CHAPTER 3 PROJECT DESCRIPTION

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3-1 Project Necessity

The Government of the Gambia is implementing measures to promote and develop artisanal fishing. It has also formulated the "Project for Development of Artisanal Fisheries" to vitalize the fisheries industry, modernize the fishing vessels, increase fish catches, and reform the distribution system. When the proportion of motorized fishing vessels is increased, the fishermen must be trained on the operation, maintenance, and repair of the outboard motors to be introduced.

(Mechanical training and repair workshop, and introduction of outboard motors)

Traditional fishing nets and gear are still being used. To increase fish catches, it will be necessary to develop more effective fishing nets and gear.

(Fishing net training and repair workshop, and introduction of fishing nets)

With its forestry resources steadily diminishing due to droughts, the Gambia will have to import wood to build traditional wooden canoes. With the lack of foreign currency, the Gambia is pressed to switch from wooden canoes to FRP vessels.

(Introduction of FRP fishing vessels)

Fresh and frozen fish is being distributed only within the vicinity of fishing villages. The distribution system must therefore be reformed to enable the transportation and marketing of fresh and frozen fish to inland areas.

(Introduction of refrigerator truck)

The transportation means for carrying out outboard motor repairs and fishing net repairs will be necessary to collect fisheries statistics.

(Introduction of motorcycles)

In order to resolve these coastal fisheries problems, the implementation of this Project is urgent due to the necessity of the requested items.

3-2 Project Objectives

The Project aims to train fishermen, modernize the fishing vessels, reform the distribution system, reinforce the outboard motor and fishing net repair operations, and improve the fisheries statistics collection system.

The Project's objectives are as follows:

① Fishermen training

A workshop building will be constructed. The ground floor will have two workshop areas, one for mechanics training and the other for fishing gear training. The first floor will have a lecture room to conduct classroom instruction.

② Modernization of fishing vessels

i. Wooden fishing vessels will be phased out in favor of FRP vessels. (Introduction of FRP vessels)

ii. Motorization of fishing vessels. (Introduction of outboard motors)

③ Distribution reform

Introduction of a 5-ton refrigerator truck.

④ Facilitation of outboard motor and fishing net repairs and fisheries statistics collection

Introduction of transportation means.

3-3 Request Analyses

The Basic Design Study for the Project confirmed that the Project's objectives were for the development of artisanal fishing. They included: fishermen training, modernization of fishing vessels, distribution reform, and reform of fisheries statistics collection methods. To assess the attainability of the Project's objectives, the capabilities of the Fisheries Department (the implementing agency), the potential of realizing the Project, the current status of the Gambia's fisheries industry, and the position of Japan's grant aid system were taken into consideration. The request was thereby studied. The following table shows the details of the request received during the Basic Design Study, based on the discussions that were held.

3-3-1 Workshop

No.	Item	Items requested	Analysis	Results
1	Scale	Workshop: 1 ground floor: Workshops for mechanical and fishing gear repairs, and storage rooms. first floor: 14 offices and 1 lecture room Total floor area: Approx. 1,050 m^2	(Items discussed) (1) Since the survey team deemed the general-purpose office to have no direct connection with the Project, it was not included in the Project. The Gambian side understood the decision. (2) A lecture room, workshops (as shown on the floor plan), offices, storage rooms, dormitory facilities, etc., were deemed necessary for fishermen training and equipment repair. (Items studied) (1) First, the equipment arrangement plan and work space shown on the mechanical training/repair workshop's floor plan were studied. (2) The fishing gear training/repair workshop's work space was studied while taking into consideration the 10-meter length required by the bottom gill net. (3) The capacity of the storage room was studied with regard to the quantity of parts, tools, nets, and gear that would be stored.	It was decided that the workshop building would be designed as follows: (1) Construction: 2-story, steel-frame construction with partial 1-story structure (2) Purpose and room name (a) Mechanical repair and training: Workshop, office, and storage room (b) Fishing gear repair and training: Workshop and storage room (c) Lectures and conferences: Lecture/conference room (d) Training: Training materials room, specialists' office (e) Trainee dormitory: 4-person room x 2 (4) Other facilities Entrance hall, stairway, corridor, lavatory

No.	Item	Items requested	Analysis	Results
			(4) There was to be one administrative office to manage both the mechanics and fishing gear workshops. (5) The lecture room was to also serve as a conference room. The room was to have a maximum capacity of 9 persons for mechanics lectures and 13 persons for fishing gear lectures. (6) The instructors' office would be used by the mechanics specialist and the fishing gear specialist. (7) It was estimated that about 80% of the trainees (10 trainees x 0.8 = 8 trainees) will come from distant areas. The two dormitory rooms have therefore been made large enough to accommodate 4 trainees each. (8) The training materials room will house model nets, engine parts, and books for training purposes.	
2	Utilities			(a) Water supply: Existing water pipes are to be used. (b) Drainage: Sewage and effluent are to be discharged to the main sewage pipe. Rainwater will be allowed to seep into the ground of the site.

No.	Item	Items requested	Analysis	Results
				(c) Hot water supply and fire hydrant: None (d) Electricity: For room lighting, a branch power line will be connected from the Fisheries Department building's distribution board. (e) Telephone lines: A branch telephone line will be connected from the Fisheries Department building. Interphones will also be installed. (f) Air-conditioning: None (g) Ventilation: Ceiling fans will be installed on the rooms' ceiling, and ventilation fans will be installed in the workshops and lavatory. (h) Furnishings: Room furnishings will be determined according to the size of the room.
3	Workshop equipment	All equipment necessary for the repair of outboard motors (gasoline or diesel powered), a refrigerator truck, and motorcycles.	Tools absolutely essential for the disassembly, repair, and installation of gasoline and diesel outboard motors were selected. Vehicle jacks were also included.	
4	Tools	Repair tools, tools for training purposes, and tools for the local offices of the Fisheries Department.	Basically, there will be one set of tools for repair purposes. Tools subject to frequent use and breakage will be supplied in multiple quantities. A separate set of tools will be reserved for trainees and small basic tools will be provided to all trainees. Providing tools for the local offices was not considered.	

3-3-2 Equipment

(1) FRP vessels

No.	Item	B/D requested	Qty.	Analysis	Results	Qty.
1	FRP vessel	4.7-meter FRP fishing vessel	100	1 These will be used as river shrimp fishing canoes. Being compact and light, they are easy to operate. 2 This type of canoe is most commonly used for river fishing. 3 Two vessels will be reserved for training purposes and the remaining 48 will be distributed to fishermen.	It was concluded that granting easily operable canoes to fishermen to promote river artisanal fishing would be effective. However, since it might strain the fishermen's operations, the quantity will be reduced.	50
2	FRP vessel	7.1-meter FRP fishing vessel	50	1 These will be used for gill net lobster catching in downstream river waters and the ocean. 2 It was deemed that 50 vessels would be excessive. It was decided that 15 vessels would be appropriate.	With gill net fishing being the main method of canoe fishing, the number of vessels will be reduced to allay fears of excessive competition.	15
3	FRP vessel	12.8-meter FRP fishing vessel	10	1 One vessel will be used by the Fisheries Department for training purposes to promote surrounding gill net fishing. 2 The vessels will be distributed to coastal fishing villages for surrounding gill net and floating gill net fishing. During the bonga season, they will be used for surrounding gill net fishing.	Since the vessel price would be high in the Gambia after arrival, it might burden the fishermen's operations. However, installing diesel outboard motors would bring substantial fuel savings and contribute to the fishermen's income. Three vessels will be granted. Two will be used on an experimental basis and the third will be granted to the Fisheries Department for training purposes.	3

(2) Outboard motors

No.	Item	B/D requested	Qty.	Analysis	Results	Qty.
1	Outboard motor	4 hp gasoline outboard motors	50	Although river fishing canoes were to be motorized, the plan was dismissed because: 1 The low horsepower of the motor would not be effective considering the river's current. (Maximum of 4 knots, with an average of 2 knots.) 2 There is still no demand for such motors among the Gambian fishermen. Obtaining spare parts would also be a problem.	Due to the reasons stated on the left, 4 hp motors will not be included.	0
2	Outboard motor	8 hp gasoline outboard motors	120	1 Since this motor is most commonly used among artisanal fishermen, they are accustomed to this type of motor. Spare parts are also readily available. 2 These will be installed on the 4.7-meter FRP fishing vessels earmarked for the Project.	1 These motors will be installed on 50 of the 4.7-meter FRP fishing vessels. 2 Three will be used for training purposes.	53
3	Outboard motor	40 hp gasoline outboard motors	50	Due to its high fuel consumption, this motor would burden fishermen operations.	These motors will not be included since they will be replaced by diesel outboard motors.	0

No.	Item	B/D requested	Qty.	Analysis	Results	Qty.
4	Outboard motor	27 hp diesel outboard motors	30	1 Fuel and repair costs are low. 2 The workshop will be equipped with these motors for repair training purposes.	The survey team proposed this type of motor since it would reduce operating costs for artisanal fishermen, and it could also be converted into a gasoline engine in the future. 1 To be installed on fifteen 7.1-meter FRP fishing vessels. 2 To be installed on three 12.8-meter FRP fishing vessels. 3 Three units will be reserved for training purposes. 4 To be installed on the repaired training vessel that was granted in 1982.	22
		Spare parts			A minimum, essential quantity of diesel engine spare parts will be provided.	

(3) Fishing nets and gear

No.	Item	B/D requested	Qty.	Analysis	Results	Qty.
1	Fishing net and gear	Bottom gill nets	150 units	1 Three units (900 meters) will be distributed to each fisherman who has completed or will complete the training plan. 2 The Fisheries Department will reserve 5 units for workshop training purposes and as a reserve.	Since this was the main method used in Gambian artisanal fishing, its development was deemed necessary. The quantity will be determined after taking into consideration the quantity of FRP fishing vessels stipulated by this Project.	75 units
2	Fishing net and gear	Surrounding gill nets	10 units	1 One net of 10 rolls and a 12-meter FRP fishing vessel equipped with an outboard motor will be distributed to each fisherman who has completed the training plan. 2 The nets will be distributed to 10 fishermen.	This was deemed essential for catching bonga, the mainstay fish stock of artisanal fishing. The quantity will be determined after taking into consideration the quantity of FRP fishing vessels to be granted for this Project.	5 units
3	Fishing net and gear	Finished surrounding gill nets Net material	2 3 units	1 The net will be loaded onto the Fisheries Department's training vessel (FRP inboard engine) for surrounding net training purposes. 2 A net will be tailored under the guidance of a net specialist. The net will then be loaded onto the training vessel (granted in 1982) for training purposes.	Since this is an effective method for increasing fish catches through the Fisheries Development Project and since it is also to be used for training purposes, the quantity requested will be approved.	1 unit 1
4	Fishing net and gear	Stow nets	20 rolls	1 The nets will be tailored under the guidance of a net specialist and distributed to fishermen for stow net river shrimp fishing. 2 Eighty sets will be made and distributed to eighty fishermen (1 set each).	Since this is the main method used for river fishing and since it is effective for development purposes, the quantity requested will be approved.	20 rolls

(4) Other items

No.	Item	B/D requested	Qty.	Analysis	Results	Qty.
1	Refrigerator truck	5-ton-capacity refrigerator trucks	2	(Items discussed) (1) Representing the Government of the Gambia's position, the Fisheries Department stated that it wanted to avoid undertaking the maintenance and management of the refrigerator trucks. The survey team assessed the appropriate quantity. (2) The survey team stated that the refrigerator trucks must be used effectively to avoid losses due to fish spoilage. (Items studied) (1) It was decided that after holding mutual discussions, careful consideration would be given to the means of transporting frozen fish. The quantity of refrigerator trucks would then be decided.	The quantity of refrigerator trucks would be determined after taking into consideration the effective use of the Fisheries Department's 2-ton refrigerator truck (granted in 1987).	1
2	Winches	Canoe landing winches	20	(1) At present, canoes are landed manually. This requires much human labor and poses safety hazards. (2) Manual landing winches will be used on a trial basis at each fishing village to promote efficiency and safety.	For artisanal fishing, landing winches are needed to ease canoe landing operations and increase safety. Since the winches will be used on a trial basis, the quantity will be adjusted.	16 pcs.

No.	Item	B/D requested		Analysis	Results	
			Qty.			Qty.
3	Motorcycles	Off-road motorcycles	20	(1) The Fisheries Department personnel stationed at the local offices will mainly perform outboard motor and fishing net repairs. (2) It is necessary to collect fisheries statistics to help realize the Fisheries Development Project's main objective of managing and exploiting fishery resources effectively. However, the Gambia's lack of transportation has hampered the collection of fisheries statistics. (3) Although it was requested that all twenty personnel to be stationed at the twelve local offices be assigned a motorcycle, the inclination was to distribute only one motorcycle to each of the twelve offices.	Three local offices are currently staffed with Fisheries personnel. The government of the Gambia has assured that it will station personnel at the remaining nine local offices by July 1990, when the motorcycles are due to arrive. The motor-cycles, one located at each of the twelve offices, will be used mainly for the repair of outboard motors and fishing nets.	12 pcs.

3-4 Project Description

3-4-1 Conditions of the Proposed Site

(1) Location and area

The site is within the Fisheries Department building property, which is located near the mouth of the Gambia River. With the National Assembly and various government agencies located nearby, this vicinity is known as Banjul's government district. The Ministry of Water Resources, Forestry, and Fisheries borders the Fisheries Department property to the east, the Banjul Municipal Assembly is adjacent to the south, and the Embassy of the People's Republic of China is to the west. The property is about 50 meters wide east to west and about 60 meters long north to south. The Fisheries Department building is adjacent to the road. The proposed site consists of the entire southern half of the property, measuring about 50 m x 30 m. About 1,500 m^2 are usable. The site has a 20 m^2 work shed which will have to be removed.

(2) Natural climate

The Gambia has two seasons: the rainy season (June to Oct.) and the dry season (Nov. to May). During the rainy season, there are periods of light rain and heavy rain. Humid seasonal winds blow toward the Sahara Desert and carry rain. Heavy rains are usually temporary, lasting for about an hour in the morning and in the afternoon. However, the temperature exceeds 30°C and the average humidity is about 90%. It is an uncomfortable season.

During the dry season, northwesterly winds blow and the temperature rarely exceeds 30°C in the coastal areas. It is relatively comfortable. However, there are times when Sahara Desert sandstorms approach the country, turning the sky reddish brown all day long.

A local survey confirmed that there were no records on past floods and earthquakes in Banjul.

(3) Geological survey

Several places on the proposed site were selected for penetration tests with a portable cone penetrometer. Based on the results, the strength measurement table was used to calculate the ground's bearing strength.

Although the site has a 1-meter stratum of fine sand, the ground is able to directly support the proposed workshop building. Special foundation work such as pile driving would therefore be unnecessary.

(4) Site infrastructure

1 Access road

Even in the capital of Banjul, many major thoroughfares are still unpaved. This is a major deficiency in the Gambia. However, the access road to the proposed site will be the 8.5-meter-wide Marine Parade, which is paved.

2 Electricity

Banjul has one electric power station whose five power generators supply about 10 megawatts of power. The power distributed is single-phase and three-phase 220 V, 50 Hz. A branch power line can feed power from the Fisheries Department building's distribution board to the workshop building.

3 Water supply

There is a water pipe under the road fronting the site. This water pipe is connected to an elevated water tank which draws water from a city well. At present, water pressure is applied only from 5:00 AM to 4:00 PM and 6:00 PM to 9:00 PM. Although the water pressure is not stable, water will be usable on the ground floor.

4 Drainage system

A sewage system is being planned for Banjul. Although a main sewer pipe is under the road fronting the site, it is still incapable of processing effluent. The Fisheries Department building uses an existing sewage treatment tank.

5 Telephone line

A branch telephone line from the Fisheries Department building can be installed at the workshop site.

6 Gas supply

Although there is no city gas installation, propane gas can be obtained.

3-4-2 Training Plan

(1) Mechanical training and repair plan

① Description

There are currently about 200 canoe outboard motors in operation in the Gambia. These were obtained by the second fisheries-related grant aid from the Government of Japan, assistance from Italy, and private purchases by fishermen. If the outboard motors earmarked for this Project are granted, the total will be boosted to about 270 units. This will increase the motorization of the Gambia's fishing vessels.

However, the country still lacks repair facilities for outboard motors. This deficiency is especially apparent in fishing villages. In order for the fishermen to use the outboard motors effectively, they must be trained on the outboard motor's basic principles and repair techniques so they can maintain and repair the motors themselves.

The mechanical training and repair plan will train fishermen on the points below to promote the effective use of outboard motors and to keep more outboard motors operative. Those who complete the training plan will return to their fishing villages and conduct on-site repairs and give advice on repairs.

i. To prevent breakdowns due to ill-use, the fishermen will be educated on the mechanics of the outboard motor.
ii. The fishermen will be trained on the outboard motor's structure and the functions of its parts. They will be taught the proper disassembly, installation, parts replacement, and maintenance schedule of the outboard motor.
iii. To prevent errors in parts orders and to shorten repair and part replacement time, the fishermen will learn the names of the spare parts.

② Implementation of training plan

The following measures will be incorporated to facilitate the smooth implementation of this training plan.

i. The equipment acquired through this Project will be distributed to those who have completed the training plan and to those who will undergo the training plan.

ii. To reduce the fishermen's financial burden and to increase training opportunities, the trainees will receive a subsidy.

iii. The trainees will be selected from among the following: those who possess an outboard motor, those who will receive an outboard motor through this Project, and those who plan to purchase an outboard motor.

iv. With regard to the Fisheries Department's manpower and resources, four trainees will be accepted per training session.

v. Trainee recruitment will be widely publicized in all fishing villages through the local offices of the Fisheries Department. No particular fishing village or area will be emphasized for recruitment.

vi. Under the guidance of specialists, Fisheries Department personnel will instruct and train the fishermen.

③ Training plan schedule

A training session will be four months long. This period will include 1 week of basic mechanical engineering, 3 weeks of mechanical structure, 4 weeks of instruction on part nomenclature and functions, and 2 months of hands-on training for the removal, disassembly, and reassembly of the outboard motor.

Mechanical training and repair plan schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12
First session	Preparation		Training (4 trainees)									
Second session						Preparation	Training (4 trainees)					
Third session											Preparation	

(2) Fishing gear training and repair plan

① Description

The fishing gear training and repair plan will train the fishermen on the points below in order to develop new fishing gear and to improve repair techniques.

i. To train fishermen who will spread their knowledge among other fishermen. Also, to develop new fishing gear and give guidance to fishermen.
ii. To offer training on the effective repair of fishing gear.

② Implementation of training plan

The following measures will be incorporated to facilitate the smooth implementation of this training plan.

i. The equipment acquired through this Project will be distributed to those who have completed the training plan and to those who will undergo the training plan.
ii. The training plan will target fishermen and those who plan to engage in the fisheries occupation.
iii. With regard to the Fisheries Department's manpower and resources, six trainees will be accepted per training session.
iv. Under the guidance of specialists, Fisheries Department personnel will instruct and train the fishermen.

③ Training plan schedule

A training session will be 3 months long. This will include 1 month of instruction on net nomenclature, fishing gear theory, and fishing methods; and 2 months of hands-on training on net repair techniques and net making.

Fishing gear training and repair schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12
First session	Prepa-ration	Training (6 trainees)										
Second session					Prepa-ration	Training (6 trainees)						
Third session									Prepa-ration	Training (6 trainees)		

3-4-3 Equipment Repair and Fishing Net Repair Development Plan

(1) Description

The Gambia does not have any facilities that can handle major repairs of FRP fishing vessels and outboard motors. It also does not have any facilities for fishing net repairs. Minor repairs of FRP fishing vessels and outboard motors can be done with selected parts and tools. Net repairs can be done outdoors. However, it is difficult to tailor fishing nets and to develop and make experimental nets outdoors. The workshop facility will therefore have the necessary equipment to perform the essential operations below:

i. Major repairs that could not be performed hitherto will be made possible.
ii. New fishing methods and fishing gear will be developed.

(2) Mechanical repair shop

The Gambia currently has about 200 outboard motors in operation. After receiving the 75 outboard motors designated for the Project, the Gambia will have a total of about 275. Assuming that 10% of these will require major repairs, about 27 outboard motors will undergo major repairs annually. Major repairs will be performed for broken propellors or propellor shafts and damaged motor frames. Since such repairs will mainly require hand-forging, about two weeks will be needed to complete the repair. Table 8 shows the personnel who will handle mechanical repairs.

(3) Fishing net repair shop

Among all fishing nets, the bottom gill net is the most common. When spread out, this net measures 20 m x 2 m. Minor repairs can be done over several repair sessions. When closers are inserted into the net or when the net is attached to a rope, the net must be folded in half. And so the length of the net repair shop must be 10 m.

(4) Development of fishing gear and methods

The fish catch volume is to be increased by developing and using unknown fishing methods (such as traps) and new fishing gear and methods.

3-4-4 Equipment Usage

(1) Usage plans

① FRP fishing vessels

The three types of FRP fishing vessels designated for the Project will be used as follows:

i. The 4.7-meter FRP fishing vessels will be used with stow nets, bottom gill nets, and fishing lines by midstream and downstream inland fishing villages. One will also be used for training purposes.

ii. The 7.1-meter FRP fishing vessels will be used with bottom gill nets, surrounding gill nets, floating gill nets, and fishing lines by downstream inland fishing villages and coastal fishing villages.

iii. The 12.8-meter FRP fishing vessel will be used at sea with bonga surrounding gill nets. It will also be used as the Fisheries Department's training vessel.

② Outboard motors

The outboard motors will be used as follows:

i. The 8 hp outboard motors will be installed on 4.7-meter FRP fishing vessels. Also, three of the motors will be used for training purposes.

ii. The 27 hp diesel outboard motors will be installed on fifteen 7.1-meter FRP fishing vessels and on three 12-meter FRP fishing vessels. Also, three of the motors will be reserved for training purposes and another will be installed on the repaired training vessel that was granted in 1982.

③ Fishing nets and fishing gear

A. Bottom gill nets

Three units (one unit consists of a 300-meter net and accessory gear) will be distributed to each fisherman and new fishermen who have completed the training session. The Fisheries Department personnel will offer these fishermen guidance on net design and tailoring. Also, 5 units will be reserved for workshop training purposes.

B. Surrounding gill nets

Five fishermen who have completed the training session will each be given ten tailored rolls.

C. Purse seine

One completed seine and one seine portion will be tailored under the guidance of Fisheries Department specialists. The seine will be used by the 2-ton FRP fishing vessel (acquired by previous grant aid) and by existing canoes.

D. Stow nets

Net material for 80 nets will be designed and tailored under the guidance of Fisheries Department specialists, and then distributed to artisanal river fishermen.

E. Fishing gear

Fishing gear will be used for tailoring fishing nets and fishermen training. Also, some of the life jackets will be distributed to fishermen.

F. Other equipment

i. Refrigerator truck

A refrigerator truck will be used to transport fresh fish to inland farming villages as well as manufactured ice from ice plants to stockers in each fishing village.

ii. Canoe landing winches

Since canoes are being landed manually at fishing villages, winches will be distributed on an experimental basis to make the landings easier.

iii. Motorcycles

Motorcycles will be distributed to the local offices of the Fisheries Department. The motorcycles will be mainly used for transporting personnel to fishing villages to give technical guidance on outboard motors and fishing nets. They will also be used for collecting fisheries statistics.

iv. Supplies for FRP repairs

FRP canoes will be distributed together with repair supplies to enable routine maintenance.

(2) Grantee selection criteria and loan repayment plan

① Selection criteria

The equipment designated for the Project will be distributed to fishermen who have completed the training plan and to fishermen who will undergo the training plan. Trainee applicants will be recommended by the local offices of the Fisheries Department and fishing village leaders. The Fisheries Department personnel will then make the final selections. Trainees will be selected according to the following prerequisites:

i. The applicant has proper qualities to be in the fisheries occupation or is mechanically inclined.
ii. The applicant intends to continue working in the fisheries industry for a prolonged period.
iii. The applicant is in a good financial position.

② Loan repayment by fishermen

Fishermen who complete the training session and receive granted equipment will be charged an amount that would not put an excessive strain on the fisherman. A repayment plan that suits the fisherman's ability to repay will be devised.

Equipment will be distributed to fishermen who arrange for a revolving loan and pay a 15% down payment. The repayment period (3 to 10 years) will then be determined according to the fisherman's financial condition and subsidy. Fixed monthly payments will be made.

The money repaid by the fishermen will be deposited into a Japanese loan account maintained by the Fisheries Department. The money in this account will be used only for the development of artisanal fishing.

(3) Income comparison between gasoline and diesel outboard motors

① Operating conditions

Based on the surrounding gill net trial operations with the existing 12-meter canoe (with 40 hp outboard motor), the operation plan for the 40 hp gasoline outboard motors designated for the Project and the 27 hp diesel outboard motors have been formulated as follows.

Surrounding gill net trial operation results for the existing 12-meter canoe (with 40 hp outboard motor)

Item		'88.9	'88.10	'88.11	'88.12	Total	Average	Unit price
No. of fishing days		10	26	25	29	90	-	-
Fish catch	Bonga (kg)	16,950	38,124	28,120	16,744	99,938	1,110.00	-
	Amount (D)	4,645	8,460	10,785	9,585	33,475	371.94	0.34
	Other fish (kg)	147	448	485	437	1,517	16.85	-
	Amount (D)	385	1,133	760	782	3,033	33.70	2.00
	Sales amount (D)	5,003	9,593	11,545	10,367	36,508	405.64	
Fuel (gasoline) (l)		306	727.5	1,011	1,318	3,362.5	37.36	-
Amount (D)		1,667.9	3,964.87	5,509.15	7,183.1	18,325.02	203.61	5.45
Personnel expenses (D)		1,334.09	2,251.25	2,415.55	1,255.56	7,256.45	80.63	-
Total expenses (D)		3,001.99	6,216.12	7,924.7	8,438.66	25,581.47	284.24	
Owner's profit (D)		2,001.01	3,376.85	3,620.30	1,928.34	10,926.53	121.44	-

Notes: D = Dalasies

According to the above table, the average fish catch per fishing day is 1.1 tons. Thus, if the 40 hp gasoline outboard motor and the 27 hp diesel outboard motor are introduced, the fish catch can be estimated as follows:

Annual days of fishing:	25 days x 12 mo. = 300 days
Annual fish catch:	1.1 tons x 300 days = 330 tons/year
No. of operations:	2 - 4 operations/day, approx. 1 hour is required per operation

Other conditional factors were determined from the survey results as follows:

Port selling price	Bonga: D 0.34/kg Other fish: D 2.00/kg
No. of crew	8 fishermen + 1 vessel owner = 9 members
Fishermen's compensation	(Sales - fuel expenses) x 40%
Finished net cost	1 net D 35,000 x 0.8 = D 28,000 (5-year repayment)
Outboard motor	1 D 10,000 x 0.8 = D 8,000 (3-year repayment)
Wooden canoe	1 D 17,000 x 0.8 = D 13,600 (5-year repayment)

The income and expenses in the case of a gasoline outboard motor were calculated as follows:

o Annual sales

D 0.34 x 1,100 kg x 300 days	= D 112,200
D 2.00 x 17 kg x 300 days	= D 10,200
Total	D 122,400

- Annual expenses

Fuel expenses	D 5.45 x 37.36 l x 300 days	=	D 61,080
Fishermen personnel expenses	(D 122,400 - D 61,080) x 0.4	=	D 24,528
Vessel owner personnel expense	D 3,066 x 1.2	=	D 3,680
Fishing gear loan repayment	D 28,000 x 1/5	=	D 5,600
Fishing gear maintenance expenses	D 35,000 x 0.1	=	D 3,500
Outboard motor loan repayment	D 8,000 x 1/3	=	D 2,667
Outboard motor repair expenses	D 10,000 x 0.2	=	D 2,000
Wooden canoe depreciation	D 13,600 x 1/5	=	D 2,720
Wooden canoe repair expenses	D 13,600 x 1/5	=	D 2,720
Total			D 108,495

- Profit/Loss

  D 122,400 - D 108,495 = D 13,905

④ Income and expenses for diesel outboard motors

According to the model calculations of the gasoline outboard motor's income and expenses, operating such motors is feasible. However, fuel expenses deducted 50% of the sales income. Profits can turn into losses if the catches are less than those projected or if fish prices decline. Shown below is the income and expense calculations of a diesel outboard motor, if it is used for the sake of lowering fuel expenses.

According to Senegal's survey data, comparative tests between a 40 hp gasoline outboard motor and a 27 hp diesel outboard motor when mounted on a 12-meter canoe showed that the diesel outboard motor was 2% slower in speed. However, the diesel outboard motor used about 55% less fuel. If this data is translated into financial costs, with the Gambia's gasoline price being 5.45 D/liter and diesel fuel costing D 3.5/liter, the following is obtained:

Annual consumption:	Gasoline	37.36 l x 300 days =	11,208 l
	Diesel fuel	37.36 l x 0.45 x 300 days =	5,044 l
Fuel expenses	Gasoline	D 5.45 x 11,208 l = Approx.	D 61,080 (100%)
	Diesel fuel	D 3.50 x 5,044 l = Approx.	D 17,654 (29%)
	Reduction amount		D 43,426 (-71%)

If the operating plan for the gasoline outboard motor is applied to the diesel outboard motor, there would be a surplus of D 38,324. The profit ratio would be 31.9% of total sales. This is 27% higher than that for gasoline outboard motors.

	Gasoline outboard motor (40 hp)	Diesel outboard motor (27 hp)
Sales	D 122,400	D 119,952 (D 122,400 x 0.98)
Fuel expenses	D 61,080	D 17,654
Fishermen personnel expenses	D 24,528	D 24,528
Vessel owner personnel expense	D 3,680	D 3,680
Fishing gear loan repayment	D 5,600	D 5,600
Fishing gear maintenance expenses	D 3,500	D 3,500
Outboard motor loan repayment	D 2,667	D 8,333
Outboard motor repair expenses	D 2,000	D 5,000
Wooden canoe depreciation	D 2,720	D 2,720
Wooden canoe repair expenses	D 2,720	D 2,720
Total expenses	D 108,495	D 73,735
Profit/Loss (Profit ratio)	D 13,905 (11.4%)	D 46,217 (38.5%)

(4) Income and expenses of other equipment

A rough estimate of the income and expenses of other equipment to be brought into this plan is as follows.

① 4.7-meter FRP fishing vessel
Stow net

Vessel type Fishing ground Outboard motor Fishing gear	4.7-meter FRP fishing vessel River waters 8 hp 2 stow nets	
Income Fish catch kg Unit price D/kg Sales D	 3.8 kg of shrimp x 0.6 x 275 days = 627 kg D 25/kg of shrimp D 25 x 627 kg	 D 15,675
Expenses Fuel consumption Fuel expenses D Fishermen personnel expenses D Fishing gear maintenance expenses D Outboard motor repair expenses Wooden canoe repair expenses Fishing gear loan stow net Outboard motor loan FRP vessel loan Wooden canoe loan	 2.5 l/day x 250 days = 625 l D 545 x 625 l D 250 x 12 mo. x 1 fisherman D 1,300 x 1 set x 0.1 7,500 x 0.2 D 1,300 x 1 set x 0.8 x 1/5 D 7,500 x 1/3 D 15,000 x 0.8 x 1/10	 D 3,407 D 3,000 D 130 D 1,500 D 208 D 2,500 D 1,200
Total expenses		D 11,945
Profit/Loss		D 3,730

② 7.1-meter FRP fishing vessel

Bottom gill net

Vessel type Fishing ground Outboard motor Fishing gear	7.1-meter FRP fishing vessel Oceanic D 27 hp 1200-meter bottom gill net	
Income Fish catch kg Unit price D/kg Sales D	 66.3 kg/1000 m x 0.7 x 1200 = 55.7 kg/day 55.7 kg/day x 275 = 15,318 kg D 3.06/kg D 3.06 x 15,318 kg	 D 46,873
Expenses Fuel consumption Fuel expenses D Fishermen personnel expenses D Fishing gear maintenance expenses D Outboard motor repair expenses Wooden canoe repair expenses Fishing gear loan Outboard motor loan FRP vessel loan Wooden canoe loan	 10 l/day x 275 days = 2750 l D 3.50 x 2750 l D 250 x 12 mo. x 3 fisherman D 4,200 x 6 sets x 0.1 D 22,000 x 0.8 x 0.2 D 4,200 x 6 sets x 0.8 x 1/5 D 22,000 x 0.8 x 1/3 D 20,500 x 0.8 x 1/10	 D 9,625 D 9,000 D 2,520 D 3,520 D 4,032 D 5,867 D 1,640
Total expenses		D 36,204
Profit/Loss		D 10,669 D(22.8%)

③ 12.8-meter FRP fishing vessel Surrounding gill net

Vessel type Fishing ground Outboard motor Fishing gear	12.8-meter FRP fishing vessel Oceanic D 27 hp 1200-meter surrounding gill net	
Income Fish catch kg Unit price D/kg Sales D	 Bonga: 1,100 kg/day x 300 days = 330,000 kg Other fish: 17 kg/day x 300 days = 5,100 kg Bonga: D 0.34/kg Other fish: D 2/kg Bonga: D 0.34/kg x 330,000 Other fish: D 2/kg x 5,100	 D 112,200 D 10,200
Total		D 122,400
Expenses		
Fuel consumption	37.36 x 0.45 x 3005 = 5,044	D 17,650
Fuel expenses D	3.50 D/L x 5,044 l	D 17,050
Fishermen personnel expenses D	(122,400 - 17,653 D) x 0.25	D 26,188
Vessel owner expense D	(26,188 / 8) x 1.2	D 3,930
Fishing gear loan repayment	28,000 x 1/5	D 5,600
Fishing gear maintenance expenses D	D 35,000 x 0.1	D 3,500
Outboard motor repair expenses	D 22,000 x 0.2	D 4,400
Outboard motor loan	D 22,000 x 0.8 x 1/3	D 5,867
FRP vessel loan	D 100,000 x 1/5	D 20,000
Wooden canoe loan		
Total expenses		D 87,135
Profit/Loss	122,400 - 87,138	D 35,265 (22.8%)

(5) Equipment distribution according to geographical area

Tables 6 and 7 show how the equipment will be distributed according to geographical area.

Table 6 Equipment Distribution

Region		Fishing village	No. of fishermen	No. of canoes		FRP fishing vessels				Outboard motors				Fishing nets and gear			
				Motorized	Non-Motorized	4.7m	7.1m	12.8m$^{0.8}$	12.8$^{1.8}$	4 hp L-type	8 hp L-type	40 hp diesel	27 hp diesel	Bottom gill net	Surrounding gill net	Stow net	Purse seine
Inland region	Midstream	Tendaba	22	6	4	5					5						
	Downstream	Bintang	39	5	24	5					5						
	Midstream	Yelli Tenda	25	0	10	5					5						
	Downstream	Sali Kenye	30	5	11	3					3						
	Midstream	Kauur	19	0	12	3					3						
	Midstream	Bansang	10	0	3	3					3						
	Midstream	George Town	20	0	12	3					3						
	Midstream	Jappine	10	0	5	2					2						
	Downstream	Tan Kular	45	2	35	3					3			50 units		20 (80 sets)	
	Downstream	Mandinari	71	3	60												
	Downstream	Kemoto	13	0	6	2					2						
	Downstream	Kerewan	35	11	17	2					2						
	Downstream	Jarunku	21	1	14	2					2						
	Downstream	Albreda	59	7	45	2	2				2		2				
	Midstream	Bamba Tenda	21	6	8	2					2						
	Downstream	Essau	24	0	21	2					2						
	Midstream	Kuntaur	22	1	15	2					2						
	Midstream	Bellengho	20	6	8	2					2						
	Other locations		524	37	402												
	Subtotal		1,030	90	712	48	2				48		2	50		20	

Region		Fishing village	No. of fishermen	No. of canoes		FRP fishing vessels				Outboard motors				Fishing nets and gear			
				Motorized	Non-Motorized	4.7m	7.1m	12.8m$^{0.8}$	12.8$^{1.8}$	4 hp L-type	8 hp L-type	40 hp diesel	27 hp diesel	Bottom gill net	Surrounding gill net	Stow net	Purse seine
Coastal region		Bataronku	22	6													
		Bakau	45	3	20		2						2				
		Banjul	80	24	25		2						2				
		Gunjur	285	27	15		3	2					5				
		Sanyang	50	4	28		1						1				
		Tanje	210	27			1						1	20 units	5 units		1 + 1
		Brufut	30	8			1						1				
		Tujereng	Included in Tanji				1						1				
		Kartong	12	1	6		1						1				
		Barra	50	4	21		1						1				
		Jeshwang	Included in Banjul														
	subtotal		784	104	115		13	2					15	20	5	2	
Fisheries Department						2		1			5		5	5			
Total			1,814	194	827	50	15	3			53		22	75	5	20	2

Table 7 Motorcycle Distribution

NAME OF BASE	NAME OF USER	VILLAGE
1. KEREWAN	MECHANIC F. ASSISTANTS	30km Jurunku/Saba/
2. TENDABA	MECHANIC F. ASSISTANTS	30km Jewof/Genier/Kayaf
3. BINTANG	- F. ASSISTANTS	70km Koveagi/Sibanor/Bwiam
4. KUNDA	- F. ASSISTANTS	30km Jareng/Kulenya
5. BANSANG	- F. ASSISTANTS	20km Georgeto Seubele keeru Korcutml Koseemcr/Bogll
6. KUNTAUR	MECHANIC F. ASSISTANTS	25km Nyanya bunk Walli kunda
7. FARAFENYE	MECHANIC F. ASSISTANTS	20km Katchang/Kani kunda/Yellitenda
8. KAUUR	- F. ASSISTANTS	30km Farafeni/Njau sanjalli/Bambali
9. BARRA	MECHANIC F. ASSISTANTS	40km Jurunku/Albreda Essau/Sika
10. JENOI	MECHANIC F. ASSISTANTS	50 km Pakaliba/Jappine tenda/Kayaf
11. JESHAWANG	MECHANIC F. ASSISTANTS	50km Pirang/Foraba Bakau/Kololi
12. SALIKENE	MECHANIC F. ASSISTANTS	50km Kafchang/Najano-Kunda

After ascertaining that the Fisheries Department would maintain and manage the motorcycles, it was decided that one motorcycle would be distributed to each local office (base). The motorcycles would be used to facilitate mechanical repairs and fishing gear repairs and to collect fisheries statistics.

3-4-5 Income and Expenses of Distribution Reform

At present, fresh fish is sold only in urban areas and in areas near fishing villages. Hardly any fresh fish is sold in farming villages due to the lack of transportation.

Thus, the Project aims to improve the distribution of fish to inland areas by using a 5-ton refrigerator truck.

The Fisheries Department used the 2-ton refrigerator truck that is still in operation and conducted a marketing test in the inland areas. The income and expenses of the 5-ton refrigerator truck will be calculated in accordance with the marketing test results below.

Results of the inland area marketing test using a 2-ton refrigerator truck

Item		1988.10	1988.11	1988.12	Total	Average per operation	Unit price
No. of operations		4	8	6	18	-	-
Expense A	Bonga caught by FRP canoes (kg)	6,200	7,657	5,016	18,873	1,048	
	Bonga caught by FRP canoes (D)	2,340	3,890	3,010	9,240	513	D0.49/kg
	Bonga caught by wooden canoes (kg)	1,000	10,511	7,640	19,151	1,064	
	Bonga caught by wooden canoes (D)	360	4,108	4,025	8,493	472	D0.44/kg
	Fuel consumption (l)	502.2	1,062.6	800.5	2,365.3	131.4	
	Fuel expenses (D)	1,760	3,719.9	2,800.5	8,280.4	460	D 3.5/L
	Ice consumption (box)	87	183	113.5	383.5	21.3	
	Ice expenses (D)	2,001	3,975	2,443.5	8,419.5	468	D22/box
	Misc. expenses (D)	377	1,050.5	526	1,953.5	108.5	
	Personnel expenses (D)	199.5	659	435.4	1,293.9	71.9	
	Total (D)	7,037.5	17,402.4	13,240.4	37,680.3	2,093.4	
	Sales (D)	9,944.8	21,960.3	14,076.7	45,981.7	2,554.5	
	Selling unit price (D/kg)	1.38	0.83	1.11	1.21	-	
	Profit (D)	2,907.3	4,557.9	836.3	8,301.5	461.2	
	Market location	Sommer-bassul	Sommer-bassul	Sommer-bassul	-	-	-
	Distance covered (km)	3,035	6,042	4,089	13,166	731	-

Note: 1. D = dalasi
2. Fuel = Gasoline & oil
3. Ice = 40 kg/box

The required conditional factors were determined as follows:

Average purchase price of bonga	D 0.47/kg
Fuel expenses	D 3.5/l
Personnel expenses (2 persons)	D 72/day
Misc. expenses	D 120/day
Fuel consumption	4 km/l
Distance covered	740 km/operation

If these conditional factors are applied, the income and expenses of the 5-ton refrigerator truck will be calculated as follows:

Expenditures			
Annual purchase	(D 0.47 x 1,000) x 900 tons	= D	423,000
Fuel expenses	740 km / 4 km/1 x D 3.5/1 x 15 days x 12 mo.	= D	116,550
Personnel expenses	D 72 x 15 days x 12 mo.	= D	12,960
Misc. expenses	D 120 x 15 days x 12 mo.	= D	21,600
Total		= D	574,110
Annual sales	(D 1.21 x 1,000) x 900 tons	= D	1,089,000
Estimated profit	D 1,089,000 - D 574,110	= D	514,890

If a single refrigerator truck is operated annually as above, a profit of D 500,000 can be estimated.

3-5 Implementing agency

The Project will be implemented by the Department of Fisheries under the Ministry of Water Resources, Forestry, and Fisheries.

The Fisheries Department has five sections: Directorate and Administration, Extension Services, Biological Research, Gear Technology and Inspectorate, and Aquaculture. It employs a total of 62 people, with 1 director, 11 in administration, 34 in development, and 16 in the other three sections.

The Fisheries Department's fiscal 1989 estimated budget is 666,530 D.

Expenses	Amount (D)
Salaries	438,330
Allowances	98,200
Daily wages	10,000
Travel expenses	30,000
Office expenses	10,000
Fisheries development and training	40,000
Motor vehicle operation and repair	40,000
Total	665,530

Of the 34 personnel employed by the Fisheries Department's Development Section, 16 will be involved in the Project's implementation. Nine temporary mechanics will also be employed in the Project. The Project's personnel assignments totaling 25 personnel, are shown in Table 8 below.

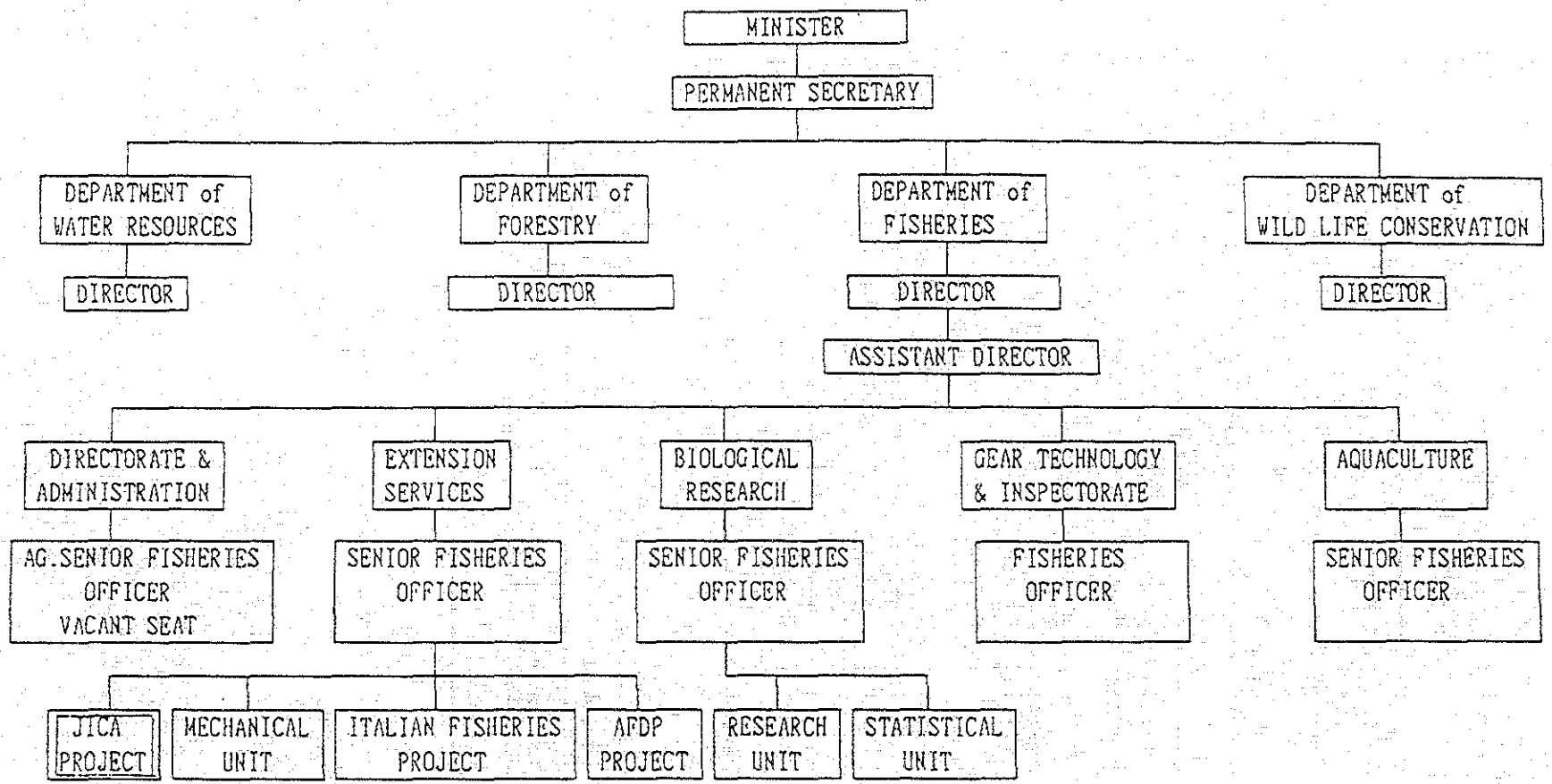
Table 8 Personnel assignments

Job title	Area of Responsibility	No. of personnel
Senior Fisheries Officer	General administration, training plan	1
Fisheries Officer	Assistant to the Senior Fisheries Officer, supervision of fishing gear repair and development, fishermen training	1
Assistant Senior Fisheries Officer	Fishing gear management, training assistant, fishing gear repair and development	2
Assistant Fisheries Officer	Fishing gear management, fishing gear repair assistant, storage management	2
Senior Mechanics Foreman	Assistant to the Senior Fisheries Officer, supervision of mechanical repairs, fishermen training	1
Assistant Senior Mechanics Foreman	Mechanical repairs, training assistant	1
Mechanics Foreman	Outboard motor repairs, storage management	1
Fisheries Technicians	Outboard motor repairs	7
Subtotal		16
Temporary mechanics	Outboard motor repairs	9
Total		25

The organization of the Department of Fisheries is included in Following page.

Organization of the Ministry of Water Resources, Forestry, and Fisheries

MINISTRY OF WATER RESOURCES, FORESTRY, AND FISHERIES (As of Feb. 1989)



3-6 Technical Cooperation

Two JICA specialists for outboard motors and fishing nets and gear are currently assigned to the Gambia. Since they are making substantial contributions to the promotion of artisanal fishing in the Gambia, they are highly esteemed locally.

If this Project is implemented, the roles of such specialists will become even more important. Thus, continued technical cooperation through the dispatching of specialists will be necessary.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic Policies

The basic policies of the basic design for the workshop construction and equipment acquisition are as follows:

(1) Based on the request of the Gambia and the Basic Design Study data, a design that takes the Project's objectives, function, and potential into consideration will be formulated.

(2) The workshop building will be able to withstand the Gambia's natural climate, including conditions during the rainy and dry seasons. Direct sunlight, natural ventilation, and rainwater drainage will also be taken into account in the workshop building design.

(3) To lower operation costs, the workshop building will incorporate natural ventilation and natural lighting.

(4) Equipment selection will be limited only to that which is necessary for the Project. Equipment is to be easy-to-use, durable, relatively easy to maintain, and have readily available spare parts.

(5) The building's finishing materials will be selected according to their durability and weatherability.

(6) The building design shall conform to the Gambia's laws and regulations, customs, fisheries conditions, social conditions, etc.

4-2 Facilities

(1) Scale of facilities

① Mechanics workshop

The mechanics workshop will be basically partitioned into the following areas: training area, equipment repair area, equipment delivery area (which is also the FRP boat, refrigerator truck, and motorcycle repair area), and storage area. After each area is outfitted with the necessary work tables, disassembly benches, tools, shelves, etc., the layout will look like that shown in the mechanics workshop and storage room's equipment arrangement plan (Fig. 6).

The mechanics workshop will require a total area of 144 m^2. This includes 54 m^2 for the training area (4 m x 12 m + 2 m x 3 m), 54 m^2 for the equipment repair area (4 m x 12 m + 2 m x 3 m), and 36 m^2 for the equipment delivery area and repair area (4 m x 9 m will be necessary to accommodate the refrigerator truck and FRP fishing vessel).

The storage area will store about 1,000 parts, 200 measuring instruments and tools, and other items. There will be shelves for these items. A space will also be needed for inventory management. A total space of 57.4 m^2 will be required.

② Fishing net/gear workshop

The fishing net/gear workshop will be used for fishermen training, fishing gear development, and net tailoring. The bottom gill net, which is the most commonly used fishing net, measures about 20 meters when spread out. When closers are inserted, when ropes are attached, or when the net is tailored, the net must be folded in half. Therefore a space of 10 meters plus some room between the net and wall will be necessary. Also, since two nets will be tailored simultaneously during a training session, a total space of about 96 m^2 (8 m x 12 m) will be necessary.

The storage rooms will need an area of 43.4 m^2. Finished nets, tailored nets, net material, ropes, etc., will be stored on the floor. And netting thread, fishing gear, etc., will be stored on shelves. A space for inventory management will also be necessary.

③ Workshop office (ground floor)

To maintain and manage the workshop building, a staff of four will work in the administrative office. This office will need an area of 30 m^2 (7 m^2 x 4 people + 2 m^2 for office equipment).

④ Lecture/Conference Room (first floor)

i. For use as a lecture room

- o Normally, the room will be used for mechanics training and fishing gear training at different times. However, if both training classes must use the room at the same time, a partition will be used to divide the room.
- o For mechanics lectures: 1 instructor + 1 assistant + 4 trainees = 6 persons
- o For fishing gear lectures: 1 instructor + 1 assistant + 6 trainees = 8 persons

ii. For use as a conference room

- o For workshop staff meetings or instruction: Max. 13 persons

⑤ Training Materials Room (first floor)

This room will need 20 m^2 for the display and preparation of net models, vessel models, motor parts, books, etc.

⑥ Specialists' Office (first floor)

To be used by mechanics and fishing gear specialists, this office is to have an area of 20 m^2 (7 m^2 x 3 persons).

⑦ Trainee dormitory (first floor)

There will be two dormitory rooms to accommodate four trainees each. Each room will be 20 m^2 (5 m^2 x 4 trainees), for a total area of 40 m^2 for eight trainees.

It was decided to have two 4-person dormitory rooms to save on electricity costs, etc., in case only a small number of trainees come from afar.

⑧ Other facilities

A lavatory, stairway, corridor, etc., will also be constructed.

(2) Workshop facilities (In m^2)

Based on the scale of facilities stated in (1) above, the workshop facilities will be as follows:

Purpose	Floor	Room name	Furnishings	Planned Area
Mechanics training and repair	G	Workshop	Outboard motors, refrigerator truck FRP canoes	148.80
		Administrative Office	Tables, chairs, lockers, bookshelves	30.00
		Storage Room		57.40
Fishing gear repair and development	G	Workshop	Fishing nets, fishing gear and tackle, tables, chairs, lockers, bookshelves	100.80
		Storage Room		43.40
Lectures and conferences	1	Lecture/Conference Room	Instructor and trainee desks, blackboard, screen, videodeck	57.40
Training	1	Training Materials Room	Net model, vessel model, motor parts, tables, chairs, lockers bookshelves	20.00
		Specialists' Office		20.00
Trainee accommodation	1	Trainee dormitory room (4 trainees)	Beds, lockers	22.26
		Trainee dormitory room (4 trainees)	Beds, lockers	21.20
Communal use	G	Lavatory	Sinks, toilets, shower room	20.00
	G, 1	Entrance hall, stairway, corridor	GF 1F	63.20 29.94
Total				634.40

ground floor 463.60 m^2 (Measured from the wall center)

first floor 170.80 m^2

Total 634.40 m^2

4-3 Building Design

(1) Design policy

The workshop building's design must conform to the basic conditions for the operation and maintenance of the workshop by the managing agency. The design must also take into account the natural climate of Banjul and Gambian social customs. Being the base for the "Project for Development of Artisanal Fisheries" in the Gambia, the workshop will offer training on outboard motors and fishing gear to fishing villages nationwide. The building is to have a simple, highly functional design. The building and furnishings must be easily maintainable. The maintenance costs and operating costs will be minimized.

Based on the above conditions, the specific design policies are as follows:

i. The workshop will house training facilities, a lecture/conference room, and other rooms. The training facilities will be on the ground floor, and the other rooms will be on the first floor.
ii. Steel-frame construction will be employed to lighten the building weight.
iii. Indoor and outdoor finishing materials will be selected according to their durability and maintenance ease.
iv. To minimize maintenance and operating costs, natural ventilation and lighting will be incorporated and furnishings will be simple.

(2) Site conditions

The road adjacent to the Fisheries Department property extends for 48 meters east to west. The property also measures 60 meters north to south. The Fisheries Department building is near the adjacent road and is set on a north-south axis.

This 40-year-old building was built during the British colonial era and it still retains a British flavor. It is a two-story, steel-frame building. However, since the roof's foundation and the external walls are made of wood, the building is deteriorating. The director's office and other offices are on the first floor, and the car port, storage, and other rooms are on the ground floor. There are tall trees on the property boundary and around the building.

The southern half of the Fisheries Department's property will be the site of the workshop. This site currently has a 20 m^2 work shed which will be removed along with several trees. There is no visible boundary dividing the site from the Fisheries Department building. The usable area of the site measures about 50 meters east to west and about 30 meters north to south for a total area of about 1,500 m^2.

(3) Floor plan

The workshop building will have workshops staffed by Fisheries Department instructors and local instructors. There will be two workshops, one for mechanical repairs and the other for fishing gear repairs. The workshops will require a large floor area, while the other rooms can be of an average size. It was therefore decided that the workshops would be on the ground floor while the other rooms would be on the first floor. The building design must contend with large beams for the workshops and smaller beams for the other rooms. It must also suppress the noise from the workshops from affecting the rooms on the first floor.

There will be an entrance hall between the two workshops on the ground floor, enabling access from the Fisheries Department. There will also be storage rooms, management offices, and a lavatory. The stairway in the entrance hall will lead to the first floor which will house the specialists' office, the training materials room, and the trainee dormitory.

(4) Facility quality

The workshop building design must take into account the Gambia's climate, natural features, and social conditions. The workshop must play an integral part in the Gambia's Fisheries Development Plan by offering training and equipment repair. With this basic policy, the building design was formulated with the following points in mind:

① The floor plan will allow the rooms to have the minimum area required. The workshop will be a steel-frame, two-story building with a partial 1-story structure.

② The building's finishing materials will be selected according to their durability, weatherability, and economy. Materials which can be procured locally in the Gambia will be selected as much as possible.

③ The water supply system, drainage system, toilet facilities, ventilation equipment, electrical equipment, etc., will be kept to a minimum to reduce maintenance and operating costs.

(5) Sectional design

The workshop building will have a steel-frame structure and a roof made of lightweight materials. The roof will be oblique. The roof over the workshop will slant northward, and the roof over the other rooms will slant southward. This is a simple roof design which will prevent rainwater drainage problems.

The height of the eaves over the workshop is to be able to accommodate truck deliveries. Also, since the rooms on the first floor will have ceiling fans, the ceiling height on the 1st and first floors will be around 3,000 mm.

(6) Building materials

The building materials to be used will be selected according to their weatherability and maintenance ease. They will be relatively maintenance-free with regard to the rainy and dry seasons, high temperatures, direct sunlight, etc.

① Roof

Since the roof is greatly affected by direct sunlight and rain, its durability is especially important. The roof will have a steel frame and an inclination of 3/10. Polyvinyl chloride coated steel paneling will be the roof finishing material. Cement excelsior boards will be used as the base material, which will also serve as a heat insulation material.

② External walls and openings

Concrete blocks will be used for most of the external walls. The upper section of the workshop and first floor rooms will have polyvinyl chloride steel panels over the steel frame.

The entrance door will have a steel door and aluminum sash. Room windows will need screens. Also, depending on the purpose of the room, window grills will be installed.

③ Floor

The workshop floor and the floor of the ground floor rooms will be made of reinforced concrete which can withstand heavy loads. The floor of the first floor rooms will have deck plating covering the steel girders. Cinder concrete will then be used. Floor finishing work will be done on the cinder concrete.

④ Workshop specifications

A. Area

ground floor	463.60 m^2
first floor	170.80 m^2
Total	634.40 m^2

B. Structure

Steel-frame construction, 1-story section (workshops) and 2-story section (rooms)

C. External finish

Baseboard: Foundation: ferroconcrete and mortar with trowel finish

Walls: Concrete block, mortar with trowel and painted finish

Roof: Polyvinyl chloride steel paneling on cement excelsior boards

D. Interior finish

Floor	Room	Flooring	Baseboard	Wall	Ceiling
1	Entrance hall terrazzo block	Ceramic tile or terrazzo block	Ceramic tile or trowel finish, paint finish	Mortar with board, paint finish	Decorated gypsum
1	Workshop trowel finish	Mortar with trowel finish	Mortar with external wall material	Concrete block,	Roof material
1	Storage room trowel finish	Mortar with trowel finish	Mortar with external wall material	Concrete block,	Deck plate
1	Administrative Office	Plastic tile or vinyl sheeting	Soft baseboard paint finish	Mortar with trowel finish,	Decorated gypsum board
1	Lavatory terrazzo block	Ceramic tile or terrazzo block	Ceramic tile or tile	Semi-porcelain board	Decorated gypsum
2	Lecture/ Conference Room	Plastic tile or vinyl sheeting	Soft baseboard trowel finish, paint finish*	Mortar with board	Decorated gypsum
2	Training Materials Room	Plastic tile or vinyl sheeting	Soft baseboard trowel finish, paint finish*	Mortar with board	Decorated gypsum
2	Trainee Dormitory	Plastic tile or vinyl sheeting	Soft baseboard trowel finish, paint finish*	Mortar with board	Decorated gypsum

*Calcium silicate boards are used in part.

(7) Structural design

① Construction

A. Workshop

1-story, steel-frame, rigid construction

Columns: Square steel pipe Beams: H-type steel girder

B. Rooms

2-story, steel-frame, rigid construction

Columns: Square steel pipe Beams: H-type steel girder

② Structural design

A. Regulations and standards

The Gambia Building Regulations were first enacted in 1966 and revised in 1988. General construction regulations follow the British Standards (BS). A study has shown that there are no detailed regulations on structural standards. After taking Japanese standards into account, the structural design will also consider local standards in the construction.

B. Earthquake resistance

Although there is no possibility of an earthquake, design calculations will be based on a seismic intensity of h = 0.1.

C. Wind pressure

Although there is no possibility of strong winds, design calculations will be based on a wind velocity pressure of g = 90 kg/m^2.

D. Soil and foundation

According to the cone penetrometer survey, the soil consists of sand-mixed clay at around GL-1.00 m. A bearing capacity of FE = 20 t/m^2 can be assumed. The structural design will require a bearing capacity of FE = 15 t/m^2 for an independent foundation.

E. Materials to be used and allowable stress (Short-term stress is indicated in parentheses.)

i.	Cement:	Ordinary Portland cement
ii.	Coarse aggregate:	Pebbles or gravel
iii.	Fine aggregate:	Sand
iv.	Concrete strength:	F 2g = 180 kg/cm^2 Compressive strength: f c = 60 (120) kg/cm^2 Shearing strength: f s = 6 (9) kg/cm^2
v.	Steel reinforcement (deformed):	SD30 Tensile strength: f t = 2,000 (3,000) kg/cm^2
vi.	Steel frame, ordinary steel:	SS41 Compressive strength, tensile strength, bending strength f = 1,600 (2,400) kg/cm^2

F. Sectional design

Because the steel frame materials will be manufactured in Japan, the sectional design will conform to the Japan Architectural Society's standards.

(8) Utilities

Utility systems that suit the site's conditions and infrastructure will be installed. Utility systems featuring easy operation/maintenance/inspection will be used. Operating and maintenance costs will also be minimized.

① Water supply

The site has a work shed and trees which will be removed. Near the shed, there is a water faucet which is currently used. The water supply system will be determined after surveying the water pressure, water pipes, and pipe diameter.

② Drainage system

The main sewer pipe is under the front road. The workshop's sewage and effluent can be directed to this pipe. The Gambia Utility Corporation (G.U.C.) wants the rainwater to be able to permeate into the ground of the site. A survey concluded that it would be appropriate to separate the rainwater from sewage and divert it for ground permeation.

③ Sanitation facilities

A. Water supply system

The ground floor will have a shower room. Since there will be no hot water supply, a 25A direct water supply system will be used.

B. Drainage system

i. Rainwater: Ground permeating system
ii. Effluent: After confluence, it will be diverted to the existing sewer pipe.
iii. Sewage: Same as for effluent.

C. Hot water supply

There will be no hot water heater. To boil water, electric heaters or hot pots will be used.

D. Lavatory equipment

Toilets (Western-style, low-tank type) and wash basins will be installed.

④ Fire hydrant

A local survey has shown that a fire hydrant will not be necessary with regard to the workshop building's purpose, structure, and scale. Fire extinguishers will be provided instead.

⑤ Electrical system

A. Power supply

A branch power line from the Fisheries Department building's distribution board will be installed underground and connected to the workshop building to supply electricity.

Power voltage: Single-phase, 2-line system, 220 V, 50 Hz

B. Feeder line

The ground floor will have a power reception and branch distribution board. The first floor will have a branch distribution board.

Outlet for lights:	Single-phase 2-line, 220 V, 50 Hz
Heavy duty use:	Single-phase 2-line, 220 V, 50 Hz

C. Lighting

Fluorescent lighting will be the main form of lighting due to its economy and regionality. The illumination level will be as follows:

Workshops:	300 lx
Instructors' offices:	500 lx
Lavatory:	100 lx
Storage rooms:	200 lx
first floor rooms:	300 lx - 400 lx
Corridor and entrance hall:	150 lx - 200 lx

⑥ Telephone lines

A branch telephone line from the Fisheries Department will be connected to the workshop building. Telephone wiring and receptacles will be installed in instructors' offices and other rooms requiring a telephone. Five interphones will also be installed (Lecture Room x 2, Administrative Office x 2, Instructors' Office x 1).

⑦ Air-conditioning and ventilation equipment

A. Air-conditioning equipment

No air-conditioning equipment will be installed in the building.

B. Ventilation equipment

Due to the local climate, wall openings should be kept to a minimum. Instead of window ventilation fans, ceiling ventilation fans with ducts will be installed. The external walls will have dust filters. Ordinary rooms will have ceiling propeller fans.

(9) Workshop drawings

The workshop drawings devised by the basic design are as follows:

① Site location

② Site plan

③ Floor plan

④ Elevation drawing

⑤ Section drawing

⑥ Workshop layout plan

4-4 Equipment Selection

4-4-1 Selection Principles

For equipment selection, the natural conditions of the Gambia's river and coastal fishing grounds; the artisanal fishermen's traditional fishing vessels, gear, fishing methods, and operations; the ease of maintenance; and the fishermen's income and expenses will be taken into consideration. In order to attain the objectives of the Coastal Fisheries Development Project, only necessary equipment which has optimum functionality will be selected.

4-4-2 Basis of Equipment Selection

(1) Natural conditions of fishing grounds

The Gambia has two seasons, the rainy season (June - Oct.) and the dry season (Nov. - May). Seasonal winds blow from the south during the rainy season and from the northwest during the dry season. It is rare for these seasonal winds to be strong enough to prevent fishing.

Since the coastal waters are shallow for a long distance, there are high waves. River waters are hardly affected by seasonal winds. However, the ocean tide causes sea water to flow upstream 200 meters from the river mouth.

(2) Fishing gear and methods

The Gambia's artisanal fishing methods, vessel length, and number of crew are shown below.

Artisanal fishing method	Vessel length (m)	No. of crew/vessel
1. Bottom gill net fishing	8	2 to 4
2. Surrounding gill net fishing	12 to 18	8 to 10
3. Purse seine fishing	12 to 18	8 to 10
4. Stow net fishing	5 to 6	1 to 2
5. Fishing line	5 to 6	1 to 2

(3) Preconditions for equipment selection

The type and structure of small FRP fishing vessels will be based on the type of canoe traditionally used by artisanal fishermen. For river waters, the vessels are to be short and stable and have a small turning radius. Outboard motors should also be easily installable on the vessels.

Coastal fishing vessels are to be large-capacity canoes which can withstand high waves and hold the necessary fishing gear and number of crew.

- The outboard motors should be the type which the fishermen are used to using.
- Spare parts must be readily available in the Gambia.

Equipment which can fulfill the above preconditions and whose spare parts are readily obtainable will be selected.

(4) Other equipment

Other equipment necessary and effective for workshop operations, fish distribution, fisheries statistics collection, and for keeping in stock, etc., will also be selected.

(5) Spare parts and special parts

A minimum number of essential spare parts for each vessel and motor will be provided. Additional spare parts required later on will be purchased with money received from loan repayments.

4-4-3 Reasons for Equipment Selection

(1) FRP fishing vessels

Most canoes in the Gambia are made of wood. However, in recent years, the increase of parched land in the Gambia and other west African countries in recent years has led to a shortage of wood. Wood must

therefore be imported. The wood shortage and higher wood prices will make wooden canoes increasingly difficult to produce. FRP material was therefore selected for the fishing vessels.

Three types of FRP fishing vessels were selected. The 4.7-meter FRP fishing vessels for river waters, the 7.1-meter FRP fishing vessels for coastal and river waters, and the 12.8-meter FRP fishing vessel for coastal waters.

(2) Outboard motors

The outboard motors' horsepower was determined as follows:

8 hp: Since this type of motor is already installed on many existing wooden canoes, fishermen are familiar with its operation. These motors were selected for installation on 4.7-meter FRP fishing vessels and for training purposes.

27 hp: Compared to gasoline outboard motors, this motor's fuel consumption and fuel costs are low. Also, maintenance is easy and spare parts are readily available. These motors were selected for installation on 7.1-meter and 12.8-meter FRP fishing vessels and for training purposes.

(3) Refrigerator truck

According to the consumption patterns of the Gambia's fish catches, only a small portion of fresh and frozen fish is consumed. The rest of the catch is smoked and shipped inland. This is due to the lack of a means of transporting fresh fish. Major fishing villages catch 40 to 50 tons of bonga a day during the bonga season. Twenty tons of this catch are sold as fresh fish through middlemen. Although the rest of the catch is smoked, the freshness deteriorates due to the limited capacity of the smoking facility.

The smoking process requires large amounts of wood. With diminishing forestry resources, the Gambia is urgently seeking to increase and reform the distribution of fresh fish. Also, a 5-ton-capacity refrigerator truck was selected over a 2-ton-capacity truck since the fuel and personnel costs per kilogram of fish would be halved.

(4) Motorcycles

Motorcycles of the same type currently used by the Fisheries Department will be selected. These motorcycles were selected because the personnel will already be familiar with their operation, their maintenance is easy, spare parts are readily available, and fuel and maintenance costs are low.