- | | | |
|----------------|--------|---------------------------|
| — 6 feet pipes | ... .. | approximate weight 56 lb. |
| — sockets | ... .. | approximate weight 2 lb. |
| — T-pieces | ... .. | approximate weight 11 lb. |
| — elbow pieces | ... .. | approximate weight 8 lb. |

In low-cost housing with adequate sanitary installations the demand for soil pipes will probably amount to 250 pounds per unit. In higher income houses, especially in urban areas, 500 pounds per unit is estimated. The introduction of extended sewage systems in urban areas will increase these estimates considerably.

If the local foundry is to meet 75 per cent of the potential local market which includes about 900 low-cost and 500 other houses per year, and an annual public mercantile construction of 20 buildings/complexes and 50 housing units, the total capacity required for soil pipes would be approximately 450 to 500 tons per year.

The market for manhole covers, floor-traps and other sanitary cast iron installation wares is estimated to be 50 tons per year in the five-year period from 1975 to 1980.

The demand for cast iron cooking utensils would be based on frying pans which vary in size from 14 to 20 inches weighing from 4 to 9.5 pounds. The average lifetime of the iron pans seems to vary between two and three years and with 25,000 households as the market base the annual requirement would be 40 to 50 tons.

The demand for special products from a jobbing foundry is difficult to estimate. No capacity has been available before and demand from the biggest industry in the Region (Sarawak Shell Berhad and its contractors) may be met from Labuan and elsewhere without registration in Sarawak import statistics.

The demand for jobbing foundry goods could be estimated at an initial volume of 300 tons increasing to double this figure within the first five years of operation. On such assumptions, an annual total foundry capacity of 1,500 tons or 125 tons per month should be planned for.

5.2 RAW MATERIALS

The raw material for cast iron varies for the type of final product required. As the production is based on grey iron products (only special orders might require white iron or semi steel alloys) pig iron will be the main raw material; as most of the products do not require specifications in classes over 40,000 pounds per square inch tensile strength, larger amounts of scrap iron might be used when available. For instance, soil iron pipe production often involves the use of 75 per cent scrap and 25 per cent pig iron.

As scrap iron is available in large quantities in Miri from former SSB drilling operations (estimated at 4,000 to 5,000 tons) a local resource for the foundry is available for the first years of operation. As oil exploration and exploitation would continue to dispose of scrap iron a local supply might be available over a longer period.

Pig iron must be imported and it is also necessary to import coke.

Limestone, clay and sand (silica) for moulds will be available locally. The annual requirements for raw materials at full capacity would be:

	Tons
Pig iron	450*
Scrap iron	1,350
Coke	300*
Sand (silica)	300
Limestone	30
Other minerals	100*

*Imported.

5.3 TECHNICAL DESCRIPTION AND LOCATION

The production process of iron casting consists of pattern making, sand preparation, mould making, melting and finishing.

Pattern making is the production of the pattern from which the iron casting is made. For special orders drawings are submitted and a wooden pattern produced according to the technical specifications. Pattern making requires a special workshop with a skilled wood worker as first pattern maker.

Sand preparation is carried out by mixing silica sand, clay and used unburned moulding sand. Sand preparation is carried out manually or mechanically, but

irrespective of the method a high degree of regularity is aimed at. Bentonite and mineral black is usually added to the sand mix.

The mould is made by using the pattern whose shape is essentially that of the desired casting. A refractory (such as moulding sand) is packed around the pattern. When the pattern is withdrawn, its imprint is left as a cavity in the refractory.

Melting is carried out in a cupola furnace, which is a vertical, cylindrical type of furnace consisting of a steel shell lined with fire bricks. The furnace is charged through a charging door close to the top of the cupola and the batch of materials include iron, coke, limestone and other minerals. A blower unit is needed to supply air for the combustion. The cupola for the kind of foundry described here would not need to be more than 35 inches in diameter. Operation is simple and economical as the fuel (coke) and metal are mixed and thus in intimate contact with each other.

When the iron is melted it is drawn off in a refractory ladle which is carried to the pouring bay where the metal is poured into the moulds. When the castings have cooled, they are shaken out, the risers are broken off and returned to the cupola while the sand is screened for reusability.

The finishing is cleaning off the casting with a steel brush or by sand-blasting. Grinding is carried out if necessary and further manufacturing on a lathe is done if specified for special orders.

The intake of raw materials and the market for the finished products would have a big influence on the location of the plant; the fuel will also be important. The example in Table 5.1 makes use of a hot blast cupola with coke as fuel but if cheap gas is available fuel costs would be reduced considerably by the use of an air furnace melting techniques. This would also allow for the use of bigger pieces of scrap and the processing of higher strength irons because of the better temperature control. For this process Miri would be the best location as it is conveniently situated for supplies of scrap iron and gas—and it has the potentially largest market for iron products.

5.4 COSTS

Based on the technical requirements described above, the costs of the plant and equipment would be as shown in Table 5.1.

TABLE 5.1 CAPITAL COSTS OF AN IRON FOUNDRY

Raw material storage and preparation (scrap breaking equipment, hoists)	80,000
Cupola with hot blast	130,000
Sand slinger, muller, conditioner	90,000
Ladles, refractories	25,000
Moulding machines	120,000
Misc. core ovens, scales and other equipment	40,000
Lathe, and other tools	45,000
Transport equipment	30,000
Total plant equipment	560,000
Buildings: Office (2,000 square feet)	30,000
Plant (15,000 square feet)	150,000
Office + miscellaneous	10,000
Total	750,000

The iron foundry is designed for local management and operation but as this industry is still new to Sarawak an initial employment of outside technicians will be necessary. The plant should thus start its operation with migrant skilled moulders and a technical manager with an engineering background. The running-in period will take three to four months and only after this will a commercial operation be achieved.

The labour input will be constant irrespective of production. The staffing requirements for a one shift operation is shown in Table 5.2.

TABLE 5.2 STAFF COSTS IN THE IRON FOUNDRY

<i>Direct labour</i>		<i>Total</i>
		<i>(\\$)</i>
Technical manager	1 at \$24,000	24,000
Technicians	2 at \$14,000	28,000
Skilled labourers	10 at \$ 6,000	60,000
Semi-skilled	15 at \$ 4,000	60,000
Unskilled	20 at \$ 3,000	60,000
Maintenance and inspection	2 at \$ 4,000	8,000
Sub-total direct labour	50	240,000
<i>Management</i>		
Technical manager (cf. above)	—	—
Office manager	1 at \$15,000	15,000
Accountant	1 at \$10,000	10,000
Clerks, typist	3 at \$ 3,000	9,000
Sub-total management	5	34,000
Total employment	55	274,000

Other production costs include raw materials, power and maintenance. The requirement for raw materials will depend on the types of production. The following inputs are estimated at full capacity:

TABLE 5.3 INPUT OF RAW MATERIALS AT FULL CAPACITY

<i>TECHNICAL DESCRIPTION AND LOCATIONS</i>	<i>Total</i>
	<i>(\\$)</i>
Pig iron	450 tons at \$285/ton 128,300
Scrap iron	1,350 tons at \$110/ton 148,500
Coke	300 tons at \$450/ton 135,000
Limestone, etc.	30 tons at \$ 20/ton 600
Moulding sand	300 tons at \$ 10/ton 3,000
Other minerals	100 tons at \$250/ton 25,000
Total raw material costs	440,400

Other operating costs are shown in Table 5.4.

TABLE 5.4 OTHER ANNUAL OPERATING COSTS IN AN IRON FOUNDRY AT FULL CAPACITY

	\$
Power	23,600
Maintenance (8 per cent of equipment)	45,000
Insurance (2.5 per cent of plant)	19,000
Total ...	87,600

5.5 ECONOMIC EVALUATION

The feasibility of the iron foundry depends not only on price and cost developments but the composition of the future product lines.

The following average prices have been assumed for the finished products ex foundry:

	<i>\$ per lb.</i>
Soil pipes, floor traps	0.70
Cooking utensils	0.80
Standard orders;	
— general	1.00
— special	2.00

For the economic evaluation price relations are assumed to be constant.

On the basis of these prices and the costs outlined in Section 5.4 the iron foundry shows a rate of return of more than 25 per cent.

