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MIRI - BINTULU REGIONAL PLANNING STUDY

PROJECT PAPER

No. 1

THE DEVELOPMENT OF BEEF PRODUCTION IN
THE MIRI - BINTULU STUDY AREA

SARAWAK 227 AM

227 AM

THE DEVELOPMENT OF BEEF PRODUCTION IN
THE MIRI-BINTULU STUDY AREA

1. Introduction

The Government has already stated its intention of developing a beef production unit in the Fourth Division. The involvement of the Consultants in this project was agreed in the first Steering Committee meeting.

In this paper we outline the aspects which have to be considered and ask the Steering Committee for decisions on certain of these aspects.

The broad aspects covered in this paper are:

- i) Justification for beef production;
- ii) Siting of the first project;
- iii) Type of project;
- iv) Direction and management of the first project;
- v) Timing.

The Steering Committee is asked to set up a task force together with the Consultants to examine the problems in detail.

2. Justification For Beef Production In Sarawak

2.1 Internal demand for beef

The present consumption of beef in Sarawak is estimated at about 1.33 pounds per head per year. The vast majority of the beef is at present imported. The retail price of imported and local beef is high, around \$2.70 per pound although the landed price of imports is only \$1.00 per pound. Assuming a population increase of 2.5 per cent per annum, an income increase of 3 per cent per annum and an income elasticity of demand of 0.5 at the current retail price, the per capita consumption could be about 2.0 pounds per year by 1995 with total consumption by then of 3.5 million pounds or 7,000 to 7,500 cattle slaughtered per year, about three times the 1970 slaughterings.

In West Malaysia where retail prices are lower, averaging \$1.60 per pound, but per capita income is similar to Sarawak the annual consumption is about 4.3 pounds per head. If the retail price in Sarawak was the same as that in West Malaysia, consumption could increase to similar levels. This could mean a total consumption of some 12 to 16 million pounds or about 24,000 cattle slaughtered per year by 1995.

2.2 World demand for beef

FAO indicate that over the next ten years there will be increasing shortages of beef and that in 1980 demand will exceed supply by some 1.7 million tons. This will undoubtedly lead to higher world prices in the future and enable a beef industry based in Sarawak to exploit both domestic and export markets.

2.3 Previous studies

In 1969, an FAO team, studying the potential for livestock development in Malaysia, concluded that no ruminant development programme should be recommended in Sarawak due to the land tenure situation and the preoccupation of the more advanced agricultural population with cash crops. We do not agree; on the contrary, for the following reasons we believe a serious attempt should be made to initiate a beef industry.

- i) The climate and soils in Sarawak are suitable;
- ii) Beef will enjoy increasing prices in the world market;
- iii) The land/labour ratio in Sarawak is favourable;
- iv) The new industry can be planned to fit the land tenure pattern of the country;
- v) The Government of Sarawak is enthusiastic to start a beef industry.

3. Siting Of The First Project

The initial efforts should be made in the Miri-Bintulu Study Area because suitable land is known to be available and because the current planning study can help ensure that all relevant planning factors will be

taken into account.

The requirements of a cattle area are:

- i) An unencumbered area of suitable size;
- ii) Terrain of a gently undulating nature;
- iii) A medium depth of soil with good internal drainage and good water holding characteristics;
- iv) Adequate water supply;
- v) Good access.

Such areas are known to exist in the study area and can be identified in detail during the normal course of the study.

4. Type of Project

4.1 The objectives of the initial project

The early aim of any local cattle development project must be to identify the problems and to find solutions. However, problems only exist in relation to objectives. The first task, therefore, is to define the relevant objectives. In the case of a new venture of this nature, the main objective must be to establish that profitable beef production can take place in Sarawak. The project should be of a modern ranch type and should be organised as a profit making business venture. Subsidiary objectives should also be set.

- i) Training of management and labour;
- ii) Provision of production parameters for future use in planning and extension;
- iii) Development of management techniques for production;
- iv) Development of markets and marketing skills;
- v) Provision of breeding stock for future expansion and breeding research.

With Government involvement, these subsidiary objectives need not unduly interfere with the primary objective of the scheme and adequate

liaison with all interested agencies should ensure a common purpose.

4.2 Direction of the initial project

Government itself should not undertake the specific task of running the project because no government department is designed for business activities. Further, if any particular agricultural service discipline were directing the scheme, it is thought that this would lead to a very natural bias in problem identification and solution, detracting from the profit making objective of the scheme. Thus veterinarians, animal husbandry specialists, agronomists, plant breeders, geneticists, nutritionists and others would all have specialised supporting contributions to make, but should not be in control of the initial scheme.

A quasi government authority such as the Sarawak Land Development Board, or the Sarawak Economic Development Corporation would be ideal bodies to carry out the work. Their main advantages are:-

- i) Fundamentally they are under Government control; an essential requirement to enable Government to have some control of the ultimate pattern of development;
- ii) They are profit-making concerns;
- iii) They already have operating management organisations and procedures for channelling government funds into development projects.

The SLDB has advantages over the SEDC in that it is already operating in the region, and in the area already alienated to it there are parts which are possibly suitable for livestock development.

4.3 Management

At present, no personnel with sufficient qualifications and experience to manage such a scheme are available within Sarawak. It is, therefore, recommended that experienced, practical men are sought from outside the country; a field management team of three persons for three to six years would be suitable. This could probably be achieved through

a technical aid programme.

Many practical field problems that will arise could be solved by an experienced and adaptable management, others will require investigation involving resources beyond the scope of such management. Thus Government specialist agencies will have a major role to play. The scheme management will identify the reality of problems and the relevant agency will then have the task of solving them.

4.4 Build up of cattle numbers

The build up of the project should be based on imported stock. The number of head in the national herd is too low to allow a meaningful rate of increase in general numbers. Added to this, the small size of the animals would necessitate a very long cross-breeding programme to stabilize a desirable type of beef animal.

A quarantine station already exists near Kuching which is capable of handling over 1,000 head of breeding cattle without significantly affecting capacity for screening stock for slaughter.

Initially only one or two breeds should be imported. Discussion is necessary as to the best breeds for initial importation.

4.5 Size and phasing

Detailed work has to be done on this aspect but a ranch of some 5,000 acres would appear to be suitable, preferably sited with land available for later expansion of the scheme. It would be desirable to phase the development over three to four years to allow lessons learned from one year to be applied to the next.

4.6 Extension and expansion

It would probably be wise to curtail expansion into small holdings for at least five to seven years to ensure that proper extension advice is available together with an adequate range of other services. The pattern of expansion to other types of holdings could take several forms.

This aspect must be the subject of considerable thought and the implementation must be carefully planned. But in the meantime, if other investors with capital and experience are willing to start further projects then they should be encouraged to do so.

5. Timing

The speed at which a cattle scheme can become operational will depend on a series of decisions to be taken and an order of necessary events. The outline logistics, including early decision points, are summarised in the attached diagram.

It would be desirable to work out a time-table of operations in order to enable land clearing to begin in December 1972. This would allow ample time to get pasture established before the heavy land rains begin in August and September. If the 1972 start is delayed, it is unlikely that large scale clearing could take place until December 1973.

6. Summary Of Recommendations About Which Decisions Are Required

6.1 A task force should be established immediately.

6.2 The scheme should be at least 5,000 acres, organised as a ranch and orientated towards making profits.

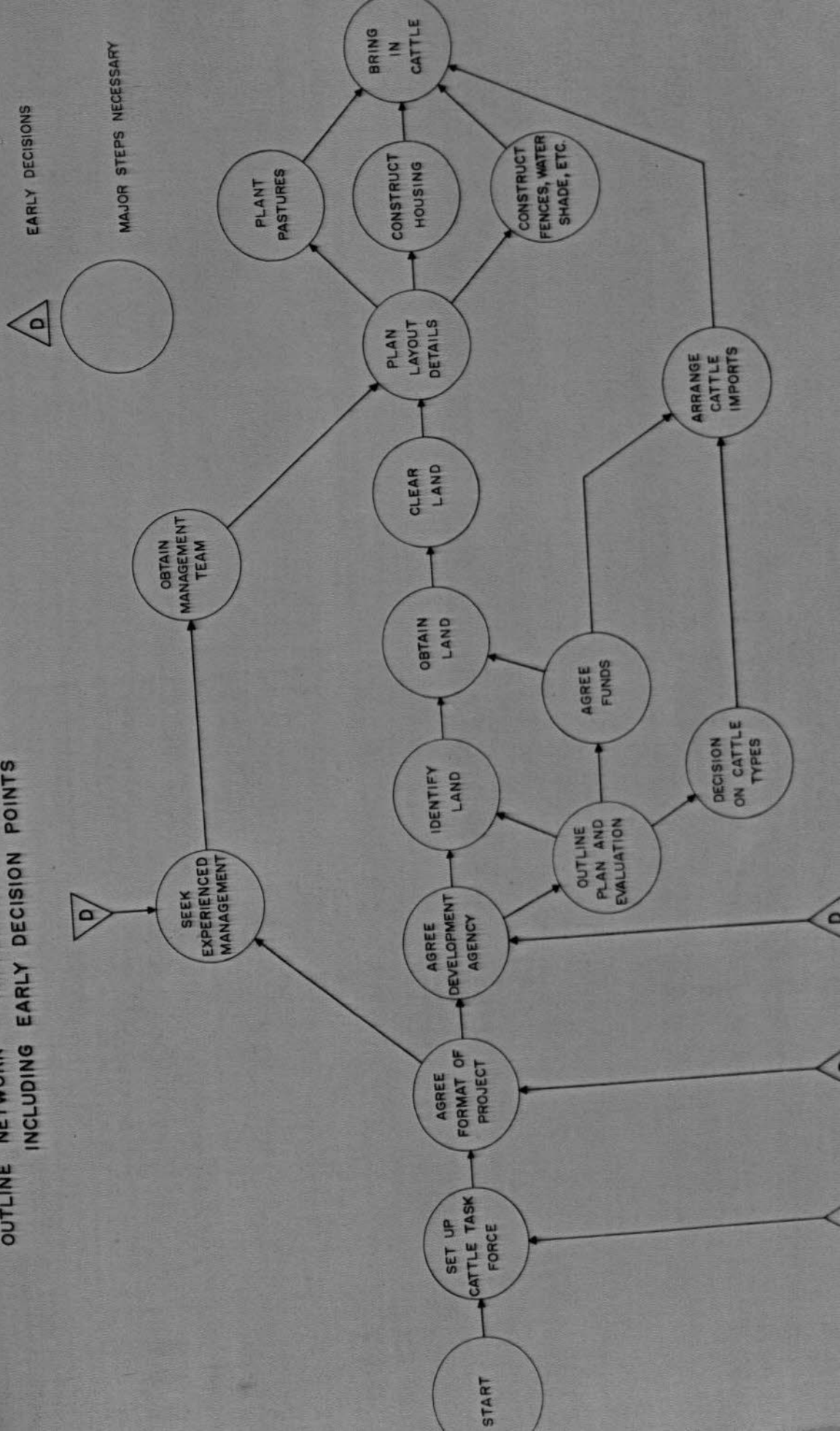
6.3 It should be directed by a strong and capable development agency orientated towards profit making.

6.4 It should be managed by experienced expatriates possibly obtained through a technical assistance programme.

6.5 The aim should be to start land clearing as soon as possible. December 1972 could be a target date.

27.7.72

OUTLINE NETWORK — IMPLEMENTATION OF CATTLE SCHEME
INCLUDING EARLY DECISION POINTS



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PRELIMINARY REPORT ON THE PROSPECTS
FOR BEEF PRODUCTION IN SARAWAK

CONTENTS

	<u>Page Number</u>
1. INTRODUCTION	1
2. MARKET POTENTIAL FOR BEEF	2
3. OBJECTIVES OF AN INITIAL PROJECT	
3.1 Main Objectives	2
3.2 Subsidiary Objectives	2
4. DETAILS OF TECHNICAL ASSUMPTIONS AND COSTING BASIS	
4.1 Development Phasing	3
4.2 Development Procedure and Costs	3
4.3 Operating Costs	4
4.4 Livestock Production Standards and Coefficients	5
5. ECONOMIC AND FINANCIAL ANALYSES	5
6. CONCLUSIONS AND RECOMMENDATIONS	
6.1 General Prospects for Beef Development	8
6.2 Decisions Required For Implementation	9

APPENDICES

APPENDIX I	MARKET PROSPECTS AND PRICES FOR BEEF	
I.1	Internal Market	13
I.2	External Market	16
I.3	Farm Gate Prices for Live Animals	16
APPENDIX II	TECHNICAL ASSUMPTIONS AND COSTING BASIS FOR FINANCIAL AND ECONOMIC CALCULATIONS	
II.1	Size and Phasing of Development	18
II.2	Development Costs	
2.1	Land clearing	18
2.2	Pasture establishment	19

	<u>Page Number</u>
2.3 Fencing	20
2.4 Roads	21
2.5 Shade and handling pens	21
2.6 Machinery and transport	21
2.7 Water	22
2.8 Buildings	22
2.9 Stock purchase	22
II.3 Operating and Recurrent Expenses	
3.1 Pasture maintenance	22
3.2 Fertilisers and herbicides	23
3.3 Veterinary expenses	23
3.4 Labour	23
3.5 Management salaries	23
APPENDIX III LIVESTOCK PLANNING COEFFICIENTS	25
APPENDIX IV LIVESTOCK UNIT EQUIVALENTS	26
APPENDIX V ESTIMATED LIVESTOCK VALUES	
V.1 Selling Prices of Stock	27
V.2 Closing Valuation of Stock	28
APPENDIX VI TYPICAL WORKING EXAMPLE OF PHYSICAL DEVELOPMENT AND HERD RECONCILIATION STATEMENT BASED ON SCHEME II	29
APPENDIX VII TYPICAL FINANCIAL BUDGET AND CASH FLOW STATEMENT BASED ON SCHEME II (THOUSAND \$)	30
APPENDIX VIII REFERENCES	31

TABLES

1. Alternative rates of development and stocking rates for 1 5,000 acre beef scheme following page 3
2. Summary of economic and financial performance for a 5,000 acre beef project in Sarawak with varying development and stocking rates following page 6

I.1	Total beef consumption and consumption per capita 1967-1970 in Sarawak	13
I.2	Projected beef consumption in Sarawak 1975-1995 at current price levels	15
I.3	Projected beef consumption in Sarawak 1975-1995 at lower price levels	15

PRELIMINARY REPORT ON THE PROSPECTS
FOR BEEF PRODUCTION IN SARAWAK

1. INTRODUCTION

The purpose of this report is to present a preliminary analysis of the prospects for commercial beef production in Sarawak. It is submitted as a working paper for consideration by a Task Force set up by the Steering Committee to decide on the next stage of more detailed investigations.

For evaluation purposes a 5,000 acre commercial type unit with varying stocking and development rates has been examined. The reasons for selecting this size of ranch and particular development rates are given in Appendix II. From the study it is possible to gain an appreciation of the economic viability of a hypothetical project and the effect of certain factors on economic performance. Once a firm decision has been taken to proceed with a scheme and an actual site has been selected, detailed studies will be required covering the following aspects:-

- clearing and land preparation methods;
- pasture establishment and control methods;
- pasture yields and quality;
- Stocking rate and animal growth rates;
- roads and fence construction and layouts;
- water supplies;
- marketing and disposal of stock;
- importation and quarantine requirements for animals;
- further development and expansion of the scheme into a beef industry.

The major factors influencing the decision regarding the location of a beef unit are discussed in Section 6.2 (a). For purposes of the financial analyses contained in this paper a location with soils and terrain suitable for pasture development and a satisfactory disposition of other factors has been assumed.

2. MARKET POTENTIAL FOR BEEF

A brief review of the market for beef has been carried out and the prospects for local and export markets appear to be good. A conservative estimate of internal beef requirements (see Appendix I) indicates that the demand for beef should more than treble over the next twenty years and this will create an immediate production target as a substitute for the beef which is currently imported in various forms by locally produced meat.

According to F.A.O. projections of supply and demand, several large beef consuming countries in the Far East are likely to face increasing shortages of meat due to the widening gap on the world market between production and consumption. A Sarawak based industry would be well placed to supply these markets but would have to compete with the traditional suppliers, namely Australia, New Zealand, Thailand and Indonesia. Only a well organised and efficient industry would be competitive with these countries.

3. OBJECTIVES OF AN INITIAL PROJECT

3.1 Main Objectives

In the absence of any previous experience of large scale beef production in Sarawak the main aims of a first scheme would be:-

- a) To identify production problems so that research may be undertaken to solve them;
- b) To establish whether profitable beef production is possible.

3.2 Subsidiary Objectives

Subsidiary objectives could include the following:-

- a) Training of management staff;
- b) Development of markets and marketing systems;
- c) Establishing production parameters for use in planning future developments;
- d) Provision of breeding stock for future expansion of beef production and for animal husbandry research programmes.

4. DETAILS OF TECHNICAL ASSUMPTIONS AND COSTING BASIS

Due to the scarcity of reliable information regarding large scale beef production in Sarawak it has been necessary to draw on information and experience gained elsewhere under similar conditions, particularly from north-eastern Australia, United States of America, South and Central America and the Caribbean islands. Clearly extrapolation of this experience to Sarawak conditions is not entirely satisfactory; several practical problems are posed in this report and there are probably others that will require solution either before or during the implementation of any scheme. Technical details and estimated costs of the assumptions used for this paper are given in Appendix II.

4.1 Development Phasing

Five combinations of three possible land development rates and three pasture stocking rates shown in Table 1 have been chosen for this Study.

Rates of land clearing and development are all well within the rates presently being achieved on schemes in various parts of the country.

Pasture stocking rates are within the range found to be obtainable on grazed pastures in wet tropical regions. Present indications are that these can be achieved in Sarawak with careful attention to selection of pasture species and grazing control.

4.2 Development Procedures and Costs

- (a) Land clearing: clearing of logged jungle is assumed to be carried out by the methods found by the experience of Sarawak Land Development Board (SLDB) at Lambir-Subis Scheme to have been suitable for oil palm development.
- (b) Pasture establishment: conventional methods involving cultivation may not be practical in Sarawak. For this report a combination of broadcasting grass and legume seeds into ash after burning the felled jungle and establishment from cuttings has been assumed.
- (c) Fencing: sub-division of the pasture area into camps is essential for effective grazing control and pasture maintenance. Internal and perimeter fences would be constructed of local

materials as far as possible. Fencing is assumed to proceed at the same rate as pasture establishment.

- (d) Roads: good access to the scheme is essential for transport in and out of materials and animals. An internal road system is necessary for management purposes but need not be constructed to very high standards.
- (e) Shade and handling pens: the land clearing methods assumed would eliminate all trees in the area so that artificial shade structures would be necessary until trees had been re-established. The structures would be constructed of local materials. Handling pens would be necessary at two complexes for regular inspection and necessary treatment of stock.
- (f) Machinery and transport: provision is made for essential vehicles and the usual basic farm equipment required for ranching operations.
- (g) Water: every paddock should have an adequate supply of good drinking water. Under tropical conditions animals may be expected to consume up to 10 gallons per day and should not have to walk more than a mile to water. A piped supply from a local source is provided for.
- (h) Buildings: basic housing and office accommodation costs are provided for and would be constructed by local contractors.
- (i) Livestock purchase: it is assumed that all breeding stock, (in-calf heifers and bulls), required to build up the herd to match the carrying capacity of pastures would be imported. The need to import breeding stock and the type of stock required are discussed in Section 6.2 (d).

4.3 Operating Expenses

Provision is made for maintenance of all capital items at an appropriate rate based on a percentage of initial outlay. Recurrent costs are provided for according to the stock numbers on the scheme or the specific items required.

- (a) Pasture maintenance: renovation of pastures may be necessary after several years of intensive grazing. Provision is made

for 10 per cent of the area to be renovated annually.

- (b) Fertilisers and chemicals: provision is made for annual applications of nutrients and herbicides for maintaining pasture productivity at optimum levels. Costs are related to stocking rate and hence herbage removal.
- (c) Veterinary expenses: provision is made for veterinary requisites for maintaining health and control of parasites.
- (d) Labour: provision is made for labourers, drivers and mechanics at current wage rates in Sarawak.
- (e) Management salaries: costs of managerial staff are estimated at rates which would be required to attract suitably qualified and experienced expatriates. The initial need for expatriate management is explained in Section 6.2 (c).

4.4 Livestock Production Standards and Coefficients

Herd build-up rates are matched to land development and carrying capacity of pastures. During the build-up period of each scheme it is assumed that over and above the female stock born and retained on the farm more breeding stock would be imported to make up the number required for the particular build-up rate.

In order to calculate how many new animals need to be bought the coefficients shown in Appendix III and the assumptions on livestock equivalents given in Appendix IV were used. The number of animals for sale each year were calculated using these parameters. Stock sales include culled cows and bulls as well as heifers and steers reared specifically for sale.

A typical statement of acreages and stock numbers is given in Appendix VI.

5. ECONOMIC AND FINANCIAL ANALYSES

Six alternative schemes have been examined for economic evaluation purposes. Revenue estimates have been compiled on the basis of estimated animal weights and prices shown in Appendix V.

Schemes I to V have been based on the development and stocking rates shown in Table 1. Sales of animals are assumed to be direct from the ranch to market at approximately 24 months and include all animals surplus to the replacement requirements of the ranch. Scheme VI, which assumes the medium rates of development and stocking, has been examined to show the effect of selling, at approximately 6 months, weaner steers for fattening and heifers for breeding or fattening. This change in selling policy was assumed to start after development year 8.

For each situation the following calculations have been made as a basis for assessing economic and financial viability:-

- i) Annual Net Cash Flow;
- ii) Cumulative Net Cash Flow;
- iii) Net Present Value (N.P.V.) of cash flows at 10 per cent;
- iv) Internal Rate of Return.

Sensitivity of the schemes to cost of breeding stock and the sale price of animals have been examined on the following basis:-

- I. Cost of breeding stock reduced by 50 per cent as might happen if similar schemes were started using breeding stock from the first scheme;
- II. Sales prices of animals increased by 20 per cent. This is considered a conservative possibility considering the apparent high profit margin in the existing meat retail trade (see Appendix I).

A typical example of the analysis calculations, which were similar for all six schemes, is shown in Appendix VII. The results of the analyses are presented in Table 2.

From Table 2 the following observations may be made regarding the economic and financial performance of potential beef production schemes in Sarawak:-

- (a) Rate of development and stocking rate both have an effect on economic and financial performance under local conditions. The most economic schemes are likely to be those based on a medium rate of herd build-up and a moderate pasture stocking rate. Under these conditions an internal rate of return of

Table 2. Summary of economic and financial performance for a 5,000 acre beef project in Sarawak with varying development and stocking rates

	Unit	Alternative Schemes (see Table 1)					
		I	II	III	IV	V	VI
I. Financial analysis							
Peak Cumulative cash flow deficit	\$'000	5,899	6,696	10,186	9,531	8,757	6,695
Break-even point	Year	22	18	20	19	19	19
Annual operating cost at maturity	\$'000	447	595	595	595	600	610
Annual output value at maturity	\$'000	934	1,400	1,396	1,404	1,397	1,440
Number saleable animals produced at maturity	head	1,884	2,825	2,819	2,832	2,852	3,905
II. Economic analysis							
N.P.V @ 10%	\$'000	-5,127	-2,287	-7,703	-5,924	-3,044	-3,754
I.R.R.	%	3	6	4	5	5	5
III. Sensitivity analysis							
Lower cost breeding stock							
N.P.V. @ 10%	\$'000	-1,290	+89	-2,115	+148	-168	-891
I.R.R.	%	6	10	7	10	10	8
Lower cost breeding stock + Increased selling price							
N.P.V. @ 10%	\$'000	-576	+1,050	+339	+1,187	+1,311	+249
I.R.R.	%	8	13	11	13	13	11

between 5 and 6 per cent may be achieved.

- (b) The cumulative cash deficit of the most favourable of the alternatives (Scheme II) would reach a peak of \$6.7 million in year 6 and then gradually diminish until a positive balance was reached in year 18. Even in this scheme the annual cash deficit for the first eight years of operation is up to \$2.6 million in any one year. This early deficit is common to all the alternatives and is due to the high initial capital costs for stock purchases and land clearing. With Scheme II a cash surplus position would be achieved by year 8 and should rise to a regular \$800,000 per annum under normal operating conditions.
- (c) The returns to all the schemes are highly sensitive to the costs of breeding stock and the selling price of animals. A 50 per cent decrease in the purchase price of breeding stock would produce a 66 per cent improvement in the internal rate of return and a positive N.P.V. in the Schemes II and IV situations. If the selling price of animals is, at the same time, increased by 20 per cent the internal rate of return for all schemes reach levels acceptable for investment.
- (d) Under the assumptions examined for the sensitivity analysis there is a re-ordering of the schemes in terms of economic viability thus:-
- under the lower cost breeding stock assumption, Scheme IV, is marginally better than Scheme II;
 - with an increased selling price assumption added to lower cost stock, Scheme V, presents the best economic returns although only marginally better than Schemes IV and II in that order.
- (e) Scheme VI does not perform any better than Scheme II in economic terms because of the direct increased cost of purchasing a larger herd of breeding cows during the development phase of the project and the higher costs of holding a greater number of animals on the scheme at any one time.

6. CONCLUSIONS AND RECOMMENDATIONS

Beef production in Sarawak is an economic proposition provided an appropriate development rate is selected and breeding stock are available at reasonable cost. The most suitable build-up rate examined was the one giving a 26 per cent compound increase per annum. In national terms a herd of 75,800 animals could result in twenty years, starting from this base.

6.1 General Prospects For Beef Development

The F.A.O. team which studied the potential for livestock production in Malaysia during 1969 concluded that no ruminant development programme should be pursued in Sarawak due to the land tenure situation and the preoccupation of the more advanced agricultural population with cash crops. However, studying the problem in terms of the national development situation and having regard to the resource base situation in Sarawak, there would appear to be several reasons, given below, why livestock development should be initiated:-

- i) Environmental conditions in Sarawak are favourable for livestock and no serious animal diseases occur in the country;
- ii) There is an increasing local market for beef which will otherwise have to be met by increasing imports on a market with rising prices;
- iii) The world market for the foreseeable future will be under supplied and this presents an opportune time to establish an export orientated industry in Sarawak;
- iv) Livestock breeding schemes could be developed on areas of land which are considered marginal for other crops while growing out and fattening might be introduced in coconut and rubber areas on pasturage established as an intercrop. In these areas, and in the country as a whole, the land-labour ratio is high which is favourable for livestock development.

6.2 Decisions Required For Implementation

A start could be made on a scheme during 1973 provided a series of co-ordinated decisions and actions are taken. The immediate decisions and investigations which should be completed before the end of 1972 are the following

- (a) Site selection: for the first project there are several available sites from which to choose. Selection must take into account the following factors:-
- i) Land suitability: high quality agricultural land is relatively scarce in Sarawak and the low profitability, and low employment opportunity offered by an initial beef enterprise makes it desirable that the first and any other breeding schemes should be located on land which is not suitable for more profitable or intensive types of agriculture. Nevertheless sites chosen should be in compact blocks and have soils capable of sustained pasture production. Soil surveys will be required of any selected areas.
 - ii) Land tenure: the economics of beef production under the conditions studied here are such that there should be no cost to the scheme of acquiring the land it occupies. Two aspects should be considered for an initial ranch type scheme:-
 - a. Unencumbered land should be available in a single block;
 - b. Suitable land should be available in the vicinity for future expansion using the initial scheme as a "nucleus".
 - iii) Access: it is essential that access to the scheme should be good, not only for management purposes but particularly for moving livestock and materials in and animals destined for market out;
 - iv) Water supplies: assured supplies of good quality drinking water should be available from rivers, streams or dams located within the farm itself;

- v) **Markets and marketing facilities:** transporting live animals over long distances can be done but is undesirable and should be avoided if possible. The initial project should preferably be reasonably accessible to the internal market it is intended to supply.
 - vi) **Quarantine facilities:** a suitable quarantine station for imported breeding stock should be close at hand.
- (b) **Responsible authority:** the authority to be responsible for the scheme and the agency through which it would operate should be agreed by Government. This body should co-ordinate the next stages in the planning and implementation of the scheme.

Any scheme established now could become the foundation of a future beef industry, and it is proper that Government should be involved and indeed guide the direction and form of the industry's development. However, it is not considered that a Government Department is the appropriate agency for operating the initial scheme, which must be run on a commercial basis. It is recommended that the Livestock Industry Development Board which was recently established under Act 73 of 1972 should be responsible for development of the project, either directly or through an associated organisation. The final choice of the operating agency should take the following factors into account:-

- i) The organisation concerned should have a suitable management structure and be "operational" in the area chosen for the scheme;
- ii) For rapid implementation an organisation with the necessary resources to clear and develop land is required.

While Government specialists would not be directly involved in project operation, they should have a definite supporting function in helping to solve technical problems identified by scheme management. Thus veterinary and disease problems should be passed to the Veterinary Division while pasture production problems would be dealt with by the Agricultural Research Division.

- (c) Management staff: the successful operation of the initial scheme will call for high calibre professional management. Staff with the necessary specialist experience are not available in Sarawak, and will have to be recruited on contract from outside the country. Practical expertise and experience in the management of tropical pastures as well as of the requirements of the cattle themselves will be needed, and the recruitment of a small top level management team may be called for. In addition to running the scheme this team would have the very important task of training locally recruited staff to fit them for subsequent management.

Owing to the absence of commercial beef herds in Sarawak there are also virtually no sub-management level staff with knowledge and skills of day to day routine operations and handling of animals. These practical skills will have to be acquired and in the early years it may be essential to recruit a few skilled stockmen from reputable commercial herds outside the country.

The possibility of obtaining these specialist management and sub-management staff from external Technical Aid sources could be explored by the management authority.

- (d) Breeding stock: successful beef production requires an animal capable of utilising available feeds efficiently and producing meat which is acceptable on the market. The selected breed should be:-

- adapted to wet tropical climate;
- capable of foraging under rigorous pasture conditions;
- a beef type animal with a good frame, suitable for crossbreeding;
- available in sufficient numbers to allow a meaningful rate of herd build-up.

The local breed of animal is generally not a suitable "beef-type" as it is too small and has a poor "frame". Furthermore, the national herd is too small to allow the selection of animals for large scale development. Imported stock should,

therefore, form the basis of the new scheme. The actual breeds to be used will require further discussion, but Zebu type animals are most likely to be suitable and available. Sources of stock have also to be investigated. Australia and the American Continent are likely to be the chief sources of animals in sufficient numbers.

- (e) Development plan and feasibility report: these should be prepared in detail for the site chosen for the scheme and cover the following aspects:-
- i) Methods of land clearing, pasture establishment and pasture management.
 - ii) Type of animal required and possible sources as well as the quarantine arrangements for their reception on arrival.
 - iii) Staff requirements and job descriptions for the various members of the management and sub-management team.
 - iv) Veterinary and other research facilities required to support the scheme.
 - v) Marketing facilities for animals produced by the scheme including the development of abattoirs, and facilities to supply local and export markets.
 - vi) Methods for the further development of the beef industry in Sarawak starting from an initial nucleus ranch.
 - vii) The need to control imports of animals and meat (of all types) for veterinary and economic reasons.

APPENDICES

Appendix A

The first appendix contains a list of all the names of the persons who were present at the meeting held on the 15th day of June, 1900, at the residence of Mr. J. H. [Name] in the city of [City]. The names are listed in alphabetical order, and each name is followed by the name of the person to whom it was assigned. The list is as follows:

APPENDICES

The second appendix contains a list of all the names of the persons who were present at the meeting held on the 15th day of June, 1900, at the residence of Mr. J. H. [Name] in the city of [City]. The names are listed in alphabetical order, and each name is followed by the name of the person to whom it was assigned. The list is as follows:

Table 1. Total land area in [State] in 1900.

Year	Total land area in [State]		Total land area in [State]	Total land area in [State]
	Acres	Sq. Miles		
1900	1,000,000	15,625	1,000,000	15,625
1901	1,000,000	15,625	1,000,000	15,625
1902	1,000,000	15,625	1,000,000	15,625
1903	1,000,000	15,625	1,000,000	15,625

The third appendix contains a list of all the names of the persons who were present at the meeting held on the 15th day of June, 1900, at the residence of Mr. J. H. [Name] in the city of [City]. The names are listed in alphabetical order, and each name is followed by the name of the person to whom it was assigned. The list is as follows:

APPENDIX I
MARKET PROSPECTS AND PRICES FOR BEEF

I.1 Internal Market

Sarawak is currently importing about \$1.3 million 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 limited data are available on animals slaughtered for domestic consumption. Few cattle and buffaloes slaughtered outside the main slaughter houses are recorded, but these are considered to be relatively insignificant. All races in Sarawak are potential beef consumers and so for the purposes of this note, global estimates are assumed.

The actual slaughter weight of domestically killed animals is not known but observation and experience suggest that cattle will be slaughtered at 300 pounds deadweight and buffaloes at 400 pounds deadweight. Using these assumptions and the slaughter house data available, Table I.1 shows the estimate of total beef consumed in Sarawak.

Table I.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 slaughter Cattle	Buffaloes	
1967	393.1	333.9	559.2	1,286.2
1968	335.7	409.2	426.4	1,171.3
1969	338.9	334.5	488.0	1,211.4
1970	540.3	357.9	424.4	1,322.6

Thus the average consumption over the period 1967-1970 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 West 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 4 pounds per year at the same per capita income level as in Sarawak.

In making projections of the demand for beef, the following assumptions are made:-

- a) The population will grow at an average 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.

There seems to be no reason to suppose that given West Malaysia prices for beef, consumption should not rise to West Malaysian levels. These appear to be three times higher than the Sarawak level.

Various estimates for income elasticity of demand for meat and beef have been made. F.A.O. estimates 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, the estimate for all meats was lowered to 0.9. Purvis, estimating in Malaya for 1957/58 data suggested a value of 1.26 for all meats. Thus a value in the range 1.0-1.4 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 countrywide consumption of beef would then be 3.5 million pounds compared to the current 1.6 million 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 I.2.

Table I.2 Projected Beef Consumption in Sarawak 1975-1995
at Current Price Levels

Year	Beef consumption		Equivalent No. carcasses @ 500 lbs. each	Total animals required*
	Per capita lbs.	Total 1,000 lbs.		
1975	1.43	1,567.0	3,134	15,700
1980	1.54	1,910.0	3,820	19,000
1985	1.66	2,329.0	4,658	23,200
1990	1.79	2,843.0	5,686	28,400
1995	1.93	3,466.0	6,932	34,600

Note - * Total number of animals required in a herd to produce the number of slaughter animals shown.

The possible effect of an increase in beef supplies would be a decrease in retail prices which, if brought to the levels prevailing in West Malaysia of \$1.60 per pound, would increase consumption to an estimated 4.3 pounds per capita. Projections based on these assumptions are shown in Table I.3. By 1995 per capita consumption might be 9.0 pounds and the total quantity of meat demanded would be 16.1 million pounds, equivalent to 32,000 carcasses per annum.

Table I.3 Projected Beef Consumption in Sarawak 1975-1995
at Lower Price Levels

Year	Beef consumption		Equivalent No. carcasses @ 500 lbs. each	Total animals required*
	Per capita lbs.	Total 1,000 lbs.		
1975	5.0	5,480.0	10,960	50,500
1980	5.8	7,192.0	14,384	71,900
1985	6.7	9,400.0	18,800	94,000
1990	7.8	12,386.0	29,770	120,400
1995	9.0	16,164.0	32,330	166,600

Note - * Total number of animals required in a herd to produce the number of slaughter animals shown.

I.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 million 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.

I.3 Farm Gate Prices for Live Animals

For purposes of this study the following farm gate prices have been estimated for animals sold from the scheme:-

Gull cows - 40 cents per pound liveweight

Steers - 50 cents per pound liveweight
 Breeding heifers - \$1.00 decreasing to 80 cents per pound
 liveweight

The consumer prices derived from these farm gate prices depend largely on the retailing margins accepted by butchers. At current consumer prices these are estimated as follows:-

	<u>Cull cows</u>		<u>Steers</u>	
Liveweight pounds	850	1,000	700	900
Killing-out percentage	50	55	50	55
Carcass weight pounds	425	550	350	500
Farm gate price per pound liveweight	\$0.40	\$0.40	\$0.50	\$0.50
Farm gate value of animal	\$340	\$400	\$350	\$450
Transport, handling and slaughter costs	\$85	\$100	\$70	\$85
Estimated cost of animal to butcher	\$425	\$500	\$420	\$535
Retail value of carcass at current prices*	\$714	\$924	\$637	\$910
Retail margin at current prices	\$289	\$424	\$217	\$375

* See Section I.1

From the above there would appear to be a clear case for either decreasing retailers margins or increasing producer prices. If the latter course were followed a 20 per cent farm gate price increase would reduce retail margins by \$70 to \$80 per carcass. There would then still appear to be scope for controlling retailer margins which would result in lower consumer prices.

APPENDIX II
TECHNICAL ASSUMPTIONS AND COSTING
BASIS FOR FINANCIAL AND ECONOMIC CALCULATIONS

II.1 Size and Phasing of Development

Economic and technical factors are the main determinants of the size and rate of development of the scheme. The economic factors are:-

- a) That the scheme should match the minimum management unit required for successful operation. Experience elsewhere indicates that for the proposed management structure a herd with at least 3,000 breeding cows would be required;
- b) That the local market should be able to absorb all or most of the saleable animals produced. Between 2,500 and 3,000 animals could easily be sold by 1985.

Technical considerations are:-

- a) The availability of breeding stock;
- b) The rate at which land could be developed;
- c) The carrying capacity of locally grown pastures.

The following are considered to be maxima for planning purposes:-

Breeding animals imported	- 2,000 per annum
Land clearing	- 2,000 acres per annum
Carrying capacity of pastures	- 1.5 L.S.U.s per acre.

II.2 Development Costs

2.1 Land clearing: land clearing costs will be related to the method of pasture establishment and the extent to which destumping is necessary. Some experience of clearing has been gained by SLDB on the Lambir-Subis Development Scheme where large scale oil palm development is being undertaken. The cost estimates used by SLDB have been adopted in this report, that is \$183 per acre. A number of factors may have a bearing on the actual cost of this operation in a specific scheme.

- i) The type of jungle being cleared, particularly whether it is undisturbed or secondary growth. There may be some

- scope for setting off the cost of clearing against the value of the timber extracted in the former situation;
- ii) The method of clearing employed, here there is a choice between: manual felling and stacking; manual felling with mechanical stackings; or mechanical clearing and stacking.

The current SLDB practice is based on manual felling and mechanised stacking. This is the first time in Sarawak when large areas have had to be developed in a relatively short time and improvement in performance is possible.

For the purposes of this report clearing costs are based on the current SLDB cost of semi-mechanised clearing without destumping. The cost is \$183 per acre. Consideration will have to be given later as to whether destumping is necessary for good pasture management.

The pasture development might be phased over four to eight years but land clearing would need to be completed by the third or seventh years and would be phased according to the rate of development as follows:-

Year	<u>Acres cleared per year</u> <u>at different rates of development</u>		
	Slow	Medium	Fast
1	500	1,000	2,000
2	500	2,000	2,000
3	500	1,000	1,000
4	1,000	1,000	-
5	1,000	-	-
6	1,000	-	-
7	500	-	-

2.2 Pasture establishment: one of the main constraints to pasture establishment in Sarawak is that mechanical seed-bed preparation will be minimal on the hilly terrain found in most areas. Steep slopes and the erodibility of soils make mechanical operations difficult and hazardous.

It is apparent that "full cultivation" as employed in similar climatic conditions in Australia will have to be dispensed with

and other means of pasture establishment investigated including the following:-

- i) aerial seeding into ash after burning;
- ii) planting cuttings or seed into manually or mechanically drawn traces;
- iii) "sod seeding" of grasses into areas of established leguminous cover crops.

Experimental pasture work at Semongok has so far shown that a mixture of Pangola grass (Digitaria decumbens) and stylo (Stylosanthes guyanensis) or Centrosema spp gives the best results under local conditions. The latter legume is also widely used as a cover crop in the Lambir-Subis oil palm scheme and is relatively easily established from seed. However, its performance under grazed conditions has not been assessed. Pangola grass can only be propagated by cuttings and may be difficult to establish over large areas without full cultivation. In addition large areas of "nursery" would need to be established.

Costs of alternative methods are estimated as follows:-

Establishment from cuttings	\$140 per acre
Sod-seeding in oil palm cover crops	\$65 per acre

For the purposes of this study pasture establishment by a combination of vegetative and seeded methods of a grass/legume mixture is assumed to cost \$100 per acre. This cost is considered to be reasonable because it is comparable to estimates for establishment following full cultivation.

2.3 Fencing: the topography of the area will have an important bearing on the layout used and the fencing requirements will be specific to the area selected for development. For costing in the present exercise the following basis was used:-

- i) Division of the area into 400 acre paddocks;
- ii) Four strand internal fences (25 miles) and five strand perimeter fence (15 miles) at an average cost of \$1,000 per mile;
- iii) Maintenance at 10 per cent of initial cost;
- iv) Fencing to be erected in the year following pasture establishment.

2.4 Roads: provision of \$15,400 has been made. At about \$3 per acre, this is in line with estimates made for a similar type of scheme in Sabah. Annual upkeep is estimated at 10 per cent of initial cost.

2.5 Shade and handling pens: fifteen shelter structures constructed of local materials and are estimated to cost \$1,000 each.

Handling pens and facilities needed include stockyards, crush pens, sprays or dips, weighing scales and loading ramps. Two complexes costing \$20,000 each are provided for.

2.6 Machinery and transport: while it is doubtful if cultivation will be possible for budgeting purposes, provision is made for a basic complement of tractors, land preparation equipment and machines required for pasture maintenance. Essential vehicles for management and livestock transportation are also included.

Details of the equipment on which the estimates are based are as follows:-

<u>Number/type</u>	<u>Estimated cost</u>
	\$
2 Tractors and trailers	28,000
2 Rotary cutters	5,000
1 Grader (blade)	5,000
1 Fertiliser distributor - spinner type	5,000
1 Disc harrow	3,000
1 Slasher - heavy blade type	5,000
	<u> </u>
Sub-total tractors and equipment	\$50,000
2 Land rovers	30,000
1 Lorry	20,000
1 Cattle transporter	35,000
Sub-total vehicles	<u>\$85,000</u>
Total	<u>\$135,000</u> =====

Maintenance and repairs are calculated at 10 per cent per annum and fuel at \$3,000 per annum.

2.7 Water: actual costs will be specific to the area selected for the scheme and will depend on whether a reliable source of suitable quality is available in the vicinity. For estimating purposes the following costs were allowed:-

- i) Water tanks and drinking troughs at \$3,000 each; serving three paddocks on average \$12,000
- ii) Piping for delivery from source, at \$4 per acre \$20,000
- iii) Supply cost of water based on 30 cents per 1,000 gallons or \$0.70 per animal per annum.

2.8 Buildings: provision of buildings constructed of timber to local standards are allowed on the following basis:-

- office, store shed, tractor shed totalling \$12,000
 - three management houses at \$15,000 each; sixteen labour units at \$2,500 each totalling \$85,000
 - electricity generator set and wiring \$25,000
- Maintenance and repairs allowed at 3 per cent of initial cost.

2.9 Stock purchase: it will be desirable to build-up herd numbers fairly rapidly and to use animals of a suitable genetic type. This means importation of breeding stock. Possible sources are Australia, United States of America, Central and South America and the Caribbean.

Costs are based on the following estimates:-

Cows	\$1,600 each
Bulls	\$3,000 each

II.3 Operating and Recurrent Expenses

3.1 Pasture maintenance: experience elsewhere indicates that even with careful stocking and grazing control pastures should require renovation after eight to twelve years. This operation would include basic fertilising, reseeding and clearing of weeds etc., and is estimated to cost \$80 per acre. It is assumed for costing purposes

336 lb / a.
 336 h / r.
 60. h / -

that 10 per cent of the pasture would require renovation each year from year 6.

3.2 Fertilisers and herbicides: annual applications of chemicals and fertilisers will be required to maintain the productivity of the sward. Herbicides will be required occasionally to treat spot infestations of various weeds; costs are estimated at \$2 per acre per annum.

Fertiliser requirements will depend on several factors principally stocking rate and herbage removal, thus costs will probably increase with stocking rate. In this report applications of a N.P.K. mixture costing \$320 per ton is envisaged at the following rates per annum:-

Stocking rate L.S.U./acre	Quantity Cwt/acre	Cost \$/acre
0.75	2.0	32
1.0	3.0	48
1.5	4.0	64

3.3 Veterinary expenses: the costs of medicines, vaccines and chemicals for dips and sprays are estimated at \$3 per head per year although under actual conditions the costs could vary considerably. There appear to be no diseases occurring locally which cannot be readily controlled and the introduction of new diseases should be guarded against by strict quarantine control.

3.4 Labour: the basic labour requirement is estimated at one man to 300 L.S.U.'s at an average wage of \$1,300 per annum. In addition one stockman to 1,500 L.S.U.'s at a wage of \$2,000 per annum is provided for.

3.5 Management salaries: for effective management the project should have a senior staff complement of perhaps three suitably qualified and experienced, practical men. The type of person required will have to be recruited initially from outside the country and salaries

assumed here are pitched accordingly.

The general manager might have two assistants responsible for _ livestock and pastures respectively. Costs are estimated as follows:-

General manager	\$50,000 per annum
Assistant managers	\$30,000 per annum (each)
Total cost	<u>\$110,000</u> =====

In addition the following junior staff are included under the management cost item:-

1 clerk/accountant	\$8,400 per annum
3 drivers	\$2,000 per annum (each)
1 mechanic	\$2,000 per annum
2 drivers assistants	\$1,300 per annum (each)
Total cost	<u>\$19,000 per annum</u> =====

APPENDIX III

LIVESTOCK PLANNING COEFFICIENTS

- a) Calving percentage 75 per cent rising to 85 per cent
in year 8;
- b) Pre-weaning mortality of calves.. 7 per cent decreasing to 6 per cent
in year 8;
- c) Mortality of growing stock 2 per cent per year;
- d) Mortality of breeding cows 4 per cent in year 2,
3 per cent in year 3,
2 per cent year 4 and after;
- e) Culling of breeding cows 10 per cent while building up herd
to year 15;
15 per cent from year 15;
- f) Steers sold 21 to 27 months, average 24 months;
- g) Heifers calve down 24 to 36 months, average 30 months;
- h) Breeding - 1 bull to 40 breeding cows.

APPENDIX IV

LIVESTOCK UNIT EQUIVALENTS

For planning purposes it is desirable to simplify calculations by enumerating the different classes of cattle on a standard basis, known as the Livestock Unit (LSU). A LSU value of unity represents an adult breeding cow of about 900 pounds liveweight. The following values have been assumed in this paper:-

<u>Class of stock</u>	<u>L.S.U.</u>
a) Breeding cow and steer	1.0
b) Male and female calf 0-6 months	0.1
c) Steer and heifer 6-18 months	0.5
d) Steer and heifer 18-30 months	0.8
e) Bull	1.3

The values may be subject to refinement in the later stages of planning and again after some data have been obtained in practice with regard to the productivity of pastures and the rates of growth achieved by the various classes of stock. For preliminary planning the above values are accurate enough.

APPENDIX V

ESTIMATED LIVESTOCK VALUES

V.1 Selling Prices of Stock

	Years of Scheme		
	1 - 5	6 - 10	11 - 20
<u>Culled cows</u>			
Liveweight	850 lbs.	950 lbs.	1,000 lbs.
Killing-out percentage	50%	52%	55%
Carcass weight	425 lbs.	490 lbs.	550 lbs.
Price per pound liveweight	\$0.40	\$0.40	\$0.40
Price per animal	\$340	\$380	\$400
<u>Steers</u>			
Liveweight	700 lbs.	800 lbs.	900 lbs.
Killing-out percentage	50%	52%	55%
Carcass weight	350 lbs.	420 lbs.	500 lbs.
Price per pound liveweight	\$0.50	\$0.50	\$0.50
Price per animal	\$350	\$400	\$450
<u>Heifers for breeding</u>			
Liveweight	700 lbs.	750 lbs.	800 lbs.
Price per pound liveweight	\$1.00	\$1.00	\$0.80
Price per animal	\$700	\$750	\$640
<u>Weaned calves</u>			
Liveweight	325 lbs.	350 lbs.	375 lbs.
Price per pound liveweight	\$0.55	\$0.55	\$0.55
Price per animal	\$180	\$195	\$210

V.2 Closing Valuation of Stock

Bulls	\$2,000 each
Breeding cows end of year	\$800 each
Calfs 0-6 months	\$75 each
Males 6-18 months	\$200 each
Heifers 6-18 months	\$250 each
Heifers 18-30 months	\$500 each

The above somewhat generalised assumptions are adequate for first stage planning; local knowledge is at present insufficient to justify more refined estimates. The parameters are considered to be conservative, and later adjustments can be expected to be in the direction of improving profitability.

TYPICAL WORKING EXAMPLE OF PHYSICAL DEVELOPMENT AND HERD RECONCILIATION STATEMENT BASED ON SCHEME II

APPENDIX VI

YEARS

ITEM	UNIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Land cleared	acres	1000	2000	1000	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pasture established	acres	1000	1000	3000	4000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Stocking rate	LSU/acre	0.75	0.75	0.75	0.75	1.2	1.2	1.2	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
1 x 2 = LU = D + B + other																					
<u>Herd Numbers</u>																					
Breeding cows beginning year	head	A	750	1848*	1913	2072	2448	2848	3258	3025	2890	3800	4215	3610	3592	3910	3814	3682	3775	3815	3752
Calves 0-6 months	head	B	524	1294*	1434	1554	1958	2278	2606	2420	2312	3040	3392	2888	2874	3128	3052	2946	3020	3052	3000
Steers 6-18 months	head			257*	634	703	761	959	1116	1277	1186	1133	1490	1652	1415	1408	1533	1495	1443	1480	1495
Steers 18-30 months	head				252	621	689	746	940	1094	1251	1162	1110	1460	1619	1387	1380	1502	1465	1414	1450
Heifers 6-18 months	head	X			257*	634	703	761	959	1116	1277	1186	1133	1490	1652	1415	1408	1533	1495	1443	1480
Heifers 18-30 months	head	Z			252	621	689	746	940	1094	1251	1162	1110	1460	1619	1387	1380	1502	1465	1414	1450
Bulls	head	C	18	46*	47	51	61	71	81	80	95	95	95	95	95	95	95	95	95	95	95
Total animals in herd	head		1292	3702	5166	6325	7367	8607	10057	10267	10156	11525	12882	12817	12629	12723	12787	12717	12706	12750	12737
Breeding cows year end	head	D	648	1613	1670	1827	2159	2512	2874	2668	2549	3332	3717	3184	3168	3257	3178	3067	3145	3179	3126
<u>Sales</u>																					
Cull	head	E	72	179	185	203	240	279	319	296	283	372	413	354	352	575	560	541	555	560	551
Steers 24 months	head			252	621	689	746	940	1094	1251	1162	1162	1110	1460	1619	1387	1380	1502	1465	1414	1450
Heifers 24 months	head								789	872		299	1217	1052	877	830	876	794	795	841	824
Total sales	head		72	179	437	824	929	1025	2048	2462	1534	1833	2740	2866	2848	2792	2816	2837	2815	2815	2825
<u>Purchased breeding stock</u>																					
Cows	head	F	750	1200	300	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	head	G	18	28	1	4	10	10	10	10	14	14	14	14	14	14	14	14	14	14	14
<u>Mortality</u>																					
Breeding cows	head	H	30	56	58	32	49	57	65	61	58	76	85	72	72	78	76	74	75	76	75
Steers 6-18 months	head		5	13	14	16	16	20	23	26	24	23	30	34	29	29	31	31	30	30	31
Heifers 6-18 months	head	I	5	13	14	16	16	20	23	26	24	23	30	34	29	29	31	31	30	30	31
Steers 18-30 months	head	J		5	13	14	15	19	19	23	26	24	23	30	33	28	28	31	30	29	30
Heifers 18-30 months	head		5	13	14	15	15	19	19	23	26	24	23	30	33	28	28	31	30	29	30
Total deaths	head		30	66	94	86	109	127	149	159	158	170	191	200	196	192	194	198	195	194	197
Waning percentage	%		70	70	75	75	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80

TYPICAL FINANCIAL BUDGET AND CASH FLOW STATEMENT BASED ON SCHEME II (THOUSAND \$)

APPENDIX VII

YEARS	COSTS													CASH INCOME	NET CASH FLOW (NCF)							
	Land clearing	Fast-ure Establisment	Fast-ure Maintenance	Fert. and chemicals	Stock purchase	Fencing	Rds.	Machinery and Transport	Vet. exp.	Shade and hand-ling pens	Water	Elec.	Management sal. wages		Le-Adm. bldgs ranch buildings	Fuel etc.	Total	Annual	Cumulative	Livestock purchases at reduced cost	Livestock at reduced cost + increased selling price	
1	140.0	100.0	-	-	-	-	3.0	136.0	-	-	2.0	25.0	88.0	-	12.0	30.0	1.0	537.0	(537.0)	(537.0)	(537)	(3)
2	325.0	200.0	-	32.0	125.0	8.0	6.3	25.0	3.9	23.0	4.8	1.0	129.0	4.5	3.0	21.0	2.0	2042.5	(2018.1)	(2555)	(891.1)	(537)
3	230.0	100.0	-	96.0	200.0	16.8	3.9	-	11.1	6.0	4.1	1.0	129.0	12.1	3.0	22.0	3.0	2642.0	(2581.2)	(5136)	(1579.2)	(886.3)
4	185.0	100.0	-	128.0	483.0	10.4	4.2	-	15.4	23.0	4.9	1.0	129.0	16.8	3.0	18.0	3.0	1124.7	(973.6)	(6110)	(732.1)	(1567.1)
5	45.0	-	-	160.0	250.0	11.2	1.5	-	19.0	3.0	3.8	1.0	129.0	21.1	3.0	3.0	3.0	653.6	(367.3)	(6477)	(242.3)	(701.9)
6	-	-	40.0	216.0	25.0	4.0	1.5	30.0	22.1	-	4.3	1.0	129.0	24.1	3.0	3.0	3.0	506.0	(139.2)	(6616)	(126.7)	(185.1)
7	-	-	40.0	216.0	25.0	4.0	1.5	-	25.8	-	5.0	1.0	129.0	28.0	3.0	3.0	3.0	484.3	(79.9)	(6696)	(67.4)	(53.4)
8	-	-	40.0	216.0	25.0	4.0	1.5	-	30.2	-	5.9	1.0	129.0	33.0	3.0	3.0	3.0	494.6	(594.3)	(6102)	(606.8)	13.4
9	-	-	40.0	216.0	25.0	4.0	1.5	63.0	30.9	-	6.0	1.0	129.0	34.0	3.0	3.0	3.0	1088.9	(644.6)	(5457)	(571.1)	824.5
10	-	-	40.0	216.0	35.0	4.0	1.5	20.0	30.5	-	6.0	1.0	129.0	34.0	3.0	3.0	3.0	559.4	(81.9)	(5375)	(99.4)	897.9
11	-	-	40.0	288.0	35.0	4.0	1.5	28.0	34.6	-	6.8	1.0	129.0	38.1	3.0	3.0	3.0	526.0	(248.0)	(5127)	(265.5)	220.9
12	-	-	40.0	288.0	35.0	4.0	1.5	35.0	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	615.0	(813.0)	(4314)	(830.5)	438.1
13	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	630.5	(876.3)	(3438)	(893.8)	1119.2
14	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	595.5	(835.1)	(2603)	(852.6)	1188.1
15	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	595.5	(810.1)	(1003)	(807.3)	1138.7
16	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	595.5	(789.8)	(1813)	(827.6)	1084.3
17	-	-	40.0	288.0	35.0	4.0	1.5	93.0	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	688.5	(810.1)	(1003)	(827.6)	1108.7
18	-	-	40.0	288.0	35.0	4.0	1.5	20.0	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	1400.4	(711.9)	(291)	(729.4)	1009.4
19	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	615.5	(774.5)	(483)	(792.0)	1070.0
20	-	-	40.0	288.0	35.0	4.0	1.5	-	38.5	-	7.5	1.0	129.0	42.0	3.0	3.0	3.0	595.5	(803.0)	(1286)	(820.5)	1100.2
TOTAL	925.0	500.0	600.0	4376.0	4476.0	106.4	41.4	450.0	570.0	55.0	121.1	44.0	2539.0	623.7	69.0	139.0	57.0	15692.6	(+4893.5)*	(+4893.5)*	(+4893.5)*	(+4893.5)*
NPV at 10%	795.1	439.5	304.2	1623.4	3486.7	67.0	26.8	262.5	207.3	45.0	49.1	33.3	1167.0	227.1	37.1	98.4	25.1	8896.6	()	()	()	()
Percentage	8.9	4.9	3.4	18.2	39.2	0.8	0.3	2.95	2.3	0.5	0.6	0.4	13.1	2.6	0.4	1.1	0.3	100	()	()	()	()

* Closing herd valuation
() Deficit cash balance

APPENDIX VIII

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