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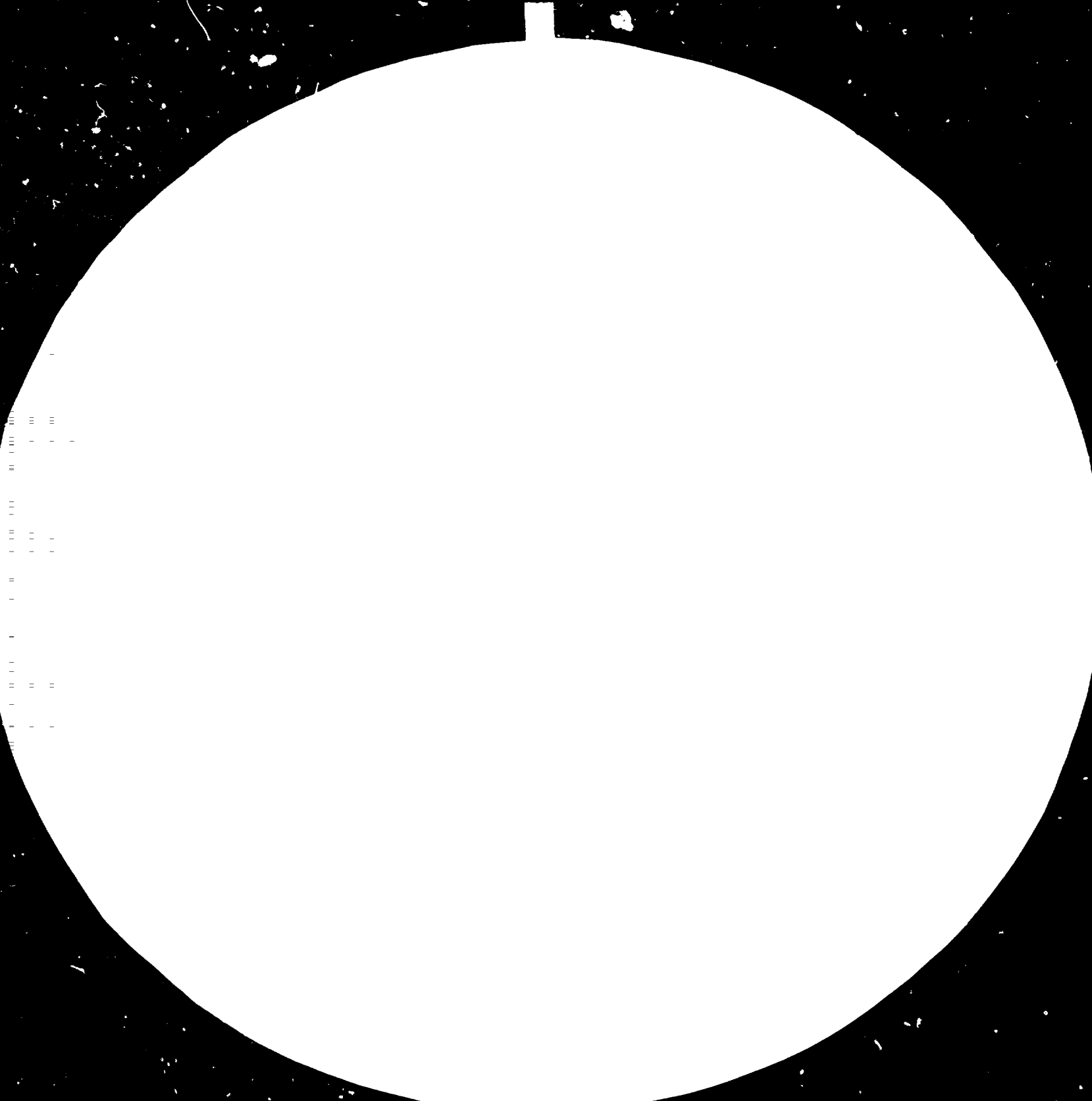

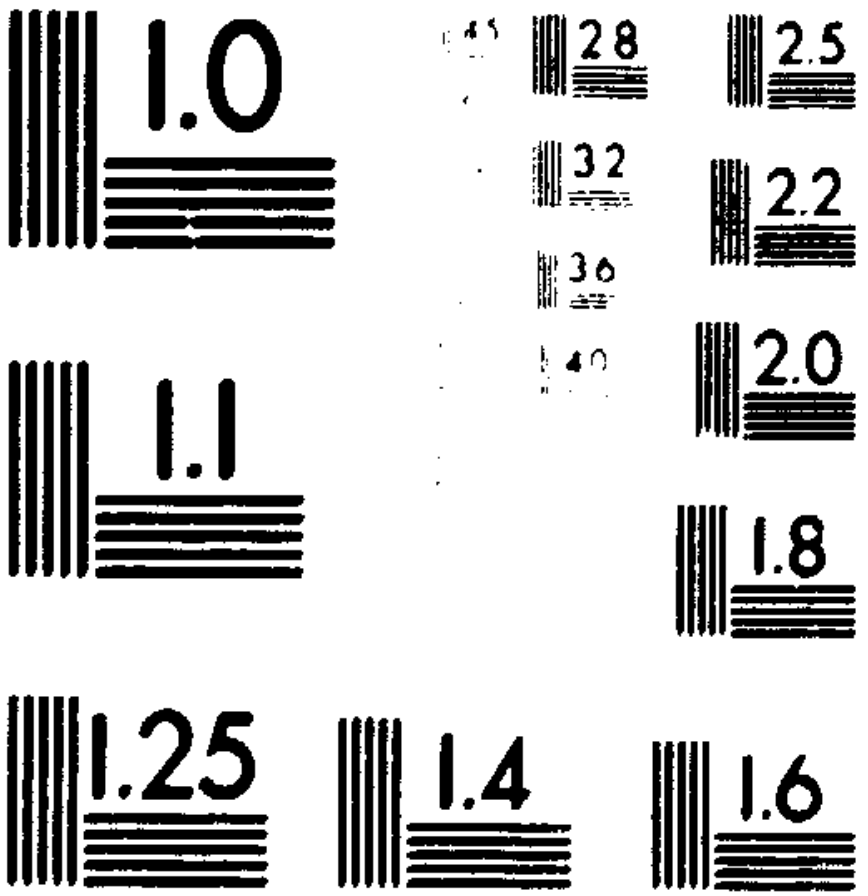

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PREPARATORY ASSISTANCE TO STRENGTHEN BOATBUILDING INDUSTRY

SI/KEN/84/801

KENYA

Technical report: Need for boatbuilding and repair facilities on Lake Victoria - Outline for a feasibility study*

Prepared for the Government of Kenya
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of George Bruce, expert in naval architecture,
and Gordon Robson, expert in industrial economy

United Nations Industrial Development Organization
Vienna

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EXPLANATORY NOTES

UNDP	United Nations Development Projects
LBDA	Lake Basin Development Authority
Lake	Lake Victoria
Gulf	Winan Gulf of Lake Victoria
FAO	Food and Agriculture Organisation, Rome
FRP	Fibre reinforced plastic
WECO	Western College of Arts and Applied Sciences
RIAT	Ramogi Institute of Advanced Technology
Exchange	15.25 Kenya shillings to 1 US dollar

ABSTRACT

Need for boatbuilding and repair facilities on Lake Victoria, Kenya, ref SI/KEN/84/801.

Preparatory report giving an outline for a feasibility study

Objective and duration of work

The report was prepared by two experts following a short visit to Kisumu on Lake Victoria in December 1984. The objective was to review the situation in the Lake Basin Development Authority region and to draft terms of reference for a study to strengthen boat and shipbuilding capacity on Winan Gulf, of Lake Victoria.

Main conclusions

There are significant possibilities for development. A feasibility study would identify what needs to be done.

Main recommendations

The Lake represents a valuable economic resource and initial recommendations include:

- developing ferry services to carry passengers and goods.
- developing the existing railway workshops for steelshipbuilding and shiprepair.
- developing designs for non-steel boats for ferry services, fishing, etc. The boats would be built locally.
- set up ventures to improve the Rural economy, particularly fishing.

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INTRODUCTION

Messrs Robson and Bruce were loaned by their Company A & P Appledore in England to UNIDO for 14 days to provide preparatory assistance to the Lake Basin Development Authority at Kisumu, Kenya to identify the need for boatbuilding and repair facilities. The assignment began on Sunday 02 December and ended on Saturday 15 December 1984. During this period the experts visited UNDP offices in Nairobi, UNDP and LBDA offices in Kisumu, various government departments and private firms in Kisumu and Nairobi, the Railway Workshops at Kisumu, five fishing beaches around the Winan Gulf of Lake Victoria and ending with debriefing at UNIDO Vienna.

This report combines the findings of the two experts. The terms of reference taken together, were intended to provide preparatory assistance to the Government in identifying the country's needs for boatbuilding and repair facilities, with a view to assisting the Government and entrepreneurs in strengthening the country's marine and boatbuilding capacities. The experts were specifically expected to:

- Undertake on-the-spot, technical and economic evaluations of existing shipyards, repair facilities and current boatbuilding requirements to achieve the envisaged output and to estimate financial inputs required.

- Analyse the current status of boatbuilding and repair facilities, equipment, design methods, skilled manpower, organisation, management, number of boats to determine the requirements of local boatbuilding enterprises.

- Prepare an outline of the needs, particularly in the region of Lake Victoria for new and for improved boatbuilding and marine engineering facilities, based on an initial evaluation of the market in the country and in the Lake Victoria region.

- Review production technology, equipment and material to be used, with particular emphasis on the requirements for imports.

- Review the needs for training local personnel and prepare a draft General Training Programme.

- Draft the terms of reference of a prefeasibility study for the draft General Development Programme.

RECOMMENDATIONS

Owing to the time limit of fourteen days, the purpose of this report is to highlight those areas where action should be taken and to outline the matters to be covered in a subsequent full feasibility study, see Annex 6. There is little point in preparing a pre-feasibility study. An analysis of the specific findings during the visit are set out in the Annexes and arising from this work the recommendations include:

1) Developing ferry services in the Gulf using the most suitable boats and building materials to carry passengers, goods, livestock, lorries and other vehicles, containers, fish, etc. Action by entrepreneurs.

2) Developing the Railway Workshop for building steel vessels. Action Railway with entrepreneurs.

3) Developing designs for non-steel boats initially built at the Fisheries Department Boat Yard at Kisumu, then at new private yards to be set up in response to demand. Action boatyard and entrepreneurs.

4) Reactivate steel shiprepairing at the Railway Workshops. Action Railway and entrepreneurs.

5) Set up ventures to improve the Rural Economy with particular emphasis on fishing.

The key factor is to test out the amount of potential which exists for moving people and goods across and around the Gulf and ultimately on the Lake as a whole. Once people have access to markets then those within the Rural Economy around the Lake may find it rewarding to produce goods which can enter the money economy.

The activities of boatbuilding and repair are low technology and labour intensive and tend to stimulate subcontract work. A high proportion of materials are available within Kenya without increasing imports.

I. OUTLINE FEASIBILITY STUDY

The remainder of the report sets out the recommendations which taken together offer an integrated development strategy for the region. Each element should be allowed to develop at its own pace. The idea is to find ways to start up ferry operations in a small way with very little need for finance. If successful, the ferry services should prove to be self financing. As ferry services expand, the number of boats needed will increase. This in turn, will allow the Railway Workshops to begin production of steel ferries. Non-steel boats can also be constructed at the Fisheries Department Boatyard.

Reactivating the Railway Workshops in a commercial way should capture a high proportion of repair work on steel ships on the Lake.

There are many improvements to fishing vessels which could help the Rural Economy. Since there is very little economic room to maneouvre, this aspect should be covered in great detail in the feasibility study.

The feasibility study will test these preliminary recommendations, expand and modify them where necessary so as to come up with carefully researched practical low cost recommendations. Thus the feasibility study is divided into sections:

- Determine the supply of goods and services from the region at present and potential for the future - see Chapter II.

- Investigate markets for the movement of people and goods in Winan Gulf, demand for goods produced in the region and wider development of international trade on Lake Victoria, see Chapter III.

- Evaluate the situation at present covering fishing, transport, other marine activities, facilities, infrastructure, etc, see Chapter IV.

- Set up a development programme which seeks to expand production of vessels to match demand established in the marketing section, see Chapter V.

- Financial and economic analysis which is designed to quantify economic inputs and outputs stemming from the proposed development programme and test the financial viability of individual elements of the programme, see Chapter VI.

- Organisation for change which indicates what the various parties involved have to do including LBDA, ministries, agencies, banks and financial institutions, the cooperative movement and private entrepreneurs, see Chapter VII.

II. DETERMINE SUPPLY

Much of the region is in the rural economy so that little is known about the quantities of products produced nor the potential for improvement. Work during the feasibility study should identif products, producing areas and their surpluses to show the potential for moving goods by land and particularly by water transport. At present, the principal products are fish, livestock and agricultural produce. Much produce is consumed locally and little transport other than by walking or on bicyles is needed.

The fish catch landed in an edible condition is running at 77,000 tonnes per year. A high proportion is Nile Perch. There are some telapia. The catch has been growing yearly. The Fisheries Department are responsible for suggesting ways to conserve the fish population and to maintain a balanced mix of fish. The Nile Perch appears to be too numerous for comfort. The FAO in Rome hold comprehensive statistics, some of which may be relevant.

Pollution from facilities around the Lake could cause a serious threat to the fish population. This aspect, together with an appraisal of the correct stock of fish and correct fishing are important aspects for the study.

Accurate assessment of other products such as livestock and agricultural products is important at feasibility stage. At present, livestock are driven to market around the Lake, with consequent deterioration of condition and value. If it becomes easier to move animals and goods to market, then quality and reliability of supply become more important. The trade is no longer haphazard and individuals may be able to afford to improve breeding methods, use better seeds and growing methods. The Ministry concerned with agriculture must become closely involved with the feasibility to assess potential for increases in production and how these can be dealt with; maybe entrepreneurs would buy goods before they are moved to market.

III. INVESTIGATE MARKETS

Consider the movement of people across Lake Victoria and along its shores particularly:

- Find out the numbers of people moved and how they are moved by any means and from which locations, in as much detail as possible by taking samples of current journeys and looking at historical records of tickets sold, etc.

- Build up a pattern of routes and volumes of people.

- Find out numbers of people living in towns and villages around lake to establish potential for movement.

- Find out what price people are prepared to pay for transport, look at alternatives, eg, bus prices.

- Identify simplest and best routes for pilot services to be run by local entrepreneurs.

This work can be carried out in Kisumu by LBDA and other ministries with assistance from experts.

Consider the movement of all types of goods across the Lake and along the shore by any means of transport including boats, lorries, carts, pack animals, humans, etc, particularly:

- Find out from samples of weighbills, direct observation, available statistics for period of, say, 3 years.

- Build up a pattern of routes for types of goods in some detail.

- Find out levels of production of relevant goods to help establish potential for future.

- Find out price people can pay, at present much may be 'costless' since it is outside the money economy. Find how money can be injected, eg, by better sales of fish.

- Start with one transport venture on an attractive route using a local entrepreneur. Maybe in conjunction with movement of people above.

This investigation work can be done by LBDA and relevant Ministries with assistance from experts.

Establish the demand from locations outside the area for goods produced in and around the Lake, at present principally fish and especially:

- Find out quantities and destinations of goods of each type purchased during the last three years from records available and by samples of weighbills, etc, including exports to Uganda, Tanzania, the Middle East and Europe.

- Find out selling prices of goods at destinations at wholesale and retail outlets from records and by sampling.

- Test for seasonal variations.

- Find out movement costs for each type of goods by each available method of movement including road, rail, air, etc.

- Consider consumption patterns in main user places to forecast rate of growth in demand (if any).

- Identify principal purchasers and arrange specific supply contracts linking through to producers, eg, individual fishermen, cooperatives, to provide goods at better quality or lower price to ultimate consumer, yet to give a higher or more stable price to producer.

- Set up pilot contract for integrated supply using equipment (maybe donated by an International agency) and a local entrepreneur in partnership with a Fishermen's Cooperative.

This work to be carried out by LBDA, Ministries, local ertrepreneurs with some help from 'experts'.

Consider the wider issues of trade around the whole Lake.

Note that this part of the work is more general since it is longer term and depends on the political framework for cooperation between Uganda, Tanzania and Kenya and other trading partners beyond.

The output of this market work should show:

- Types of vessels required on the Lake, eg, a range of multi-purpose vessels for carrying goods, cattle, cars, fish, people, etc. Another range of vessels for specialised use on Lake including fish trawlers, refrigerated 'mother' boats, etc.

- Potential values of each type of trade to the operators of vessels and to their customers in lower costs (as against other forms of transport).

- The amounts of goods produced which could be sold outside the Lake area with an outline cost and price structure which would show advantages to ultimate users, transporters and producers. Some middlemen may lose.

- Potential for growth within the local area within Kenya and internationally.

- A series of low cost ventures which should be started now.

IV. THE SITUATION AT PRESENT

Existing operations are considered under categories to establish a starting point from which changes and improvements can be developed:

- Vessels operating on Lake Victoria
- Kenya Railways ferry services
- Shore establishments around Lake Victoria
- Fishing and fish sales outside the area
- Infrastructure

Published statistics have been used as relevant, see Useful Statistics, Annex 2.

A. Vessels on the Lake

The major vessels operating on the Lake at present include the Tanzanian passenger ferry under repair at Railway Workshop, Kisumu, and other ferries and vessels operated from Kenya, Tanzania and Uganda. A complete list was not available.

The principal routes are restricted to those operated by Kenya Railway ferry services at present, but are likely to be expanded to include international routes Many of these routes were operated successfully prior to the breakdown of the Union between Kenya, Uganda and Tanzania some years ago.

Load factors for these vessels have not been considered at this stage. However the ferry sailing at 09.00 on 07 December 1984 Kisumu to Kendu Bay was packed full with approximately 200 passengers.

B. Kenya Railways ferry services

As originally conceived, the railway shipping services provided a link between Kisumu and Uganda, thus providing a complete service to the coast. The 'Uhuru' and her sister ship were both built to carry railway rolling stock for this purpose. This service is no longer operating, but some of the ancillary services which grew up remain.

There are two operational services, see Map 1. The first is Kisumu - Kendu Bay - Homa Bay - Asembo Bay. The ferry completes the run to Asembo Bay during one day and returns to Kisumu the next day.

The second service is:

Kisumu - Kendu Bay - Homa Bay - Manango - Mbita - Karangu.

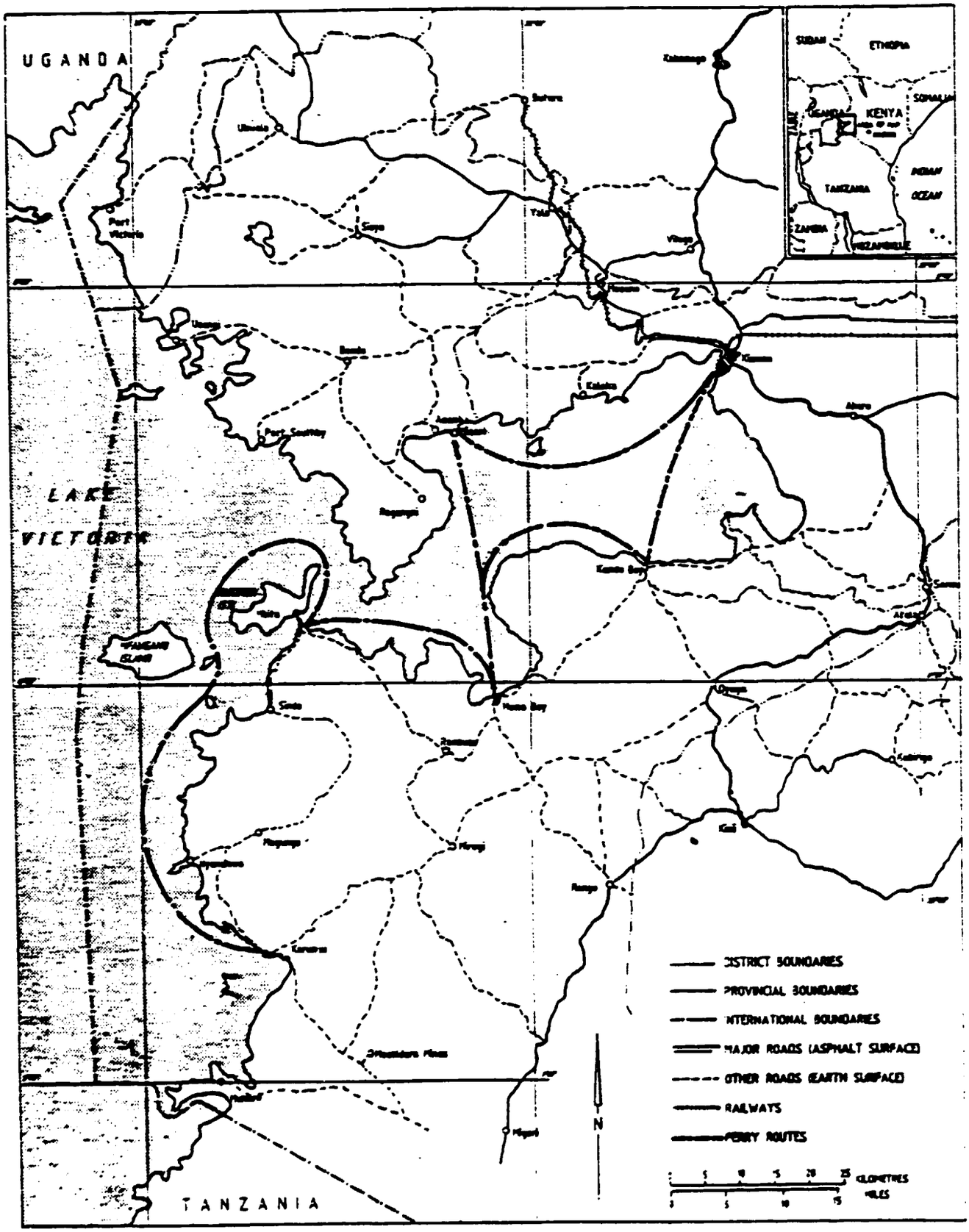
Three ferries are available for the services.

The services appear well used. The ferry services provide more capacity for luggage and goods than bus services.

Although the vessels are old, they have recently been re-engined and overhauled. They can make a speed of eight knots, so that the trip from Kisumu to Kendu Bay, for example, takes just under two hours. This compares favourably with the time for a vehicle to make the same trip, because of the much longer road distance.

The major drawback of the existing services is their infrequency. Despite their refits, the vessels will have higher operating costs and less flexibility than a modern vessel.

Prices charged to passengers are now competitive with bus fares, see Figure 2.



KENYA RAILWAYS FERRY SERVICES

MAP 1

Figure 2

Comparative bus and rail ferry fares

Kenya Shillings

Kisumu - Asembo Bay Ferry	Railway Ferry Fares			Bus Fares
Kisumu to:	1st	2nd	3rd	
- Kendu Bay	30	22	12	25
- Homa Bay	52	38	18	35
- Asembo Bay	85	62	25	30
Kisumu - Karungu Ferry				
Kisumu to:				
- Kendu Bay	30	22	12	N/A
- Homa Bay	52	38	18	N/A
- Kuwur	52	38	18	N/A
- Manangano	93	63	33	N/A
- Mbita	78	56	28	45
- Karungu	N/A	N/A	N/A	45

C. Shore establishments around Lake

The main store establishments include:

- Railway workshops, quays and railhead at Kisumu.
- Drydock and shiprepair facilities at Kisumu.
- Jetties capable of accommodating lake motor vessels at various sites including Kendu Bay, Homa Bay.
- Government boatbuilding yards at Kisumu.

1. Kenya Railways workshop

Kenya Railways operate various vessels on Lake Victoria, which connect with the rail link to Nairobi. In order to service these vessels, the company have a shiprepair facility. This is presently operating well below its maximum capacity. The repair facility has a dry dock and two slipways.

The dock is large enough to take the 'Uhuru' which is the largest vessel on Lake Victoria. It is in generally sound condition and was in use at the time of the visit. The slipway capacity of 300 tonnes, with a maximum available length of 300 feet (95 metres). The slipway was used for the assembly of the 'Uhuru'.

The 'Uhuru' main dimensions are:

LOA	91.75 metres
Breadth	16.45 metres
Depth	4.27 metres

At the time of the visit, one of the two slipways was unoccupied, except for a vessel which had been under construction. The partly framed hull is at the landward end of the slipway. The second slipway had a small vessel on its cradle.

The dock is served by a small crane of 3 tonne capacity, which can travel the length of the dock.

In addition to the dock and slipways, there are a number of workshops, including:

- Steel fabrication shop
- Machine shop
- Fitting shop
- Electrical shop
- Blacksmiths and pipe shop
- Small training centre

The equipment is all old, but well maintained. In the case of the steel and pipeshops there is not sufficient capacity for a shipbuilding programme. The steelshop is laid out and equipped for rivetted construction and has no prefabrication area. The pipe shop relies on hot bending and this would give a severely limited capacity, compared with cold bending techniques. A cold pipe bending machine would be needed to support a shipbuilding programme. A larger workshop area using additional equipment could be needed for shipbuilding.

The machine shop is well equipped, including a tailshaft lathe. It would be capable of supporting a wide range of shipbuilding and shiprepairing activities.

2. Jetties

The locations served by the Railway ferries each have a jetty beside which the vessels can berth. These are finger jetties, which project far enough into the Lake to give adequate water depth. They are only suitable for foot passengers and light goods. The jetties have no cranes or other cargo handling facilities. Passengers embark and disembark using a gangway.

3. Existing fishing vessel construction

The boats in use are open wooden boats of traditional design and construction. They vary in length from around 12 feet (4 metres) to 25 feet (8 metres). Vessels are built by fishermen themselves, or by local craftsmen on a part time basis. There are no boatbuilding facilities as such other than the Fisheries Department boatyard. Vessels are constructed at or near to the fishing beaches, using only hand tools. Very few of the craftsmen are employed full time in boatbuilding.

There are two broad types of vessel, although because boatbuilding is a traditional craft, there are no standard designs. In each type, the boats have a similar design but with small variations in detail. The design of the boats is simple and standardised within the limits of the very basic technology used to build them. The first type have a flat bottom and straight sides. The only assistance required in construction is bending the side planks to attach them to the frames. The boats are simple to produce.

However, there are disadvantages. The boats do not sail well and this creates problems. It takes time to travel from the fishing area to shore, and as a result, some of the catch is spoiled. The boats have a limited capacity and no facilities for keeping the catch fresh.

The boats are cheap to produce but have a limited life. After at most ten years, they are replaced or completely rebuilt. This type is typically around twenty feet (6 metres) long.

The second type is much smaller and simpler. It has a frameless construction. Bottom and sides are simply planked, the planks being joined using sheetmetal strips nailed over a rubber moulding over the seams inside and out.

Both boats have a keel which is carried beyond the main hull fore and aft. In some cases, this keel is brought up above the waterline and decorated.

Because of the very informal organisation and the basic methods in use, it is not feasible for existing boatbuilders to sustain an improvement and development programme.

4. Fisheries Department boatyard

The Fisheries Department boatyard is located at Kisumu. It consists basically of a small building, about twelve metres by fifteen metres, and a slipway. The building is in two main sections. Half the area is used for part preparation, and is equipped with power tools for woodworking. The other half is used for boat assembly. Two boats are assembled simultaneously, over a four week period. Finished boats are manhandled to the slipway for launching.

A partially finished boat hull made from FRP was seen in the boatyard.

The boats seen were of substantially better quality than those produced on beaches. The materials and methods (with the exception of the power tools) are the same.

D. Fishing

Fishing is carried out by about 25,000 fishermen using about 4,000 boats and about 60,000 nets of various types, see Annex 4. Questions of fishing practices, timing of fishing sorties, use of nets, depth of fishing, types of fish have not been considered at this stage. However, these matters must be covered in the feasibility study, so that developments are in line with the actual conditions likely to be found in future and under continuous study by the Fisheries Ministry.

Fish are landed at beaches around the Lake including Kendu Bay, Homa Bay, Mbita, Karungu and Kaloka. Fish are a useful source of protein for the Rural population, see Annex 3.

A typical daily catch for one boat might be 200 Kilos of Nile Perch which would sell at 70 cents to 1/70 per kilo depending on the market conditions. This gives a daily income of 140/- to 340/- to be shared between a crew of four. Thus a fisherman may earn 35/- to 85/- per day or 700/- to 1,799/- per month for 20 fishing sorties. This is in line with the statutory minimum wage for carpenters and steelworkers which ranges from 687/70 for an unskilled worker to 1,173/- for a skilled worker. Analysis is more complex in practice since some boats are operated by their owners and others by crew who own nets. In general, the proceeds of a catch are shared out according to the number of nets operated by each crew member.

Fish are carried by hand from boats on the beach to a simple roofed concrete structure with tables and a weighing machine. Fish are sold individually or in small numbers to local fishmongers who carry them away to market or for smoking if there is no market. Traders buy from the more accessible beaches for transportation to Nairobi using ice boxes to keep the fish fresh.

Owing to slow movement from fishing grounds to landing beaches some fish are not sold and are allowed to rot since there are no processing facilities.

All fish should be weigned and entered into statistics maintained by an official at each beach.

Many of the fisherman are members of Cooperatives, see Figure 3 and Map 4. Membership is volunary, but not all the Cooperatives are yet able to offer their members significant advantages over remaining independant. For example, the Union at Mbita charges 20/- for a share and 5/- for administration. Thereafter members pay in 10% of the proceeds of their catch which is credited to an account held in their name. Traders who are not members pay a service charge of 10% by value which is the only active income for the Cooperatives. Income is just adequate to cover administration costs but not enough to market products to help members. Cooperatives dues are collected by agents who get 20% of sums collected.

There is a steady demand for fish for other locations in Kenya, notably Nairobi. A significant proportion of fresh fish landed is sold outside the area principally to:

- Nairobi
- Mombasa
- United Kingdom
- Continental Europe
- Middle East

Prices and transport costs are estimated to be:

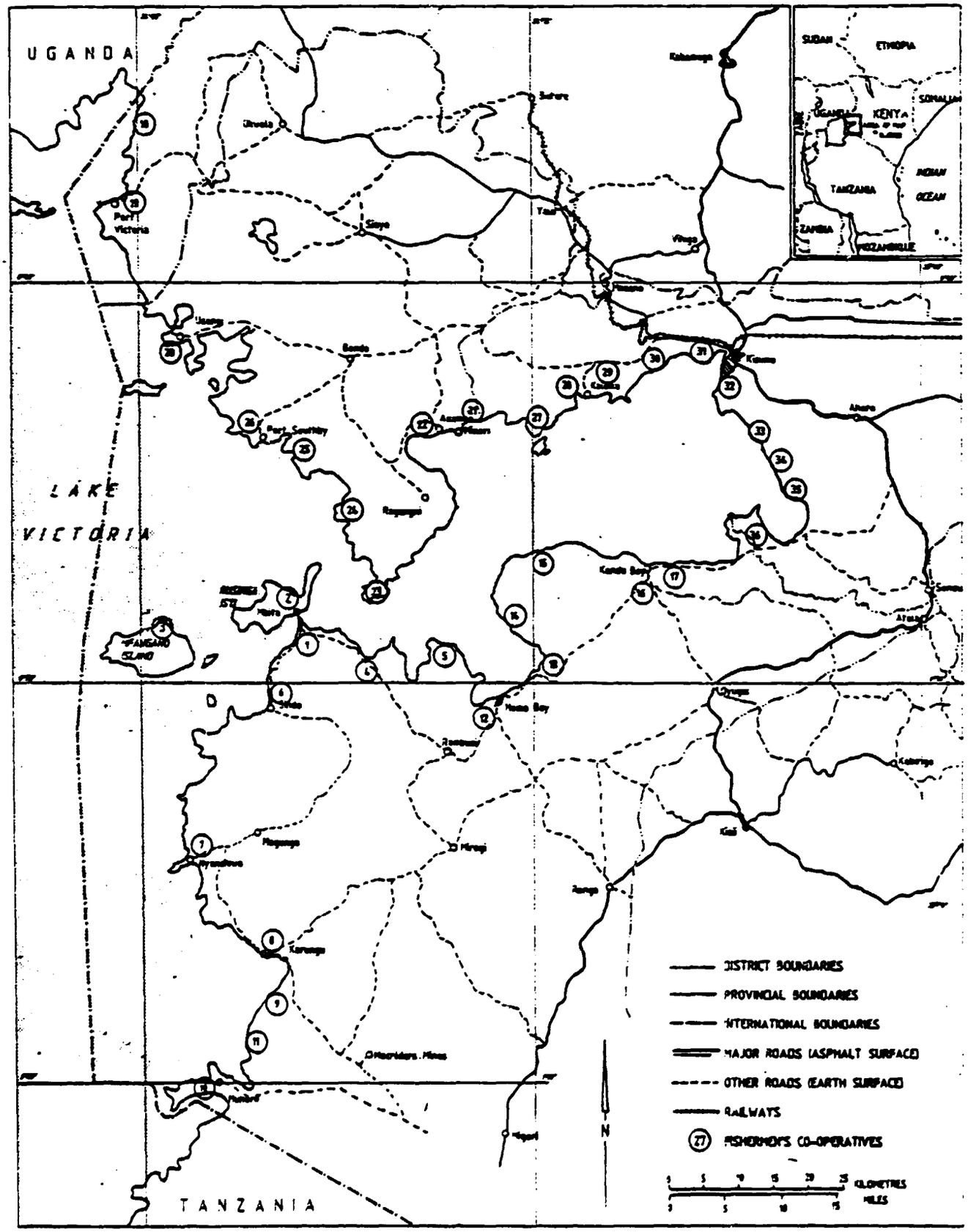
- Nile perch sold in a retail shop in Nairobi - 20/- to 30/- per kilo filletted - small quantities only.

- Nile perch sold retail to Kenyans in Nairobi and Mombasa at 5/50 per kilo in ice, not filletted (buy at 2/-). Yet too expens e for many.

Figure 3

Fishermen's Cooperatives

Number on Map	Name of Cooperative Society	Nyanza Province District
1	Mbita	South Nyanza
2	Rusinga	-
3	Mfango	-
4	Gembe	-
5	Lambwe	-
6	Kasingri	-
7	Gwasi	-
8	Karungu	-
9	North Kadem	-
10	Muhoro Bay	-
11	South Kadem	-
12	Homa Bay	-
13	Ngegu	-
14	Luanda Kanam	-
15	West Karachouonyo	-
16	Kendu Bay	-
17	Wang Chieng	-
18	Samia	Busia
19	Bunyala	-
20	Yimbo	Siaya
21	East Asembo	-
22	West Asembo	-
23	Uyoma	-
24	Misori	-
25	Wichlum	-
26	Liunda	-
27	Asat	Kisumu
28	Kaloka	-
29	Ogal	-
30	Paga	-
31	Usoma	-
32	Dunga	-
33	Nyakweri	-
34	Miruti	-
35	Nduku	-
36	Nyakach	-



LOCATIONS OF FISHING CO-OPERATIVES

MAP 4

- Nile perch blocks 35/- kilo for 3 kilos - equivalent to 11/70 per kilo filletted.

- Telapia 7/- per kilo on beach then 12/- to 15/- per kilo to hotels at wholesale price. Limited quantities.

- 20 feet loaded refrigerated container Mombasa to Nairobi 4,291/- for 530 kilometres by rail - broadly equivalent to 18/- per 100 kilos including box and packing.

- Electrically or mechanically refrigerated rail vans from Kisumu to Nairobi at 56/- per 100 kilos for 400 kilometres (reduced to 35/- for quantities above 10,000 kilos).

E. Infrastructure

Infrastructure is considered in a wide sense to include roads, railways, water supply, electricity supply, access to goods and services including insurance and banking, communications including telephone and telex, labour supply, availability of organs of government including Lake Basin Development Authority and Ministries, etc.

There are good metalled roads between main centres. Feeder roads are not metalled and in certain places are very bumpy. During rains the surface is poor and these roads are impassable until they have dried out.

The road system tends to link up villages but is not yet developed to provide a network for easy transport in any direction. Thus relatively short direct distances may entail long detours by road.

The Lake itself is a major impediment to road traffic. Approximate times for typical journeys are shown on Figure 5. Many of the ideas in this report are concerned to improve journey times by combining water travel with land travel.

Figure 5

Approximate times for journeys

Kisumu to:	By road
- Kendu Bay	120 minutes
- Homa Bay	210 minutes
- Mbita	330 minutes
- Karungu	350 minutes
- Kaloka	40 minutes

The Lake is a natural resource which is underused. Thus initially, development of transport on the Lake should be cheaper in both investment and running costs as opposed to an equal service provided on land. In certain cases, eg, crossing between Mbita and Port Southby land travel cannot compete.

The railway ending in Kisumu links directly with Nairobi. The train takes twelve hours to Nairobi. This mode of transport could be competitive with road for certain goods. Passenger fares are shown on Figure 6.

Water is available in adequate quantities but costs were not available. If there is substantial shipbuilding and shiprepairing at a major site, say Railway Workshops at Kisumu, annual useage of water could be substantial.

Electricity is available from the grid but costs would depend on site and usage. The electricity authority would expect the user to pay for the cost of connection to the nearest available source.

Most materials are available in Kenya. Local resources would be used as much as possible.

Banking, insurance and financial services are available in Kisumu and Homa Bay.

Telephone and telex services are available in towns but not at many of the fishing beaches.

There is ample labour available for a major facility. A short period of training (say, six months) would be needed for young people completing the various levels of school and vocational courses. Older workers and staff would be trained for specific jobs over a one to six month period, depending on the type of job.

Figure 6

Passenger fares Kisumu - Nairobi

Mini bus	from	100/-	
	to	145/-	at 14.00 and 11.00
Bus		80/-	at 11.00 and 20.30
Small station wagon		140/-	all times
Train		110/-	2nd class - daily 18.00
		254/-	1st class
		55/-	3rd class
Aeroplane, Kenyan Airways		450/-	

Note: All single fares.

Labour for a series of minor facilities for boatbuilding would come from existing boatbuilders, fishermen who might like to stay on land, local people in the area and young people from the training establishments. There would be a short period of training (up to six months) for each new worker.

The numbers involved in a major facility would be in a range 200 to 500 workers and staff. In the minor sites (say eight), up to some 100 workers and staff would be involved excluding part time labour.

Staff with relevant experience could be difficult to find so that expatriates may be used for limited periods in selected tasks, eg, mould making, technical drawing, foremen, etc.

The area is fully covered by staff of ministries for fisheries coordinated overall by the LBDA itself. There is a great variety of talents available to give help needed to entrepreneurs, cooperatives and others who wish to carry out improvements.

V. DEVELOPMENT PROGRAMME

A. New vessels

1. Introduction

A study of the market will determine the demand for various types of vessels and allow the development of outline specifications. For each type, the specification will have to be developed into a design. To do this, a series of design studies should form part of the overall study.

An initial assessment has indicated a number of vessel types which could be required. These are discussed in turn in the subsequent sub-sections.

2. Fishing boats

The existing designs of fishing boats have a number of drawbacks in operation and construction.

In addition to reviewing the production methods and materials, it is also essential that the boat designs are reviewed. Considerable theoretical and practical work has been carried out into suitable designs of fishing boat for rural and developing communities. Work has also been carried out on alternative low cost materials, in particular on using indigenous materials where possible.

Thus the feasibility study should:

- Review available literature on fishing boats and select several types for further development. The review should take note of the various materials which could be used. The review could be carried out by Ministry of Fisheries/LBDA, with assistance from an expert.

- Develop selected types of fishing boat adapting the designs to suit local conditions and preferred materials.

- Set up a pilot project to build prototype vessels of one or more selected and developed designs. Subsequent building work would take place at existing workshops.

- Evaluate similar vessels in use elsewhere to determine their suitability for local conditions and acceptability to the local fishermen.

- Make any necessary design modifications to further adapt the vessels.

On completion of the evaluation and modification process, the operating and economic characteristics of the vessel or vessel types would be fully established. The production phase could then begin, building up to the projected maximum capacity over a period.

Some potential alternative design ideas have been discussed with LBDA and with some operators. Possible vessels include a similar size and type of vessel to those in use, but with modifications.

These might incorporate:

- Lighter construction, utilising a plywood skin over framing.

- Provision for the incorporation of a small diesel engine to increase range and give the ability to sail against the wind. The diesel could be fitted at a later stage when the individual owner could afford it.

- Two sizes, one for fishing close to the shore, and a larger boat for working further into the lake.

- Improved sea-keeping and sailing characteristics. Taking advantage of the change in materials and production methods to revise the hull form.

- A vessel as above, but constructed from an alternative material, eg, FRP.

- A twin hull vessel with a large working deck, see Figure 7. This could be constructed using the facilities and materials selected, but would have some advantages:

  - More working space for gear and catch.

  - The flat deck would be readily used to carry ice in boxes.

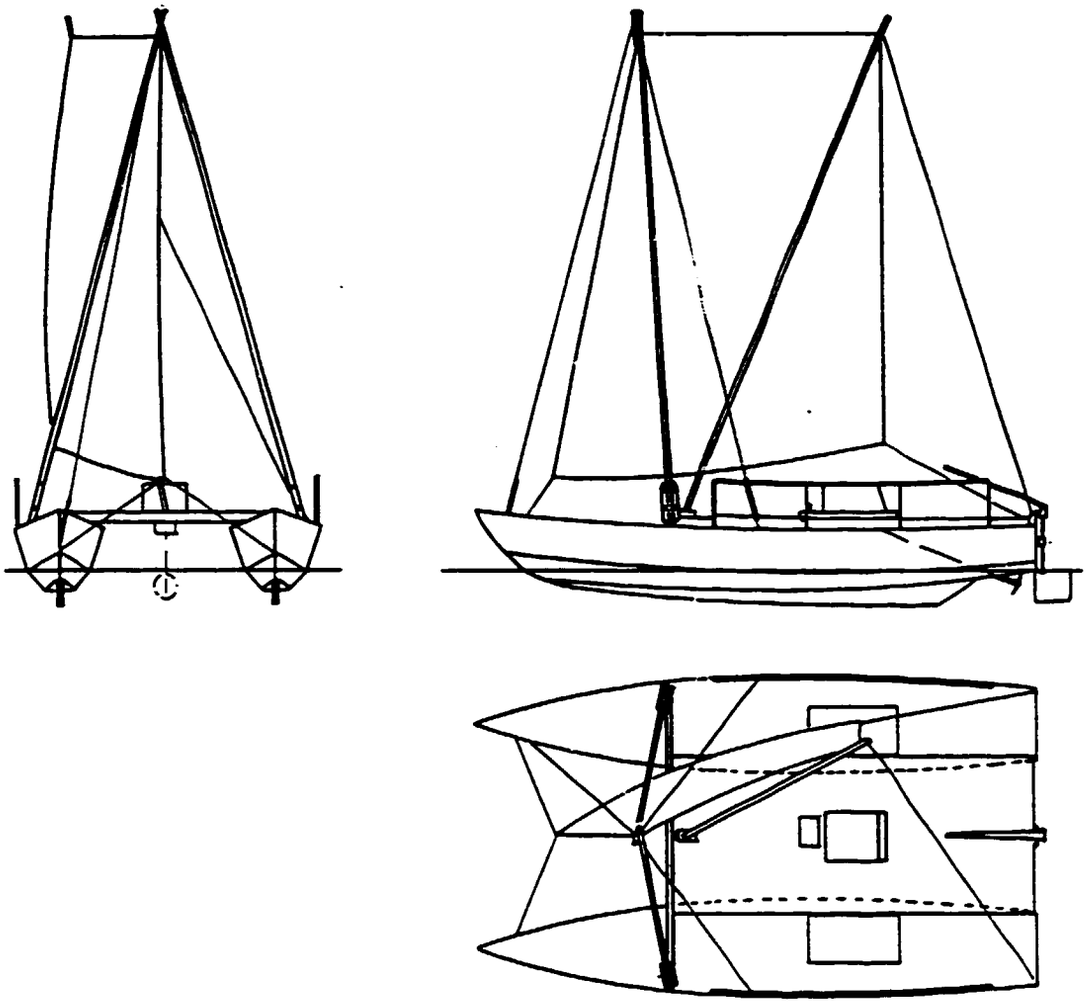
  - The vessel would have great stability and good sailing characteristics.

Other vessel types may be identified during the feasibility study. The type will depend on the extent to which the fishing operations are modified. For example, the need to motorize individual craft could be eliminated by use of a 'mother craft'.

3. Transport boats

Existing transport of people or goods is by Kenya Railways vessels on limited routes. The only alternative is to use one of the traditional boats as a ferry on an ad hoc basis. This is a limited service and carries some risk as the boat may be overloaded.

FISHING CATAMARAN



LENGTH 4.9 METRES

BEAM 2.4 METRES

CAPACITY 500Kg.

CAN BE FITTED WITH A 6 H.P. DIESEL

A potential market exists for transport boats. The detailed study of the market will establish the numbers of potential passengers and the volume of goods. Thereafter, a design study will be required to identify a suitable vessel with due consideration to available facilities and materials.

The study should:

- Establish an outline specification for the vessel, based on the carrying requirements for goods, livestock or people.

- Dependent on size and complexity either develop a design, suitable for local conditions, or evaluate one or more existing commercial designs.

- Adapt the design as necessary to available materials and facilities.

- Confirm the acceptability of the design to the regulatory body.

Some external expert assistance would be needed to carry out the design study.

Potentially a vessel similar to the fishing boats, but significantly larger, may be suitable. This would be a large open vessel, possibly fitted with a ramp at the forward end. At the aft end would be a diesel engine and steering, also with a small deck for the helmsman. The well would be fitted with seats for passengers. These would be removable to allow other cargoes as necessary.

The vessel could be designed to be built from wood, FRP, ferro-cement or steel. If steel is used, then it may be possible to utilize the Kenya Railways shipyard, which would permit construction sooner than if a purpose-designed facility is developed.

4. 'Mother' boats

In order to assist the cooperatives to market fish in the best possible condition, two needs are apparent. These are first, to reduce the time taken for the fish to reach the markets and second, to provide means of preserving the fish. The 'mother' boat is intended to fulfil both of these purposes. It would accompany the fishermen, or follow them to the fishing grounds. Once fish were landed in the boats, the mother boat would collect them and transfer them immediately to cold storage. On a small prototype, this would be provided by an insulated container with ice. On a larger vessel, which would be provided once the concept is demonstrated to be viable, refrigerating plant would be provided.

Initially, the boats would only be used to move fish rapidly to the shore, either for local sale or for transport to other markets. The use of ice is feasible only in conjunction with fishing centres equipped with ice plants. However, even without ice, the concept would allow fishing further afield.

Given larger boats, and an organised distribution system, the mother boats would connect the fishing cooperatives direct with Kisumu, or other points. Fish would be cleaned prior to freezing if required by the market.

The requirements for mother boats should be investigated, at the appropriate times in the overall development programme. Two design studies would be required, the first to examine small local boats, the second to examine larger boats for distribution throughout Winan Gulf.

Both studies would follow the same overall pattern.

5. Ramp ferries

To serve a larger market for the transport of people or goods in Kenyan waters, a ramp ferry might be utilised, see Figure 8. The market study will identify the need for transport, which would include vehicles, containers and livestock, in addition to passengers.

A design study would then be required to identify a suitable vessel. The study would:

- Drawn up on outline specification, based on the market.
- Commission a design, or carry out an evaluation of available designs.
- Adapt the design to local conditions.
- Confirm the acceptability of the design to the local regulatory body.
- Carry out detailed design and prepare production drawings.
- Prepare a schedule of materials which require to be purchased.

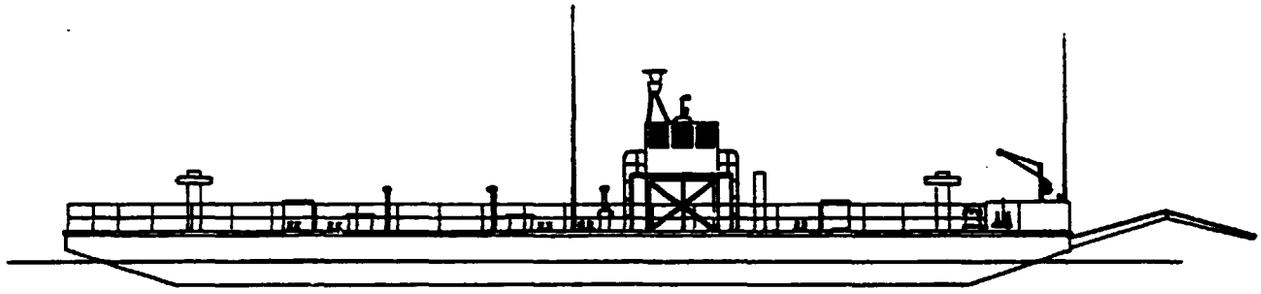
It is likely that a vessel of this size and operational requirement would be constructed of steel. It would have a diesel engine at the aft end, with a raised deck over or could utilise rudder-propellers. Some passenger accommodation would be provided on the deck, with a wheelhouse above. This would depend on demand. Forward of the engine space would be a deck which could carry vehicles, live stock or goods in containers. At each side of the vessel would be tanks for water ballast but potentially adaptable to liquid cargoes.

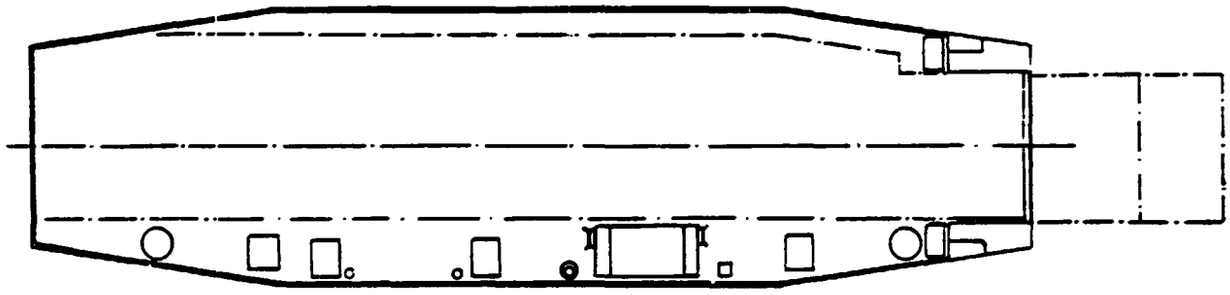
The bottom of the vessel at the fore end would be sloped to allow beaching. A ramp at the bow would lowered to provide access to shore.

Such a vessel could operate along the coast and would be capable of landing at many points where there is adequate water depth close to shore. For regular routes, a road ending in a ramp into the water would provide a suitable loading point.

RAMP FERRY

LENGTH OVERALL	35 METRES
BREADTH	9.0 METRES
DRAFT	0.7 METRES
SPEED	7 KNOTS





RAMP FOR VEHICLE OR LIVESTOCK ACCESS

NO SHORE UNLOADING FACILITIES NEEDED.

FIGURE 9

Construction of such a vessel would be a considerably greater task than that outlined for the boats discussed above. It would require a purpose-designed facility or utilisation of the existing facility at the Railway Workshops with some upgrading.

6. Passenger/cargo vessels

The form of passenger and cargo vessels would depend on the nature of the transport requirements. As international trade develops a number of types might evolve. Examples would be:

- A container vessel used to link with the railway and overseas trade. A design which creates the least need for enhanced port facilities should be adopted, see Figure 9.

- A new train ferry at a future time.

- A passenger vessel for cruising or ferrying.

Other types could be imagined. Any of these would require large scale facilities and are therefore very much in the future. For any vessel, a major design study would be required. This would be similar in form to that for the ramp ferry but on a larger scale.

CONTAINER VESSEL

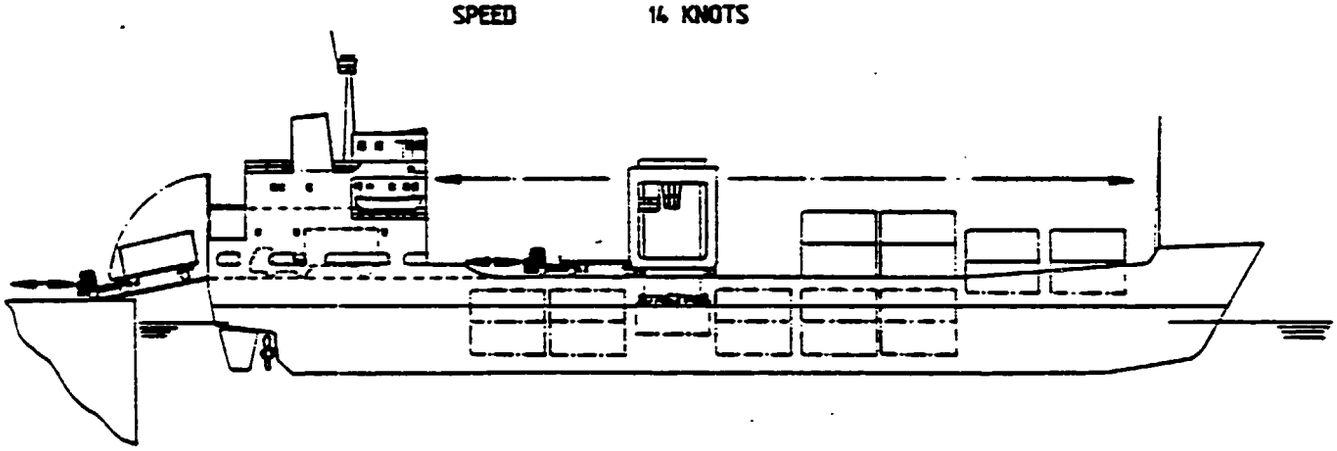
LENGTH OVERALL 85 METRES

BEAM 13.7 METRES

DRAFT 4.5 METRES

CAPACITY 110 - 20'-0" CONTAINERS

SPEED 14 KNOTS



RAMP FOR TRAILER ACCESS OR RAIL ACCESS

DECK CRANE FOR CONTAINER STACKING

NO SHORE FACILITIES (E.G. CRANE) NEEDED

FIGURE 9

B. New facilities

1. Introduction

In order to increase the utilisation of the lakes and associated areas, a tentative vessel construction programme has been developed. This has identified four broad categories of vessel, each of which would require different facilities.

The four categories are:

- Small boats, in particular, fishing vessels. This category includes boats up to thirty feet (ten metres).

- Larger boats, for service functions. These include vessels for transport of fish, passengers or goods and official vessels. This category includes vessels up to 60 feet (twenty metres):

- Small ships, for transport of people, vehicles, livestock and goods in Kenyan waters. This category includes vessels up to 150 feet (fifty metres).

- Large ships for international trade. Vessels in this category would be up to 300 feet (95 metres) to conform with the size of the drydock which is available at Kisumu.

Each of the four categories would require different facilities and these are discussed in outline in subsequent paragraphs. The first category requires basic boat-building facilities. The size of the potential market for upgrading the fishing fleet is up to 400 vessels per year. In order to be flexible in response to local demand and to reduce investment costs (for example, associated with the necessary infrastructure), a number of facilities should be built.

The second category has a much smaller market, and given the size and greater complexity of vessels, a single facility is preferred. This should be located in the light of infrastructure, particularly transport. Kisumu is the best location from that viewpoint.

The third and fourth categories move into steel as the main construction material and a much greater requirement for outfit materials, some of which will be imported. Kisumu is the preferred location.

Rather than separate facilities, a single facility which is capable of a phased expansion programme should be provided. The first phase facility is described, in outline, below. Provision for expansion is built into the facility.

An alternative, which should be explored, is to make use of the existing slipways at the Kenya Railways site, at Kisumu. This would reduce the amount of investment and allow development to take place in small increments.

2. Small boat construction

An outline facility is shown in Figure 10. This would employ around five workers with relevant skills and produce around forty boats per year. The main features are:

- Site approximately 25 metres by 30 metres.
- Boats produced at a rate of one per week.
- Each boat produced in five stages; two weeks constructing the hull, two weeks outfitting and one week rigging and testing.
- Provision for fitting engines is also made when required.

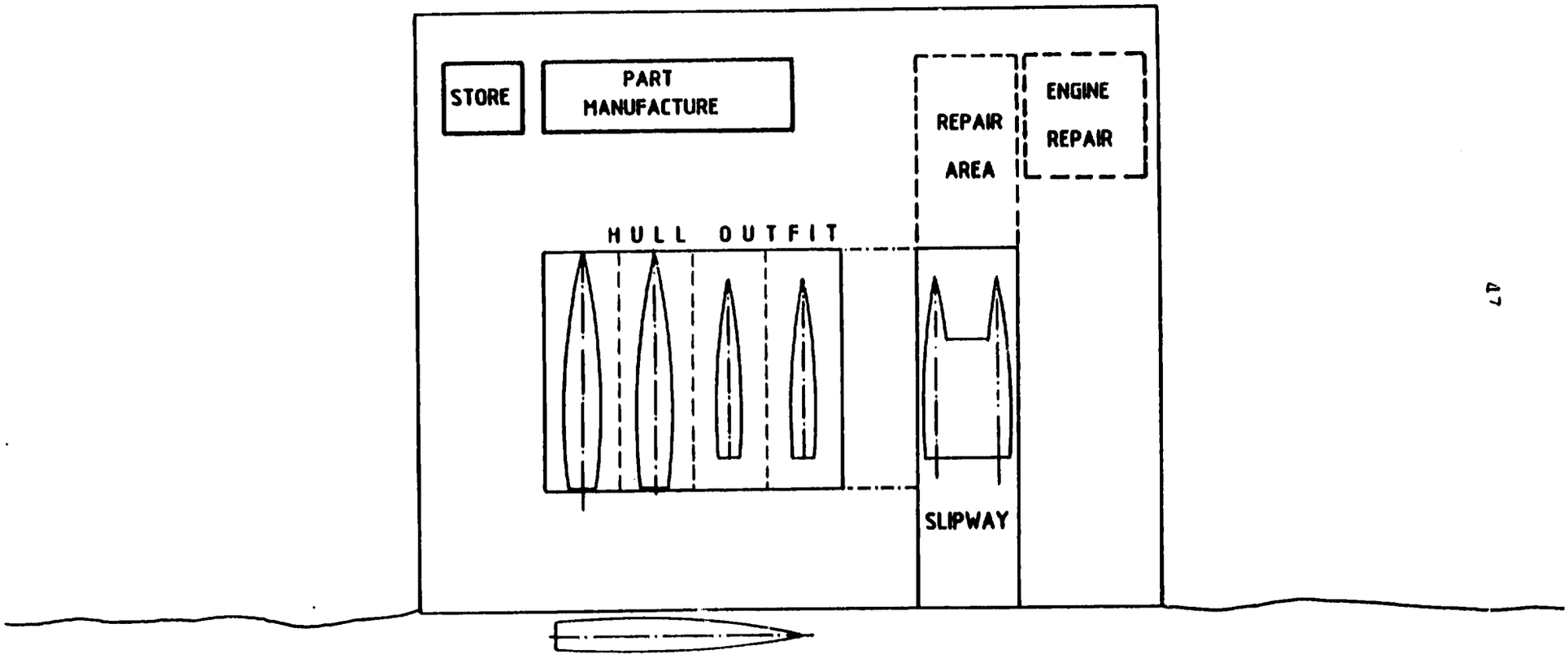


FIGURE 10

OUTLINE BOATYARD - BOATS UP TO 10 METRES LENGTH

SCALE 1:250

- Boats produced under a roof to allow work during hot or wet weather. The roofed area is 10 metres by 12 metres with possibility of extension. Local materials would be used and the building would have a concrete floor.

- A small building for storage of materials and an office and a second workshop for making parts are included.

- Provision is made for a future workshop for diesel engine maintenance.

- An earth slipway for launch and recovery of boats - moved on rollers.

- An area for boat repairs.

The technology to be employed would remain very basic, whatever material is used. In the parts workshop, handtools and benches would be required. To make the various parts, jigs and templates should be used. This would ensure accuracy and therefore reduce the time and effort required for assembly of the boat.

At the hull assembly site, jigs (moulds for FRP or ferro-cement), would ensure the accuracy of the hull. The hull would be assembled, laid up or cast during one week. A second site is available for curing time, or for additions or modifications to meet particular owners' requirements. Two sites are available for outfitting the boats. The second site would be necessary for bigger boats for fitting of diesel engines.

Rigging the boat and testing would be done with the boat afloat. The boat could readily be brought ashore if any adjustments are necessary.

For diesel maintenance, only hand tools and benches would be required. Lifting the engines and removing them for production of overhaul would be aided by a small hoist block on an overhead beam. This equipment is well within the capability of training establishments such as WECO, the Kenya Railway workshops or other local workshops.

3. Large boat construction

The facility would be very similar in concept to the small boat facility. However, because of the smaller market fewer such facilities would be required. An outline is shown in Figure 11. The facility would employ approximately five workers and produce ten boats per year depending on size.

The main facilities are:

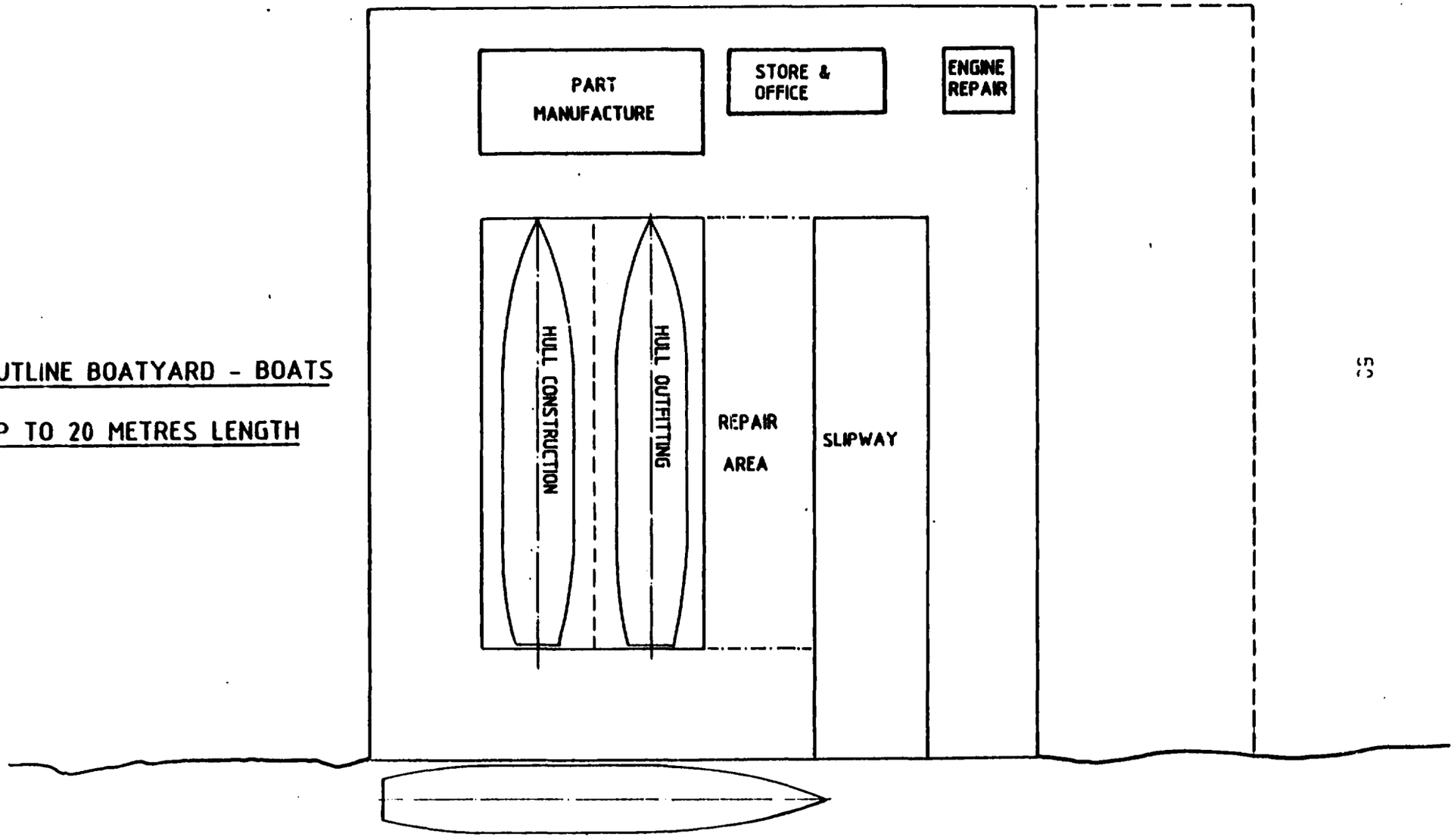
- Site approximately 35 metres by 30 metres.

- Boats produced at the rate of one per four weeks.

- Each boat produced in three stages; four weeks constructing the hull, four weeks outfitting and a period (up to four weeks if required) commissioning and testing.

- Provision for installation and future provision for maintenance is included.

- Boats produced under a roof to allow work in hot or wet weather. The roofed area is 20 by 10 metres and could be extended. The building would have a concrete floor and its construction would be of local materials.



OUTLINE BOATYARD - BOATS

UP TO 20 METRES LENGTH

SCALE 1:250

FIGURE 11

- Because of vessel size, a surface may be needed for the slipway. Rollers would be used to launch and recover vessels. Because of the weight, a pulley system to give sufficient mechanical advantage would be required. Alternatively, a vehicle could be used to pull boats onto this slip.

- A small building for storage of materials and an office.

- A workshop for making parts and for diesel engine maintenance.

- An area for boat repairs can be provided.

The technology to be employed would be similar to that for the smaller boats. In order to facilitate handling of larger pieces, hoist blocks would be required which could be supplied locally.

4. Ship construction

For larger vessels, a much larger investment will be needed. The vessels will be of steel, which requires specialised equipment. An alternative to a new facility is to utilise the existing Kenya Railways facility.

An outline of a new facility is shown in Figure 12. The main features are:

- A launchway, initially fifty metres long (or to suit the first vessels) capable of extension when required up to one hundred metres. The launchway would be served by a crane (for example, a building construction tower crane) of five tonne capacity. Provision on the site for a second slipway to meet maximum potential demand.

- A steel preparation assembly building, which would extend from an initial area of approximately 1,000 square metres, to a maximum of 2,000 square metres, dependent of vessel size and type.

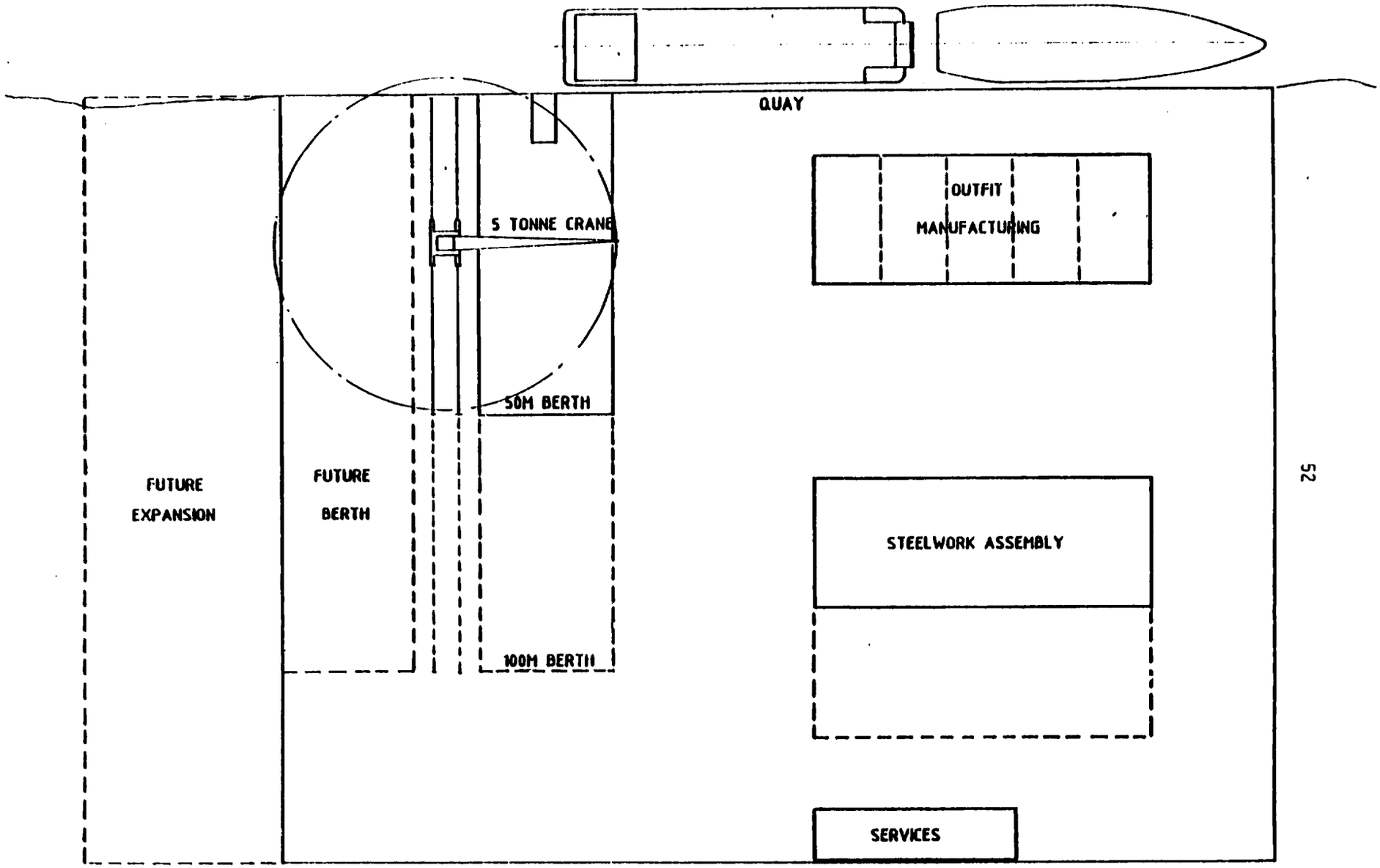


FIGURE 12

OUTLINE FACILITY - VESSELS UP TO 50 METRES LENGTH ——
VESSELS UP TO 90 METRES LENGTH - - - - -

SCALE 1:750

- An outfit workshop up to 1,000 square metres in area, to house all the equipment and trades necessary to complete the vessels.

- Various stores and offices.

- A quay at which vessels can be finished and commissioned. The aft end of the vessel at the quay is accessible by the tower crane.

- No repair facilities, because these are available at the Kenya Railway site.

The technology to be used would be as simple as is compatible with the requirements of good quality ship production. Important areas would be:

- Steel plate cutting. If the parts which are prepared are accurate, then the assembly process is made easier. Adequate investment in this area is essential, to include machines, jigs and templates.

- Steel profile cutting. The design should reduce the need for accuracy but where needed it is important.

- Welding can initially be by manual metal arc. This requires good training, but reduces the investment. It is a slow process, but a large number of welders can be employed.

- The assembly process should be divided into workstations, designed to make specific assemblies. The design of any vessel to be built should be tailored to suit the facilities.

- Large assemblies can be moved independently of cranes by use of water bearings. These are simple and robust and require minimum investment.

5. Expansion of existing facilities

As an alternative to the development of a new facility, the existing Kenya Railway site could be developed. This would significantly reduce the amount of investment, because a number of the main elements, in particular slipways, outfit workshops and quay already exist. The facility is capable as it stands of small scale steel ship production. To develop to the maximum market potential would require a development of the steel preparation and assembly workshop. In addition, a new pipe production facility would be needed. Otherwise, on the basis of initial consideration, the facility could effectively be utilised.

The proposed study should identify the facilities requirements whether new or extended in greater detail, based on a detailed evaluation of the market and the vessels to serve that market. The study should:

- Examine the selected design to identify its production requirements.
- Determine the areas required for various production operations. This would include provision for future operations based on potential market developments.
- Identify a suitable site, based on infrastructure, area, ground condition and location of vessel owners.
- Carry out building and facility design work.
- Determine costs of the facility and confirm these are in line with the overall economic assessment.
- Identify suppliers and contractors, whether local people or companies and prepare necessary documentation to seek tenders.

6. Location of facilities

The choice of location for a shipbuilding or repairing facility is a function of two groups of requirements. The first is infrastructure, and includes such aspects as:

- communications
- available workforce
- material supplies
- subcontractors
- utilities

The need to satisfy these requirements will lead to the selection of the overall location. In the case of Lake Victoria these requirements will determine the best locations along the lakeshore.

The second set of requirements determine the suitability of a particular site. They include:

- access to water
- adequate water depth
- soil conditions
- access to infrastructure
- adequate area

The general requirements of a site are set by the preliminary layout.

The proposed study will need to consider the site locations on the basis of the detailed facilities design. At this stage it is possible to consider the overall locations, though this will also form part of a project study.

For steel shipbuilding, the Kisumu area is the obvious choice on an initial assessment, on the basis of the available infrastructure.

For boatbuilding, the requirements for materials and other supplies are much smaller. If an adequate transport service can be set up on the Lake, then most sites can be serviced. Proximity to the customer then becomes important, particularly where the facility will cater for repair as well as building. A number of sites for fishing boats should be considered, each located near a fishing centre.

7. Repair

Repair must be an integral part of any overall plan to improve the utilisation of the lake. The requirements for repair will lie in the four vessel categories identified for construction.

For the small boats, building centres have been proposed which will be close to fishing centres. The building centres will be able to recover boats from the water using the same ramp as for launching. A repair area will be established adjacent to the building area. In the event of diesel engines being fitted to boats, a small work area for their servicing would be built adjacent to the slipway.

Larger boats will generally be able to be repaired at the proposed boat building facility. The outline arrangement of this facility is similar to that for fishing boats, in that the launch ramp can be used to recover vessels. An arrangement of blocks and ropes will be needed to recover larger boats.

All other vessels, especially the larger sizes, will need a more sophisticated arrangement. Any new dock or slipway would be expensive and in the medium term, the potential repair market is modest. The immediate key to future shiprepair operations on the Kenyan lakeshore, is the existing Kenya Railways drydock.

This dock has the capacity to dock the largest vessel on the lake, the Uhuru, whose dimensions are:

Length - 301 feet (91.75m)
Beam - 54 feet (16.45m)
Depth - 14 feet (4.27m)

The dimensions are the largest which would allow any new vessel to use the drydock.

With the exception of major steelwork replacement (for example, collison or grounding damage), the facility is already equipped to carry out all repairs. It is active, repairing and refitting railway vessels and during November-December 1984, a Tanzanian passenger ferry.

Nevertheless, the facility has a considerable potential for increasing its activity. In general, if a drydock is associated with quay space, so that vessels can be moored before and after docking, a dock should be able to handle fifty vessels per year. This excludes extensive rebuilding or conversion work. To achieve this level of turnover, as much work as possible is done while vessels are afloat. The vessels are only docked for essential activities, such as hull cleaning and painting, propeller and rudder repairs.

Currently, the market for shiprepair on Lake Victoria is small. However, the potential market, given that the total marine development outlined in this document occurs, is large. Including vessels from Uganda and Tanzania, it is ultimately greater than fifty vessels. It is not certain how frequently vessels require to be docked in the fresh water environment of the Lake. Nevertheless, regular maintenance is important to ensure reliability and hence good service to users of vessels. The market size may therefore eventually grow to a point where additional facilities are needed. In the short and medium term, the existing facility should be well managed and aggressively marketed to attract the available work.

The need for steelwork and pipework is greater in shipbuilding and a development to cover these needs would give adequate repair capacity.

C. Materials

1. Introduction

A range of materials can be used for hull construction. All have advantages and disadvantages for various vessel types. The main materials are:

- Steel
- Wood
- Fibre reinforced plastics (FRP)
- Aluminium
- Ferro-cement

At present, all the small fishing boats and launches are made of wood. Some of the pleasure craft are FRP and the large steamers are of steel construction.

2. Steel

For future development, it is almost inevitable that steel will be used for vessels longer than around twenty metres. It is the usual material for such vessels and normally gives both technical and cost advantages. This would have to be reviewed in the light of the import cost of steel.

3. Wood

Wood is the traditional material and is used for fishing boats in particular. It is not cheap and no longer readily available, in the types needed for boat building. Much of the suitable wood has to be imported from Uganda. Alternatives to the traditional heavy planking is the use of plywood, which can be supplied in Kenya.

4. Fibre reinforced plastics

Fibre-reinforced plastics have been used for relatively large military vessels, but would generally be used as a substitute for wood on smaller craft. The advantages of FRP are:

- Lightness
- Lack of maintenance requirements
- Ease of repairs

It is understood to be expensive in Kenya. As a material, it is easy to work. Once a suitable mould has been made, production of hulls is routine. One drawback is the generation of fumes during lay-up and curing but good ventilation can overcome this. The temperature and humidity conditions at various seasons would need to be determined to be certain of satisfactory curing.

5. Aluminium

Aluminium is very light and therefore is excellent for small vessels with a high payload requirements. Its common application is in small fast warships and patrol craft. It is however, an expensive material and for this reason, it is unlikely to figure in any boat or shipbuilding programme for the lake.

A method has recently been reported (see Bibliography, Annex 5) in which aluminium is used to produce a stressed skin vessel. This then only requires simple transverse framing. The method generally simplifies the construction technique and reduces the necessary skill levels.

6. Ferro-cement

Ferro-cement has been used infrequently for boat construction and not on a large scale for commercial operations. However, in recent years, it has attracted considerable attention as a low-cost alternative to conventional materials. In particular, it has been used for boat-construction in developing nations. It has the great advantages of cheapness and availability. It also does not require conventional boat-building skills. Some scepticism was encountered from operators as to the feasibility of such vessels, but a number of reports describe successful use (see Bibliography, Annex 5).

7. Materials study

The study should include an evaluation of different construction materials. This would be carried out in conjunction with the evaluation of designs:

- Review literature on the use of various materials, especially in the context of low cost construction of small boats.

- Identify the cost and availability of all possible materials, in various grades and sizes.

- In conjunction with the design review, calculate the cost of using different materials for the contruction of the designs which have been identified.

- Select the design/material combinations for prototype construction.

- Review the ease of construction, actual cost, wastage and performance of the various materials which have been used elsewhere.

- Make the final selection prior to production.

8. Vessel equipment

The study will examine both materials and equipment for vessels. Whereas the hull materials are expected to be supplied locally, much of the equipment, for larger vessels in particular, will have to be imported.

An investigation into the ability of local suppliers to provide suitable materials and equipment will therefore be important. Given the sheltered waters and environmental conditions less harsh than those encountered at sea, it is possible that non-marine equipment can be adapted to shipboard use.

D. Production technology

1. Introduction

The initial boat building operation will only use simple technology. Larger boats will require more equipment, possible substituting power tools for hand tools. Steel shipbuilding will use a higher level of technology, requiring a number of machine tools and some lifting equipment.

An outline of the need in equipment is given for boatbuilding and for shipbuilding. This will vary with the actual designs to be built, materials to be used and facilities. The feasibility study will establish the detailed requirements for equipment. This will be based on the assessment of the level of technology and the facilities required.

2. Level of technology

It is important to note that, with the exception of large scale welded steel construction, all the technologies which are needed exist in the Lake Basin area.

There would be some development needs to upgrade the available levels, for example, in boat building or steel assembly. The first need is for a training programme. This would have two functions:

- To introduce specifically marine skills.
- To upgrade existing skills to required levels.

A further need is for skilled supervision to ensure that work is carried out according to intention.

There is no technical expertise available related to ship design which, because its specialised nature and the small requirement, would at least initially, have to come from external sources.

Ship and boat construction is essentially an assembly industry, using relatively simple skills. A small number of workers are engaged in manufacture of parts. These require specialised training. A small number require some specialised skills to serve the assembly process. This includes, in particular, the use of templates, jigs and other means to ensure accuracy. The ability to check accuracy and ensure the vessel conforms to plans is also needed.

The feasibility study will require to establish the required technology in detail. Based on the design adopted and the facility, the study would:

- Determine the sequence of construction and the time taken.

- Evaluate alternative production processes and methods comparing costs of labour and equipment.

- Select the most suitable processes and equipment.

- Design the production system in detail and determine costs. The design will take into account local facilities and materials. Import content would be reduced to the minimum possible.

3. Production equipment - boats

Basic requirements:

- Work benches with vices
- Hand tools
- Rollers to move completed boats

For FRP:

- Hull moulds
- Resin storage and mixing
- Glass setting and lay-up

For ferro-cement:

- Hull moulds
- Cement mixing

For diesel engines:

- Hoist block
- Benches, vices
- Maintenance equipment

4. Production equipment - large boats

Requirements are basically the same as for small boats. The main difference is in the weights of the various components which require to be handled. Therefore, in addition to the equipment above, it would be necessary to provide:

- Additional hoist blocks
- Manual winch for launch and recovery
- Power tools for component production
- Generator - if no power supply to site

5. Production equipment - steel ships

Preparation:

- Overhead crane - 3 tonnes
- Flame cutting machine
- Stiffener cutting machine
- Pipe bending machine
- Jigs, templates
- Hand and power tools

Assembly:

- Overhead cranes - 5 tonnes
- Welding equipment
- Jigs
- Hand tools

Transport:

- Fork lift truck
- Trailers
- Water bearings

Ship construction:

- Tower crane - 5 tonnes
- Welding equipment
- Tools and fairing aids

On the basis of using the existing facilities, outfitting, stores equipment and offices already exist. Miscellaneous equipment would be made in-house from local materials.

6. Additional equipment - large ships

Preparation:

- Flame cutting machine
- Forming machine

Assembly/construction:

- cranes

The scale of other equipment and tools would be increased.

E. Manpower and training requirements

1. Size of labour force

A number of potential developments can be identified for marine activities on the Lake. The demand for new vessels and subsequent repair of these vessels will require additional facilities.

In order to operate these facilities, an adequate supply of trained labour is a pre-requisite. This labour will require technical support and supervision. A carefully devised and managed training programme is needed to ensure that the labour supply is available.

The size of the labour force is a function of the vessel construction and repair programme and of the productivity which can be achieved. Productivity is a function of vessel type, design, materials, technology and the quality of training. An estimate of productivity will be an important component of the study.

2. Courses and facilities

Once the size of the labour force has been determined, the training programme can be devised. The functions of the study in relation to manpower and training requirements will be:

- Determine the necessary levels of skill.
- Determine the numbers required for each type of skill.
- Determine the build up of the labour force to a steady state, and the necessary recruitment programme.

- Identify sources of labour and the existing levels of skill and education.

- Develop the various training modules needed to bring recruits up to the required skill levels.

- Determine the necessary facilities and staffing for the training programme.

- Identify sources for all the necessary resources.

- Determine the training costs.

3. Number of trainees

In order to provide a preliminary estimate of the requirements for manpower, and hence training, it is necessary first to make a set of assumptions. These are:

- A vessel construction programme, based on the potential identified above.

- Levels of productivity for boat building which are similar to existing levels. Any improvement in fishing operations, for example, would derive from the design improvements and reduced materials costs rather than reduced vessel costs.

- Levels of productivity for shipbuilding which are consistent with similar facilities elsewhere at the same stage of development.

- Shiprepair is ignored on the basis that the existing facility can absorb the available market during the time period considered.

Based on the above assumptions, an overall timetable can be developed, see Figure 13, which includes:

- Fishing boat construction and the associated build-up of manpower.

- Small ferry and miscellaneous boat building programme and manpower.

- Small steel ship (ramp ferries) and large shipbuilding programme and manpower.

The main points to emerge are:

- Boat building training is carried out in groups of five. Each group trains for six months, giving a continuous training programme over five years.

- Steel shipbulding training is carried out in groups of thirty. This reflects the need to train larger numbers over a short period. Training take place over two periods, the first to coincide with the start of ramp ferry production and the second to coincide with the start of production of international trading vessels.

- The total number of trainees is two hundred and forty, over a five year period, excluding wastage.

4. Boatbuilding

Two possibilities exist for boat building. If wood is still the most appropriate material, then training to upgrade existing boat builders could be considered. They could then use the proposed new facilities and methods, but would continue to operate on a casual ad hoc basis. The precise number of builders is very difficult to establish because of the informal way in which they operate. It is anticipated that the numbers to be trained would be approximately the same as described above.

OVERALL DEVELOPMENT TIMETABLE

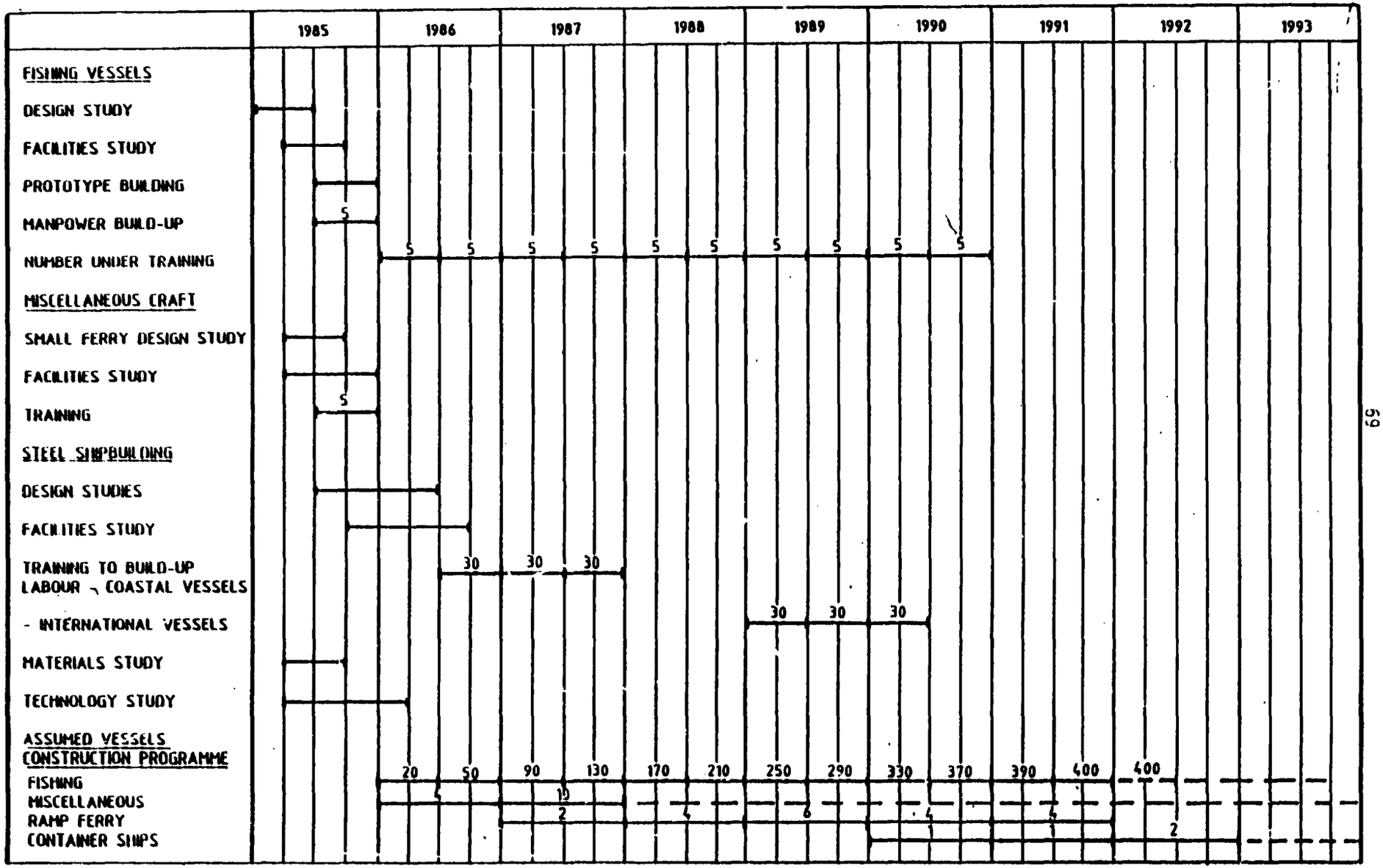


FIGURE 13

The second possibility is that a new material will be selected, or that a range of materials will ultimately be used. In this case, the trainees may be existing builders, or new entrants to boat building. The second possibility is considered in more detail.

Recruits to the training programme should have basic woodworking skills (gained for example at RIAT), or be experienced builders demonstrably willing to adapt. Some exposure to industrial environments will be important and an institution such as RIAT can provide this.

The function of the training will therefore be primarily to adapt the existing skills of the trainees to the specific requirements of boat building. A six month course is proposed, which would be largely practical, that is actual construction of boats. Like the various training estalishments which were visited, boat building training can be partly self financing through the sale of products. An outline of the course content is shown in Figure 14. This would be developed subsequently by a pilot scheme.

Figure 14

Outline training programme for boatbuilding

Recruitment - one week

- Basic skills testing
- Interview

Introduction Training - three weeks

- The programme
- Safety
- Boat characteristics
- Quality

Basic Training - two months

- Elements of boat construction
- Using materials (eg, FRP, ferro-cement)
- Using specialised tools
- Using jigs and templates
- Practical training

Planned experience - three months

- Building under supervision
- Working unsupervised
- Organising the work
- Repair of boats

The programme would last six months. It would include skills such as rigging boats, launch, recovery and handling boats afloat.

In addition to the basic training in boat building, there would be a need for supervisors to run the various building facilities and some technical specialists, for example, in diesel engine work. Supervisors would be selected from those showing special aptitude on the training course, and those showing leadership qualities in the course of working in boat buiding. Technical specialists would be recruited via the existing training establishments. Training would cover various aspects and trainees would participate in them as necessary.

Familiarisation

- Introduction to boat building
- Safety
- Quality
- Use of materials
- Use of tools and jigs
- Practical work

Organisational Skills

- Planning work
- Quality (standards and inspection)
- Material purchasing
- Discipline
- Training, welfare

Technical Skills

- Understanding plans
- Diesel engine maintenance

Some parts of the programme could take place at different sites. The numbers on a course would depend on the availability of suitable instructors and materials and on the actual demand for the various types of boats.

5. Shipbuilding

Given the existence of the railway facilities and their existing skilled workforce, the two key areas for training are steelwork and pipework. Although a low cost, non-mechanised facility is envisaged, the nature of shipbuilding is such that modern practices and small scale equipment can readily be adopted by new entrants to the field. A combination of the best available technology with a flexibility between different trades, which is often not possible in existing shipyards, should be sought. Training would be given as a series of modules covering common basic skills and necessary specialised skills.

The numbers required to be trained will depend on the numbers and types of vessel and the productivity. Once the numbers have been established, a detailed training programme can be established.

An outline training programme has been developed based on the assumptions above. The trainees would be selected from those with adequate educaton and, where appropriate, technical training. Initially, a six month course would be developed outlined in Figure 15.

Figure 15

Outline training programme for shipbuilding

To provide a degree of flexibility, all steel and pipeworkers would receive a common initial training, followed by specialised modules for particular skills. The objective would be to achieve an acceptable standard in one or two skills, to enable productive work to be started. Subsequent training would extend the range of individual skills.

Common Training

- Introduction to shipbuilding
- Layout of facility
- Use of tools
- Use of materials
- Plan reading
- Safety
- Practical work

Specialised Training
(Example for steelworker-plater)

Five modules are undertaken:

- Loftwork and marking off	6 weeks
- Preparation of steel components	8 weeks
- Assembly	8 weeks
- Welding	2 weeks
- Gas cutting	2 weeks

VI. FINANCIAL AND ECONOMIC ANALYSIS

In order to test the viability of ventures proposed and to project economic inputs and outputs to the region, a simplified model of the economy of the region should be set up. The model would consider the situation at present to assess the stocks of fish, livestock and crops, and the ranges of sustainable output together with the number of roads/jetties, dwellings and other facilities and the level of maintenance needed. It would then consider the population in the region as between the rural economy and the money economy. People will then be considered as consumers on the one hand and as producers as individuals, cooperatives, companies, etc, on the other. The position of agencies, institutions, banks and government industries will be included insofar as they affect the model in any meaningful way. People will also be considered by trade and skill, be they fishermen, drivers, boatmen, ferry operators, foremen, boatbuilders, managers, clerks, etc. People as consumers will be classified as head of a family, dependents including women, children and older people.

The model will be limited to the LBDA region. Movements of goods and services outside the region are regarded as imports and exports. Inside the region the rural economy and the money economy will be classified and transfers from one to the other identified.

The exact form of the model will be the product of the data made available. Once set up the model may be tested using historical data and can be used to project the effect of different development plans, changes to productivity, changes in production and potential capacity, etc.

Within the model each venture is considered in conventional cash flow terms to test its viability. Thus the financing needs of each venture will be established individually.

The model in aggregate shows inputs and outputs over time and stocks at points in time. It can quantify potential benefits from the development programme and help to rank them in order of priority.

VII. ORGANISATION FOR CHANGE

At this point in the feasibility study there should be defined projects which have potential and which are viable financially taken individually and collectively. The object of the study is to establish a series of ventures which once started are self-sustainable. The initial projects are likely to be low cost and involve few people so that they are easy to start. The idea for the first ferry service comes into this category. Later on there could be more expensive projects, like building steel ships to carry containers. Yet with adequate financial backing such projects are potentially viable.

The LBDA, other ministries within the Government of Kenya and external agencies will have been involved to varying degrees in the feasibility study. For example, the LBDA would control the feasibility study, its content and collection of data, provide staff and coordinate experts maybe financed by an external agency such as UNIDO.

The main responsibility for implementing ventures should be with entrepreneurs. They may work as individuals, through companies or partnerships, with cooperatives, etc. In short each venture should be implemented by the most suitable mix of entrepreneurs for that venture.

In most cases finance should be provided from normal lending agencies, such as banks, insurance companies, holding companies, etc. Each entrepreneur will be expected to take a financial risk for a potential profit.

Problems are likely to arise with the early projects since banks and others may not be prepared to take risks without suitable collateral. The Kenya Government backed as needed by external agencies, such as UNIDO, should in these cases act as underwriter and guarantor of the venture for a predetermined period. Outright grants and gifts may be essential in isolated cases but should be avoided, since they undermine the principle that ventures must be self-sustaining. If they are not self-sustaining they will not benefit the region.

The LBDA and ministries have an important continuing role after they have set the initial framework within which the entrepreneurs implement projects. Since entrepreneurs must be allowed to operate freely, the LBDA must act as watchdog on behalf of the rural community. The tax system ensures that a proportion of profits accrues to Government. If ventures are successful, capital will be re-invested in expansion. Hopefully the ferry ventures should be of this kind.

The LBDA and ministries have a particular responsibility to foster successful cooperatives and to try to encourage more of them to be viable in the interests of fishermen and the communities they serve.

ANNEX 1

FINDINGS FROM VISITS

Agencies

The LBDA is responsible for coordinating developments in the region around Lake Victoria. There is a comprehensive range of government departments responsible for specific functions.

UNIDO is able, in suitable circumstances, to provide support up to about US$ 100,000 and is well placed to coordinate other agencies who may provide assistance in the form of loans, grants, guarantees, etc.

Facilities

The Railway Workshops at Kisumu have the capacity and potential to build and repair steel vessels up to the largest on the Lake at present. The management of these workshops would need to operate along commercial lines to benefit fully from a shipbuilding programme or from re-activating shiprepair.

The Fisheries Department boatyard is capable of building wooden and FRP boats up to 15 metres. The management needs to be on commercial lines. Experiments with different designs and building materials could be carried out in this boatyard.

Education, Labour and Training

It is clear from visits to a range of educational establishments that the standard of technical achievement is adequate for the future demands for skilled labour for boatbuilding and repairing.

There is a pool of unemployed people in Kisumu and the immediate area. Some additional training would be needed.

WECO operate a production unit which makes excellent water pumps.

The Ramogi Institute is planning to set up a small boatyard on the Lake.

Minimum pay rates for carpenters and sheet metal workers range from:

-	No grade	687/70 Kenya shillings per month
-	Grade III	862/50 Kenya shillings per month
-	Grade II	966/- Kenya shillings per month
-	Grade I	1,173/- Kenya shillings per month

See Regional Wages Order, Legal Notice 120/1982.

Utilities

Electricity supplies are available at 415 volts, 3 phase at 50 Hts and 240 volts, single phase at 80 Hts. It is possible to provide 11 kV, 3 phase at 50 Hts.

A new boatbuilding facility would have to pay for the cost of an additional line from the nearest existing supply and also for the cost of additional conductors on existing lines.

Budget costs will be quoted when a site is chosen and estimated demand established.

It was not possible to find out the position on water supplies as all relevant staff were on leave.

Fishermens' Cooperatives

Some cooperatives provide a valuable service to their members. The most useful service is to offer a stable price to fishermen on the beach. The cooperatives then sell-on to traders locally and beyond. The subsequent profit is then shared with members.

Other cooperatives do little more than provide a clerical service in return for 10% of sales put on loan to the cooperative by members.

Fish prices on beach are about 1/70 per kilo for Nile perch.

Cost of wood and materials, excluding sails, can be 8,600/- out of total cost of 9,000/- for a boat (the boatbuilder gets 400/- for working during about two weeks to assemble the boat).

Entrepreneurs

Nile perch are purchased at beaches from fishermen direct or through a cooperative. Fish is ice chilled and moved by road to Nairobi. Most is sold in Nairobi, a little goes to Mombasa and small quantities are exported, mainly to England.

Purchases at beaches are at about 2/- per kilo. Wholesale prices vary according to how the fish are sold (fillets, blocks, etc). The trade is profitable but urban Kenyans cannot afford high prices nor can they afford to eat large quantities of fish. Not everyone likes Nile perch, which is inclined to be fatty. Thus the amount of fish that can be sold this way is limited at present.

Visits Made

Some 24 separate sets of people were seen in fourteen days, see Table A1.

Table A1

People and places visited

1)	United Nations Development Projects Workshop Road, Nairobi. Tel: 28776 Mrs Cheryl Round-Turner	Monday, 3 Dec
2)	Lake Basin Development Authority PO Box 1516, Kisumu. Tel: 40230 / Tlx: LABDA 31011 Mr S B Obura, Managing Director Mr J N Bonuke, Deputy Managing Director Mr A P Achieng, Fisheries Specialist Mr Moses Lihemo, Industrial Economist Mr David L Mshila, Senior Planner	Tuesday, 4 Dec to Wednesday, 11 Dec (incl)
3)	Railway Workshops, Kisumu Mr Charles Mbasa	Wednesday, 5 Dec
4)	Education Office, Kisumu Mr Samuel K Cherniyot	Wednesday, 5 Dec
5)	Labour Office, Kisumu Mr E H Ochieng	Wednesday, 5 Dec
6)	Industrial Training Centre PO Box 1732, Kisumu Mr James Makombwa, Senior Training Officer	Wednesday, 5 Dec
7)	Statistics Office, Kisumu Mr P O Agulo	
8)	The Kenya Power and Lighting Company, Kisumu Mr Eric K Korir	
9)	Ramogi Institute of Advanced Technology PO Box 1738, Kisumu	Thursday, 6 Dec
10)	Western College of Arts and Applied Sciences PO Box 190, Kakamaga Tel: 20455 Mr Mark Kisembe, Deputy Principal WECO	Thursday, 6 Dec

11)	A village polytechnic near Kakamega	Thursday, 6 Dec
12)	Afro Impex Agencies (1979) Ltd Obote Road Kisumu Mr Oracha	Thursday, 6 Dec
13)	Motor Ship Across Winan Gulf from Kisumu to Kendu Bay	Friday, 7 Dec
14)	Kendu Bay Cooperative Beach fish sales and boatbuilding	Friday, 7 Dec
15)	Homa Bay Cooperative Beach fish sales and boatbuilding Mr James Siwombuga Mr Aggreys Busiega	Friday, 7 Dec
16)	Mbita Cooperative Beach fish sales Mr Moses Tonga Mr John Oko Otieno Mr Moses Ocar Mr Otula	Friday, 7 Dec
17)	Karungu Cooperative Beach fish sales and boatbuilding	Saturday, 8 Dec
18)	J J Cottington Ltd PO Box 47648, Nairobi Mr Solomon W Ohingo	Saturday, 8 Dec & Sunday, 9 Dec in Kisumu and Thursday 13 Dec in Nairobi
19)	Fisheries Department Boatyard Near Kisumu	Monday, 10 Dec
20)	Kaloka Cooperative Beach fish sales and boatbuilding	Monday, 10 Dec
21)	Final meetings with LBDA	Tuesday, 11 Dec
22)	Travel Kisumu/Nairobi (National holiday - JAMHURI)	Wednesday, 12 Dec
23)	Samaki Industries (Kenya) Ltd PO Box 41218, Nairobi Tel: 556359/555825 / Tlx: 22104 Mr Janmohid (John) Varjee, Managing Director	Thursday, 13 Dec

24) Kenya Coid Storage, Nairobi — Thursday, 13 Dec
Mr Fiaz

25) UNIDO — Friday, 14 Dec
Wagramer Strasse 5, Vienna 22, Austria
PO Box 300, A-1400 Vienna
Tel: (0222) 26310
Dr Milan D Delos, Engineering Industries Branch
Mr Smirnov (Deputising for Mr Eugeniy G Sharapov)

ANNEX 2

USEFUL STATISTICS

Source	1983 - Central Bureau of Statistics Ministry of Economic Planning and Development
Lake Victoria	3,755 km2 area in Kenya
Rainfall	1,367.6 mm/year - average
Temperature	Mean maximum 29.9 degrees Centigrade Mean minimum 17.1 degrees Centigrade
Humidity	Mean at 1,200m Monthly range 41 to 55
Sun	Mean Monthly range 7.7 to 9.3 hours per day
Population	Kenyans - 15.1 Other - 0.2 15.3 million in Kenya
Population	Kisumu region 482,000 2,093 km2 Density 230 km2 NB Nairobi 1,210 persons/km2 Mombasa 1,622 persons/km2

Tribes

	Male	Female	Total
Kikuyu	1.5	1.6	3.2
Luhya	1.0	1.1	2.1
Luo	1.0	1.0	2.0
Kamba	0.9	0.9	1.7
Meru	0.4	0.4	0.8
Kisii	0.5	0.5	0.9

About 28 tribes (including above)
+ other nationalities
Total Kenyans 15.1 million

Population Age	0 - 4	2.8 million	45 - 49	0.4 million
	5 - 9	2.5	50 - 54	0.4
	10 - 14	2.1	55 - 59	0.3
	15 - 19	1.7	60 - 64	0.2
	20 - 24	1.3	65 - 69	0.2
	25 - 29	1.1	70 - 74	0.1
	30 - 34	0.8	75 +	0.2
	35 - 39	0.6	Age NS	-
	40 - 44	0.5	Total	15.3 million

Education	None		7.8
	Primary	1-4 years	3.5
		5-7 years	2.6
	Secondary	1-4 years	1.1
		5+ years	0.1
	Others		0.1
			15.3 million

NB: Males better educated

Birth/Deaths 1977	Nyanza Thousands	Kenya Thousands
Births	45.6	275.8
Deaths	10.4	47.3
Infant deaths	2.8	

Little migration 1,700 in 1982

Holiday/Business Visitors 433,200 (all Kenya)

Sources of Arrivals	Thousands
- Africa	122.6
- America	46.9
- Asia	30.8
- Europe	229.3
- Other	3.7
Total	433.3

Visitors 1982 Length of stay:	Average Stay	Total Days	Reason	Average Stay	Total Days
0 - 14 days	7.3 days	1,684	Holiday	25.1 days	6,716
15 - 28 days	20.5 days	1,755	Business	14.4 days	608
28 + days	122.9 days	4,113	Transit	5.5 days	228
		7,552			7,552

Visitors from	
- East Africa	307
- Other Africa	555
- UK	1,041
- West Germany	1,919
- Other Europe	2,499
- North America	675
- Asia	457
- All Other	98
	7,552 days

Hotel Rooms 1982	Nyanza Basin	
- Rooms (thousand)	148 room nights	262 bed nights
- Occupancy	47%	34%

Guest Nights 1982	Thousands
- Nairobi	1,400.7
- Coastal	2,425.1
- Other	802.7
Total	4,628.5

At current prices	1982	
GDP at factor cost	2,950.62 K£million	20/- = K£1
- Traditional	164.47	per capita 172.4K£
- Monetary	2,786.15	fishing 7.44m

Add Indirect taxes		471.24	
Deduct Subsidies		1.58	
GDP at market prices (A)		3,420.28	
Add Imports - goods and services		1,041.40	) Imports exceed exports
Deduct Exports		856.80	) by 184.6 K£m
Resources for domestic investment and consumption		3,604.88	
Gross fixed capital formation		686.96	
Changes in stocks		77.03	
Gross investment		763.99	
Public consumption		663.50	
Private consumption		2,177.39	
Total consumption		2,840.89	
Also GDP at market prices (A)		3,420.28	
Add Factor income from abroad		25.70	
Deduct Factor income paid abroad		157,50	
Gross national product		3,288.48	
Production accounts			
GDP at factor cost		2,950.62	
- Labour costs	1,233.08		
- Operating surplus	1,717.55		
Of which fishing			
Gross output	8.38		
less international consumption	0.94		
GDP		7.44	
Labour costs	1.84		
Operating surplus	** 5.58		

** includes consumption of fixed capital

Balance of Payments 1982 — K£ million

	Debits/Assets	Credits/ Liabilities	Net Credits
Current account			
- Visible	976.3	519.5	456.8 DR
- Invisible	244.4	421.6	177.2
Sub-total	1,220.7	941.1	279.6 DR
Capital	13.5	184.4	170.9
Monetary changes	17.9	122.7	104.8
Errors and omissions	-	-	3.9

Fish

918 tonnes fish preparations exported in 1982
7,186 tonnes fish preparations exported in 1979

		1982 K£ m	
Imports		Exports	
Crude Petroleum (2,162 tonnes)	299	Agricultural products	262
		Petroleum/coal	149
Others	601		
		Others	135
Total	900	Total	546

Import duty 1982 — K£158 million

Only 806,000 people in establishments 1982

Quantity and value of fresh water fish landed 1982		K£ m	K Sh per Kilo
Lake Victoria	57,000 tonnes	5.1	1/79 cents
Ponds	440 tonnes	1.3	2/95 cents
Others	12,560 tonnes	1.0	1/59 cents
Total	70,000 tonnes	7.4	2/11 cents

Production - manufacturing 1977	Kenya	Kisumu District	K£000
- Establishments	13,999	75	
- Persons	169,943	2,263	
- Labour cost	85,193	6,899	
- GDP K£K	195,103	1,301	
- Input	861,237	3,269	
- Output	1,056,040	4,570	

Electricity	1982 kW	
- Nairobi & Mt Kenya	396,400	installed capacity
- Coast	110,200	
- Rift Valley, Western	31,500	
		(Thermal 189,600
Total	538,100	(Hydro 348,500

Million Kwh 1982	Prod/Impts	Sales	
Nairobi & Mt Kenya	1,464	957	
Coast	262	392	
Rift Valley	-	86	
Eldoret, Nyanza, Kitch	0.6	195	
Total	1,726	1,631	
Imported ex Uganda	212	315	power station transmission losses
	1,939	1,946	

Sales by use 1982	Kwh
- Domestic	451
- Off peak	114
- Industrial	644
- Community	406
- Streets	11
- Staff quarters	3
Total	1,631

Interest rates 1982		Range %		
- Bills, etc, Central Bank 1982	13.48	to	14.50	
- Commercial Banks type/time	12.50	to	16.00	
- Post Office	10.00	to	-	
- Agriculture Finance	12.00	to	14.00	
- HP	16.00	to	16.25	
- Building Loans (Deposit)	15.25	to	16.00	(Loan)

Land Development Loans

- March 1982	K£4.3 b	(4,290,710,000)

New Agricultural Credit

- 1982	K£14.2 m	(14,170,000)

East African Industrial Shares Index

- December 1983	382.23	(1 Jan 64 = 100)

Transport Value of Output	K£m
- Rail	49.9
- Road	117.8
- Water	54.6
- Air	48.4
- Incidental	40.3
	311.1
Pipeline	20.1
Communications	74.8
Total	406.1

Earnings

Passenger Traffic	
- Rail	4.4
- Road	38.7
	43.1

	Kfm
Freight	
- Rail	45.5
- Road	79.1
	124.6
Totals	
- Rail	49.9
- Road	117.8
	167.7

Kenya Railways and Harbours 1982	Kfm
Revenue	42.2
Water transport	0.077 *

Kenya Railways and Ports	
Expenditure - operations	36.3
Water transport	0.664 *

Road Vehicles 1982	
- numbers	247,867 (incl 114,710 cars)

Telephones in use	
- Call offices	655
- Direct exchange lines	75,682
- Extension phones	126,303
	202,640

Schools 1982

- Primary	11,497
- Secondary	2,131
- Teacher Training	21
- Technical	18
	13,667

Pupils 1982

- Primary	4,184,602
- Secondary	438,424
- Teacher Training	11,405
- Technical	9,199
	4,643,630

Teachers 1982	Trained	Untrained	
- Primary	80,664	34,430	
- Secondary	8,277	8,571	
- Teacher Training	720	-	
- Technical	343	192	
			133,197

Taxation 30 June 1981 for Income Year 1980

		Individuals and Employees	Companies and Clubs	Totals
Number		41,536	4,585	46,121
Income	K£m	94.3	53.1	147.4
Tax payable		21.0	21.2	42.3

Note: Incomes and tax much higher 1976/77

Wage employment 1982	'000		
- Private agriculture	167.5	District	Kisumu 35,400 persons (B)
- Other private	372.9	Town	Kisumu 17,500 persons (A)
- Public	497.6		
	1,038.0 persons		

Wage Employment Kisumu Town 1982

- Agriculture	123
- Mining	32
- Manufacture	3,913
- Electricity, water	415
- Construction	1,231
- Wholesale, retail	1,680
- Transport	1,332
- Finance, Insurance, Business	852
- Community, Social, Personal	7,876
	17,454 (A) persons

Earnings 1982	K£m	K Sh per month
Kisumu District	24.9 (B)	1,171/67
Kisumu Town	14.7 (A)	1,403/33

ANNEX 3

PROTEIN COST INDEX FOR SELECTED COMMODITIES, 1980

Commodity	Protein content %	Mean price to producers K Sh/100g 1971	1980	Annual increase %	Protein cost index 1980 K Sh/100g	Protein cost equivalent to fish
Cereals	(a)	(b)	(b)			
Maize	9.3	0.33	0.95	15.08 +/- 9.86	1.02	0.8
Wheat	10.5	0.51	1.64	14.61 +/- 8.35	1.56	1.3
Rice	7.0	0.48	1.51	15.8 +/- 15.74	2.16	1.8
Meats						
Beef (low grade)	20.6	2.85	7.95	12.4 +/- 5.68	3.86	3.2
Pig	12.4	3.70	8.59	10.17 +/- 6.02	6.93	5.7
Mutton	16.9	2.51	10.97	22.06 +/- 24.5	6.49	5.4
Poultry	19.0	-	(10)	-	(5.26)	4.3
Fish						
All 850109	18.8	1.09	2.27	10.19 +/- 5.34	1.21	1.0
Tilapia (Lake Victoria)	12.0	1.52	3.52	10.15 +/- 5.82	2.93	2.4
Milk	3.8	0.69	1.46	9.08 +/- 6.25	3.84	3.2

a) Protein content estimates after Ritchie, 1978
b) Producer prices according to Kenya, 1979a and Kenya, 1981a

ANNEX 4

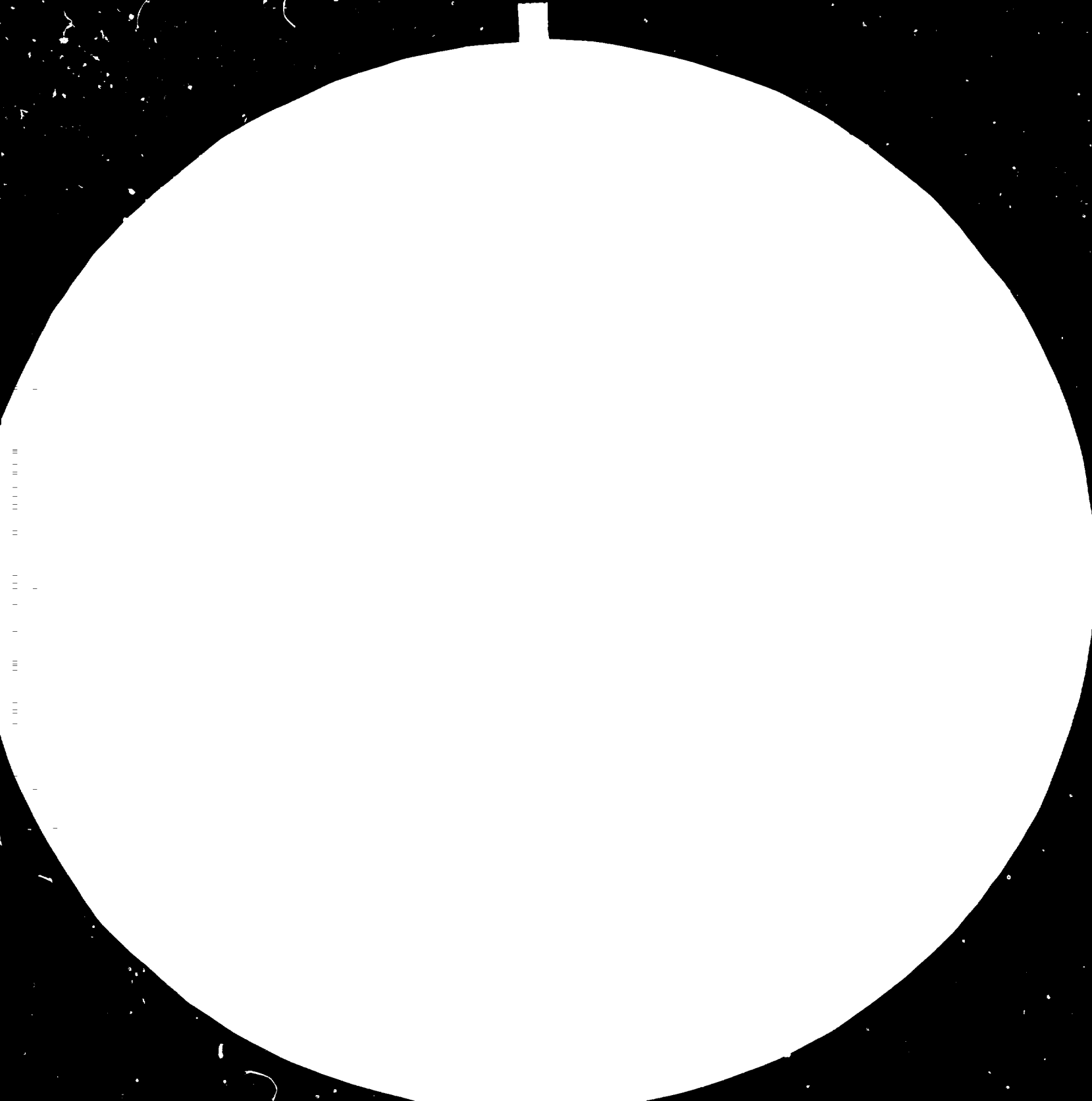
FISHERMENS' COOPERATIVE

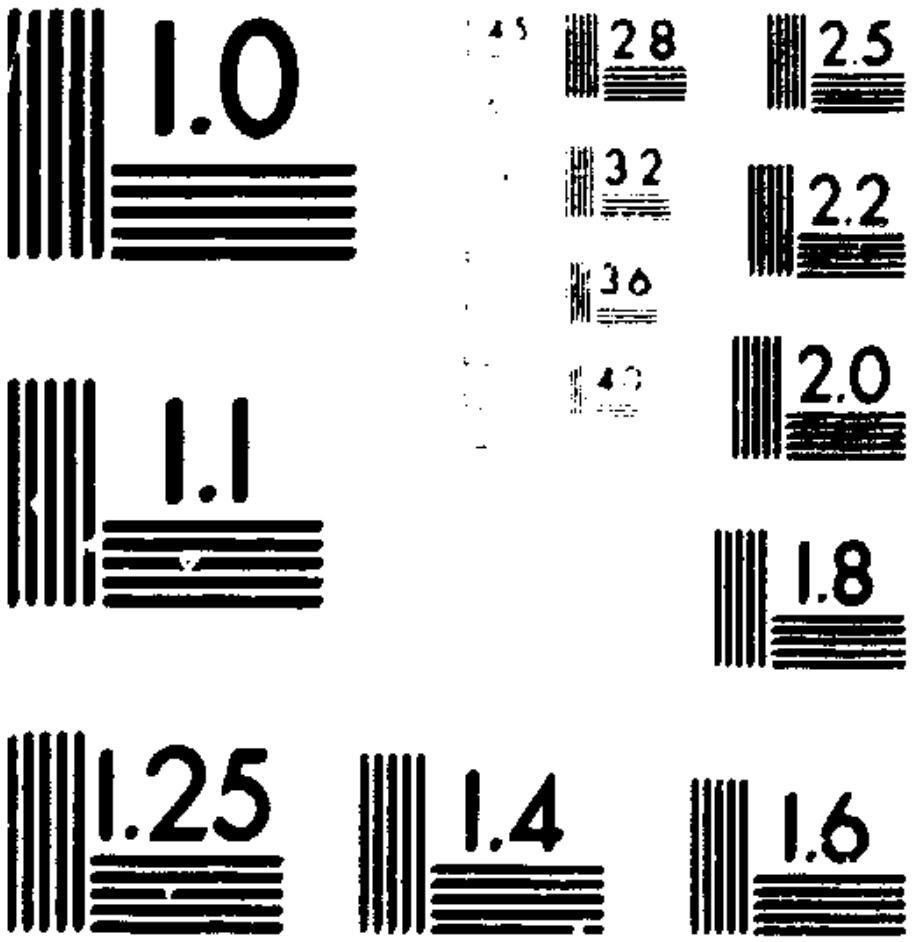
	Members /active	Fisher -men	Boats Mbrs	Boats Others	Turnover Comm	Turnover Others	Cost Salaries Comm	Notes*
Wanyama Rusinga	300/na	2,500	800	400	7,238	-	6,544	PB 1
Mfangano	149/na	na	130	120	12,584	-	30,360	PB 1
Gembe	582/na	600	300	100	10,410	-	15,802	PB 2
Lambwe (proposed)								
Kasingri	178/57	350	20	80	18,000	-	11,400	PB 2
(all above part of Mbita)								
Gwasi	200/na	1,200	-----30----		na	-	8,400	PB 1
Karungu	20/na	na	60	240	na	na	na	na
North Kadem	90/90	260	41	na	na	na	20,400	-
Muhuru Bay	303/285	600	250	100	19,000	-	9,300	V(1)
Arako, S Kadem	136/na	360	25	na	15,000	-	na	na
Homa Bay	319/150	500	105	50	18,000	-	22,020	(2)
Ngegu	500/362	1,000	53	30	7,200	-	2,448	-
Luanda Kanamu (proposed)								
W Karachouonyo	375/278	2,000	340	60	na	-	660	-
Kendu Bay	238/160	1,800	129	na	16,000	35,000	10,860	-
Wang Chieng	153/120	1,560	150	115	53,000	-	21,600	-
Samia	265/150	400	----114----		9,834	-	9,600	(4)
Bunyala	820/300	4,000	250	1,290	24,000	-	12,720	(5)
Yimbo	358/150	2,500	703	160	19,797	-	10,800	-
East Asembo	44/42	70	38	-	8,500	-	4,450	-
West Asembo	29/20	200	38	-	8,500	-	4,450	-
Uyoma	200/200	2,500	150	850	42,178	-	36,000	-
Misori	103/100	300	45	118	na	-	18,900	-
Wichlum	266/180	320	50	40	18,000	-	9,720	-
Liunda	190/170	500	200	50	38,000	-	11,580	-
Asat	120/75	200	76	74	2,000	-	7,200	-
Kaloka	150/25	250	54	-	30,999	85,000	13,800	-
Ogal	120/na	176	-----44----		24,000	-	na	-
Paga (proposed)								
Usoma	60/46	300	63	24	15,000	-	2,160	PB 3
Dunga	69/47	100	-----70----		8,775	-	na	-
Nyakweri (proposed)								
Miruti	40/40	300	-----45----		na	-	7,800	-
Nduku	180/180	600	180	40	6,000	-	-	-
Nyakach	214/150	350	----500----		na	-	9,000	-

1) Japanese smoke oven never used since no knowhow.
2) Outboard engines 6 HP to 15 HP.
3) 11 with 15-45 HP Yamaha and Johnson outboard engines.
4) Women have nets stolen so beach seine only.
5) 50 mechanised boats courtesy coffee boom (ended 1978).

* Powered boat (PB) Vehicle (V) not available na.
Members (mbrs) Commission (comm) turnover & costs K shg per year
Source: Survey by Norwegians about 1982


85.05.22
AD.86.07





ANNEX 5

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ANNEX 6

DRAFT TERMS OF REFERENCE FOR A FEASIBILITY STUDY

Determine supply of goods and services from the region:

- goods including fish, livestock, agricultural products.
- inhibiting factors includng pollution, climate, fish husbandry.
- potential in future.

Investigate markets:

- movement of people and goods, routes, centres of population, seasonal variations, consumption patterns.
- costs and prices, from producers, transport, wholesale, retail.
- identify modes of transport needed including boats and ships.
- potential in future.

Review the existing situation:

- vessels operating on the Lake at present, types, routes, uses, fishing.
- Kenya Railways ferry services, vessels, routes, fares, costs, load factors.

- shore establishments around Lake, Railways Workshop, Fisheries Department boatyard, boatbuilders.

- fishing and sales outside the region, methods, ice cooling, motorised boats, costs, prices, selling and marketing, types of fish, cooperatives.

- infrastructure jetties, roads, rail, air, utilities, electricity, water, telephone, telex, supply of materials, financial services, labour supply.

Consider development programmes suggested from market study:

- new and existing vessels, fishing, transport, ferries, 'mother' ships, ramp ferries.

- new or improved facilities to build vessels identified and to repair them, location, size.

- use of materials, wood, steel, FRP, ferr-cement.

- level of technology needed to build vessels, productivity, equipment.

- manpower and training requirements.

Financial and economic analysis:

- existing situation.
- development proposals individually and together.
- financing.
- economic effect on region.

Action plan:

- who does what and when.
- identify specific, low cost ventures for early action.