7-9 Fish Processing Facilities

Fish catch is processed to frozen fish, canned fish, fish meal, fish oil, and dried fish. Table 24 shows the numbers of processing facilities and plants and their production capacity. The greater part of these processing facilities are located in Karachi in its environs, so that raw materials consist mainly of fish catch landed at Karachi Port and neighbouring fishing villages, but shrimps and other high-class fish are transported by air to Karachi for freezing or canning.

Fish meal is produced mainly from sun-dried materials carried from distant fishing villages.

The above fact points to the necessity for improving the freshness and transport facilities.

Tables 25 and 26 show the volume and value of processed export items.

Table 24. Fish Processing Facilities

Type of Plant	Plant Facilities		Plants in Operation					
	Number	24-hour Production Capacity (ton)	Number of Facilities			24-hour Production Capacity (ton)		
			1976	1977	1978	1976	1977	1978
Freezing plant	17	180.85	14	13	13	158.85	148.85	155.85
Canning plant	11	87.29	9	10	10	78.26	79.79	79.79
Fish meal plant	11	163.00	8	11	8	108.00	163.00	122.00
Fish oil plant	1	5.00	1	1	1	5.00	5.00	5.00
Dried fish plant	1	5.00	-	-	0	-	-	-
Total	41							

Table 25. Export of Mechanically Processed Marine Products

Product	Volume (Metric tons)			Value (RS.1,000)		
	1976	1977	1978	1976	1977	1978
Frozen fish	5,302	4,730	4,778	273,819	249,618	261,169
Canned fish	1,611	1,343	1,260	56,185	55,456	52,136
Fish meal	11,025	17,264	17,801	22,597	49,187	48,230
Fish oil	Supplied to domestic market					
Dried fish	Supplied to domestic market					
Total	17,938	23,337	23,839	352,601	354,261	

Table 26. Export of Frozen Fish (1977 & 1978)

Product	Volume (Metric tons)		Ratio		Value (RS.1,000)		Ratio	
	1977	1978	1977	1978	1977	1978	1977	1978
Shrimp	4,450	4,229	94.09%	88.51%	240,365	250,466	96.29%	95.90%
Lobster	85	81	1.79	1.70	5,699	5,576	2.28	2.14
Fish	195	468	4.12	9.79	3,534	5,127	1.43	1.96
Frog legs	ϕ		0	0	20		0.00%	0.00
Total	4,730	4,778	100%	100%	249,618	261,169	100%	100%

Note: ϕ indicates that the volume is less than 1 metric ton.

8. Physical Basis for Determination of Specifications, Quantities, Etc. of Equipment and Materials to be Supplied to Baluchistan Province and Sind Province

8-1 Introduction

It admits of no argument that the specifications, quantities, etc. of the equipment and materials to be supplied under the present aid plan should be so determined that the fisheries in the two provinces, where such equipment and materials will actually be utilized, will be developed to ensure increased fish catches and higher income from landed catches and at the same assure mitigated labour and greater safety for fishermen.

When examined from this viewpoint, the findings of the survey suggest that the equipment and materials requested to be supplied do not necessarily suffice for the planned development of coast fisheries.

To be more specific, it appears feasible, as detailed later, to obtain great development effect within a relatively short period if freezing carriers of suitable class (e.g., used Japanese squid fishing boats of 99-ton class) or model boats of suitable class and design are used in areas like Gwadar and Pasni, Baluchistan Province, which are far from consuming areas and export ports and confronted with the difficulty in maintaining the freshness of catch.

Under the present aid plan, however, the Team is required to determine the specifications, etc. of the requested equipment and materials alone with full consideration given to the desires expressed by the pertinent Pakistani authorities, and to modify the originally requested specifications, etc. after a prudent and logical analysis for rational appropriation of the budget which is not sufficient for the supply of all equipment and materials requested by the Pakistani Government.

Since the aid is offered to the Pakistani Government, determination of distribution ratios to the two provinces is not the final objective of the survey. However, since the overall distribution of the equipment and materials as well as their specifications, quantities, etc. must naturally

be based on the distribution ratio compatible with the situation in each province, the Team determined the specifications, etc. and the distribution ratios with careful consideration given to the existing state and future prospects of fisheries in the two provices as well as to the possibility of contributing towards fisheries development in both provinces. It may as well be mentioned here that the official request of the Pakistani Government was made not for a single project area but for each of the two provinces.

Table 27 shows the contents of the Pakistani request and the Team's modifications of same.

Table 27. Original Pakistani Request and Team's Modifications of Same

Equipment/ Materials	Original Pakistani Request		Team's Modifications		Total Amount
	Baluchistan Province	Sind Province	Baluchistan Province	Sind Province	
1. Engine					
1) Outboard engines	5 ~ 20 p.s. x 300 ~ 500, Kerosene engine, W/long shafts, and spare parts equivalent to 20% of total cost.	5 ~ 20 p.s. x 300, Kerosene engine if possible, or diesel oil engine, W/long shafts, and spare parts equivalent to 20% of total cost.	7 p.s. x 508 (60%), 12 p.s. x 251 (40%), Integrated spark ignition type Kerosene engine with directly coupled shaft and propeller, W/spare parts equivalent to 20% of total cost.	7 p.s. x 134 (30%), 12 p.s. x 232 (70%), - Same as left - - Same as left -	¥283,300 thousand
2) Inboard engines	20 ~ 40 p.s. x 100, Kersone engine if possible, or diesel oil engine,, W/spare tail parts equivalent to 20% of total cost.	20 ~ 40 p.s. x 100, - Same as left - - Same as left -	22 p.s. x 5, 33 p.s x 5, Diesel oil engine with shaft and propeller, W/machinery and tools for 4 workshops.	45 p.s. x 24, - Same as left - W/machinery and tools for 3 workshops	

Equipment/ Materials	Original Pakistani Request		Team's Modifications		Total Amount
	Baluchistan Province	Sind Province	Baluchistan Province	Sind Province	
2. Materials for Fishing Gear 1) Nylon twines	Nylon twines for gillnet and dredge net, Equal quantities of 210 D/3/12, 18, 24, 27, (100,000 kg).	- Same as left - Netting for shrimp fishing.		Nylon netting & webbing twines, 210 D/3/60 - 60 kg " /45 - 5656 kg " /39 - 22943 kg " /12 - 7173 kg Vinylon twines 20S/3/18 - 441 kg. Netting 210 D/3/4 - 1766.2 kg	¥76,980 thousand
2) Nylon ropes	Nylon head & foot ropes for sea fishery nets, 6-6 or 6 polyamide, 2 - 3 strand, 1/8 & 1/2 in. dia., breaking strength of 7725 Ibs (100,000 kg)	- Same as left - 1/4 & 1/2 in. dia., - Same as left -		Nylon ropes 20 mmφ 4883.8 kg 12 mmφ 4840.7 kg 10 mmφ 10195.0 kg 4 mmφ 2196.0 kg	

Equipment/ Materials	Original Pakistani Request		Team's Modifications		Total Amount
	Baluchistan Province	Sind Province	Baluchistan Province	Sind Province	
3) Synthetic floats	Float tops or equivalent, Base 4-1/2" Height 6" Hole 7/8" (75,000)	- Same as left - (100,000)		PVC floats 197 x 60.5 x 39.5 - 12,870 pcs 197 x 60.5 x 33.5 - 2,448 pcs 70 x 18 x 45 - 321,356 pcs	

Notes: The above modifications were made within 90% of the budget, with 10% earmarked to provide against the possible rises in commodity price in the future.

8-2 Basis for Determination of Specifications, Quantities, Etc. of Equipment and Materials

8-2-1 Fundamental Policy for Determination

(a) The distribution ratios of each kind of equipment and materials to be supplied to the two provinces, as specified in the official request of the Pakistani Government, were construed to have been agreed upon between the two Provincial Governments, and were consequently used in preliminary determination of the actual distribution ratios. The budgetary appropriation to the two provinces was made on the basis of the Team's own views detailed later, with due account taken of the opinions of the two Provincial Governments.

(b) In the above determination of distribution ratios, the geographical and economic characteristics of the two provinces as disclosed by the survey were taken into consideration.

(c) The budgetary appropriation to the two major divisions of assistance, i.e., engines and materials for fishing gear, was made in accordance with the opinion of each Provincial Government.

(d) The distribution ratio of each kind of equipment and materials was also determined in accordance with the opinion of each Provincial Government.

(e) The originally requested quantity of twines and ropes, which was 100 tons for specification, was found to be rather incompatible with the actual structure and operation of fishing gear. Accordingly, the Team designed rational fishing gear as shown in Fig. 15 to find out the materials and their quantities required for their operation, and determined the quantity of each of such materials within in the limits of appropriated budget.

(f) At the request of the Provincial Government of Baluchistan, the budget for this province was appropriated only to engines, disregarding the materials for fishing gear.

8-2-2 Basis for Budgetary Appropriation

1) Basis for Determining Budgetary Appropriation to Two Provinces

The official Pakistani request was made for virtually the same value of equipment and materials to the two provinces, although some differences in quantity were specified. Specifically, the equipment and materials requested to be supplied to Baluchistan Province amounted to RS.83,000,000 in value (¥166 million at the exchange rate of RS.1 = ¥20) and those requested to be supplied to Sind Province were worth RS.79,000,000 (¥158 million), so that the difference was only RS.400,000 (¥8 million). Hence, it can be said that the Pakistani request for budgetary appropriation for aid was equivalent for both provinces.

With this in mind, the Team appropriated 45% of the budget to Baluchistan Province and 55% to Sind Province by reason of the factors enumerated below. It is to be noted that these budgetary appropriation rates were adopted for determination of the specifications, quantities, etc. of all equipment and materials, but actual distribution of the equipment and materials between the two provinces will be left to the discretion of the Pakistani Government.

(1) There exists a difference between the two provinces in terms of motorization rate of fishing boats engaged in sea fishery in 1978.

Sind Province (incl. Karachi):

$$\frac{\text{Non-motorized fishing boats}}{\text{All fishing boats}} = \frac{4,191}{6,647} \fallingdotseq \frac{63}{100}$$

Baluchistan Province:

$$\frac{\text{Non-motorized fishing boats}}{\text{All fishing boats}} = \frac{1,673}{2,392} \fallingdotseq \frac{70}{100}$$

As seen in the above calculation, 70% of fishing boats in Baluchistan Province are not motorized as against 63% in Sind Province.

(2) Sind Province is conditioned favourably for obtaining income from the sales of fish catches because of its relative proximity to main consuming areas including Karachi. Baluchistan Province, on the other hand, is not only far from consuming areas but also isolated by adverse geographic and topographic conditions which make it difficult to market fish catches on advantageous terms. Hence, it can be said that the fishermen's capacity for obtaining engines and materials on a commercial basis is low in this province.

(3) Sind Province is more capable than Baluchistan Province for utilizing international financing institutions including ADB, but has not benefited by these institutions.

(4) The number of engines to be supplied to Baluchistan Province was increased by the request of the Provincial Government that the budget for materials for fishing gear be appropriated to engines.

(5) By reason of the equal budgetary appropriation for the two provinces requested by the Pakistani Government and the budgetary arrangement requested by the Provincial Government of Baluchistan mentioned in Item (4) above, the Team adopted the said appropriate rates of 45% and 55% for Baluchistan and Sind, respectively.

2) Budgetary Appropriation for Each Kind of Equipment and Materials for Baluchistan Province

The budgetary appropriation rate for each kind of equipment and materials shown in the following table was determined with due regard to the opinion of the Provincial Government.

Table 28. Budgetary Appropriation Rate for Equipment and Materials

Equipment/ Materials	Rate Desired by Provincial Government	Corresponding Amount	Rate Determined by Team	Corresponding Amount
Engine	100%	152,000 x 0.8 = ¥121,600 thousand	100%	152,000 x 0.8 = ¥121,600 thousand
Outboard engine	65%	79,040 thousand	Approx. 92.3%	112,250 thousand
6 p.s.	10%	79,040 thousand	7 p.s. 40%	44,900 thousand
8 p.s.	20%	158,040 thousand		
16 p.s.	70%	553,280 thousand	12 p.s. 60%	67,350 thousand
Inboard engine	35%	42,560 thousand	Approx. 7.7%	9,350 thousand
22 p.s.	60%	225,360 thousand	40%*	3,800 thousand
33 p.s.	40%	170,240 thousand	60%*	5,550 thousand
45 p.s.	0%	0	0%	0
Fishing gear materials	0%	0	0%	0

Rates for engines are inclusive of neither machinery and tools for workshops nor spare parts equivalent to 20% of total engine cost.

* Rates determined for equalising the number of engines (5 each).

As seen in the above table, the Team reduced the originally desired appropriation rate for inboard engines because fishing vessels in Baluchistan Province cannot mount these engines due to their projecting bow and stern, although some are large enough to mount them.

3) Budgetary Appropriation for Each Kind of Equipment and Materials for Sind Province

The budgetary appropriation rate for each equipment and material to be supplied to Sind Province was also determined with due regard to the opinion of the Provincial Government.

Table 29. Budgetary Appropriation Rate for Equipment and Materials

Equipment/ Materials	Rate Desired by Provincial Government	Corresponding Amount	Rate Determined by Team	Corresponding Amount
Engine	60%	114,300 x 0.8 = ¥91,440 thousand	Same as left	Same as left
Outboard engine	65%	594,360 thousand	Same as left	Same as left
6 p.s.	10%	594,360 thousand	7 p.s. 30%	¥1,783,080 thousand
8 p.s.	20%	1,188,720 thousand		
16 p.s.	70%	4,160,520 thousand	12 p.s. 70%	4,160,520 thousand
Inboard engine	35%	320,040 thousand	Same as left	Same as left
22 p.s. (average of 20 - 25 p.s.)	0%			
33 p.s. (average of 30 - 35 p.s.)	0%			
45 p.s.	100%	320,040 thousand	Same as left	Same as left
Exclusive the cost of machinery and tools for workshops and the cost of spare parts (20% of total engine cost).			*	

* Originally desired horsepowers were changed because the presently used engines are extremely low in efficiency and the two ratings adopted by the Team suffice to produce greater engine efficiency and output than desired.

- cont'd -

Equipment/ Materials	Rate Desired by Provincial Government	Corresponding Amount	Rate Determined by Team	Corresponding Amount
Materials for Fishing Gear (Materials for gillnet)	40%	¥76,020 thousand	Same as left	Same as left
Materials for large size gillnet	40%	30,480 thousand	Same as left	Same as left
Materials for medium size gillnet	30%	22,860 thousand	Same as left	Same as left
Materials for small size gillnet	15%	11,430 thousand	Same as left	Same as left
Materials for beach seine	15%	11,430 thousand	Same as left	Same as left

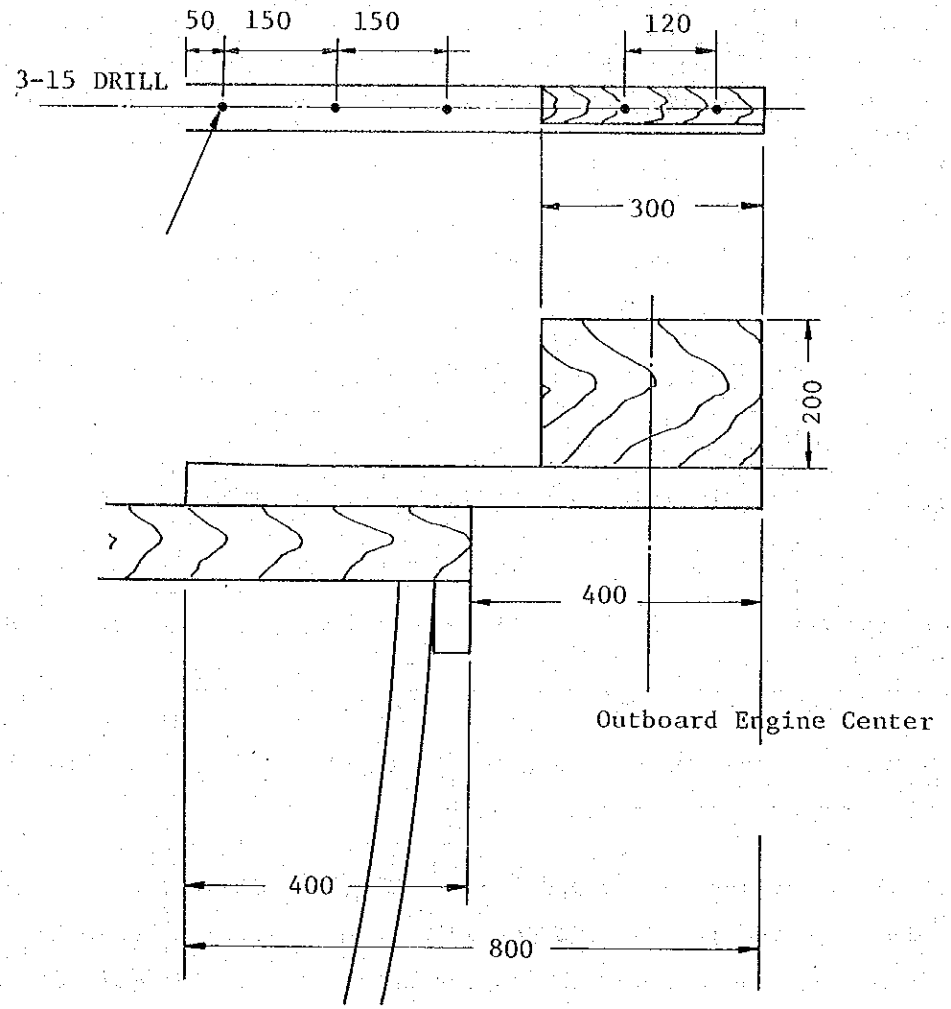
8-2-3 Specifications, Quantities, and Appropriated Budget of Each Kind of Equipment and Materials

As detailed in Sections 8-2-1 and 8-2-2, 10% (¥40 million) of the budget was earmarked to provide against the possible future rises in commodity price, and the remainder of ¥360 million was appropriated to each kind of equipment and materials as shown in Tables 28 and 29, with account taken of the desires of each Provincial Government and the Team's findings and reviewal.

The desires of the two Provincial Governments were taken into full consideration in determining the specifications of equipment. As regards the materials for fishing gear, however, the team found it necessary, for reasons described later, to change the originally requested specifications and quantities of twines and ropes which were the same for both provinces.

1) Engine

Specifications of engines, comprised of outboard and inboard engines, were determined as follows. Fig. 11 shows the dimensions of the outboard engine mounting base.



Remarks: Main material - Carbon steel (thickness 6 mm)

Weight - about 8 kg

Fig. 11. Mounting Base of Outboard Engine

a) Outboard Engine

Engines of fishing boats currently in use in Pakistan are spark ignition type air-cooled kerosene engines with long-tail shaft. The long-tail shaft of this type of engine is disadvantageous for reducing the overall engine weight. After a careful study based on the weight comparison shown in Table 30, the Team selected an integrated spark ignition type kerosene engine with directly coupled shaft and propeller. In order to secure a sufficient propeller depth, it was determined that this engine would have a shaft length of 70 cm for both 7 p.s. and 12 p.s., which is 20 cm longer than the shaft of standard engines.

Table 30. Weight Comparison between Presently Used Engine and Newly Selected Engine

Item / p.s.	Presently Used Engine			Newly Selected Engine		
	Engine Body	Long-tail Shaft	Total Weight	Engine W/Shaft and Propeller	Weight Increment due to Additional 20 cm Shaft Length	Total Weight
7.5 p.s.	35 kg	13 kg	48 kg			
7 p.s.				30 kg	3 kg	33 kg
12 p.s.				40 kg	4 kg	44 kg
16 p.s.	42 kg	15 kg	57 kg			

Note: Ref. Table 12.

Differences between the two types of engines in performance, output, efficiency, method of operation and mounting, etc. are explained below for better understanding of the newly selected engine in comparison with the presently used long-tail shaft type engine.

As for the differences in engine body, it will be seen from Table 31 that the newly selected engine is identical to the presently used one except in the cooling method.

Table 31. Differences in Engine Body between Two Types

Item \ Engine Type	Presently Used Long-tail Shaft Type	Newly Selected Integrated Type
1. Starting method	Starter wheel is turned by pulling the rope. Gasoline is used.	Same as left.
2. Fuel after starting	Kerosene.	Same as left.
3. Ignition method	Spark ignition.	Same as left
4. Cooling system	Air-cooled (due to the use of long-tail shaft).	Water-cooled (automatic suction of sea water near propeller for supply to engine).
5. Weight in the air	Integrated type is smaller in total weight.	
6. Revolutions	3,200 - 3,600 rpm for engine, but no speed reduction for propeller (See the efficiency comparison table).	5,500 rpm is reduced to 1/2.
7. Speed adjustment	Revolutions are adjustable, but reversing or clutch ON-OFF operation is not possible.	Revolutions are adjustable, and reversing and clutch ON-OFF operation are possible.
8. Efficiency	Extremely poor due to lack of matching between propeller performance and high RPM.	High efficiency ensured as propeller performance is matched with RPM.

Table 32. Engine Horsepower and Speed by Ship Class

Ship Class	Engine Horse-Power	Engine RPM	Displacement (LWL x B x d x CB x 1.025)	Propeller (Blade x Dia x Pitch)	Speed
30 Feet (9.1 m)	7 p.s.	5,500 R.P.M.	8 x 2 x 0.5 x 4.5 x 1.025 = 4.1 tons	(9 inch)(5-1/4 inch) 3 x 228mm x 146 mm	6.4kf
35 Feet (10.6 m)	7 p.s.	5,500 R.P.M.	10 x 2.5 x 0.65 x 0.5 x 1.025 = 8.3 tons	3 x 228 x 146	6.0kf
35 Feet (10.6 m)	12 p.s.	5,500 R.P.M.	10 x 2.5 x 0.65 x 0.5 x 1.025 = 8.3 tons	(9-1/4 inch)(8 inch) 3 x 235 x 203	7.0kf
40 Feet 12.1 m)	12 p.s.	5,500 R.P.M.	11 x 3 x 0.8 x 0.5 x 1.025 = 13.5 tons	(9-1/4 inch)(8 inch) 3 x 235 x 203	6.4kf

Notes: 1. Reduction ratio = 2.08

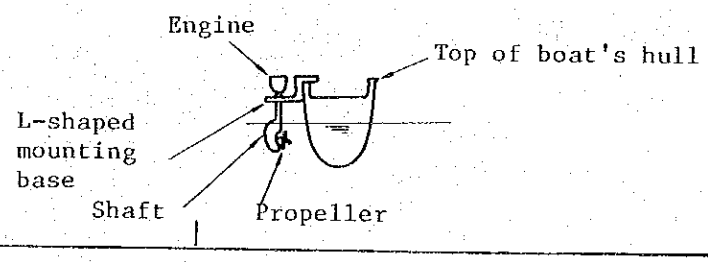
2. Boats with a length of about 40 ft. usually mount 2 - 3 engines, so that their speed is greater than the value shown above which is attainable by a single engine.

The propeller of the presently used engines is a local product. Since its specification is not matched with RPM, its efficiency is extremely poor and causes the engine horsepower to decline considerably from the nominal value. The actual maximum output of the presently used engines is much lower than the rated value of 16 p.s.

For this reason, two output ratings, 7 p.s. and 12 p.s. were determined for the newly selected integrated type engine. It is considered that these ratings of the new engine are more than sufficient to cover the desired outputs of 6 & 8 p.s. and 16 p.s., respectively.

Table 33. Comparison of Engine Installation Method

(Ref. Figs. 12, 13)

Item \ Engine Type	Presently Used Long-Tail Shaft Type	Newly Selected Integrated Type
1. Installation position	To be installed to a side of boat at a point about 1/3 of boat length away from stern.	Same as left, except that engine must be projected slightly more from broadside because vertical shaft is fitted directly below it.
2. Tilting	Free tilting to a certain angle is possible, but engine must held with hand to fix it in the tilted position.	Free tilting from vertical to horizontal positions and fixing in 4 positions is possible.
3. Horizontal turning	Not possible.	Possible, so that engine can be used as rudder.
4. Horizontal propeller direction	Constant. Propeller angle conforms with shaft directional angle.	Propeller direction is horizontal when engine is held vertical, and can be turned freely to the right or left by changing the engine direction.
5. Water depth required for propeller	Determined by maximum tilting angle and length of shaft.	Propeller depth can be adjusted by changing height of mounting base (shown below) from top of boat's hull. But sufficient propeller depth can be secured simply by projecting mounting base horizontally from top of boat's hull because shaft is 200 mm longer than that of standard engines. 

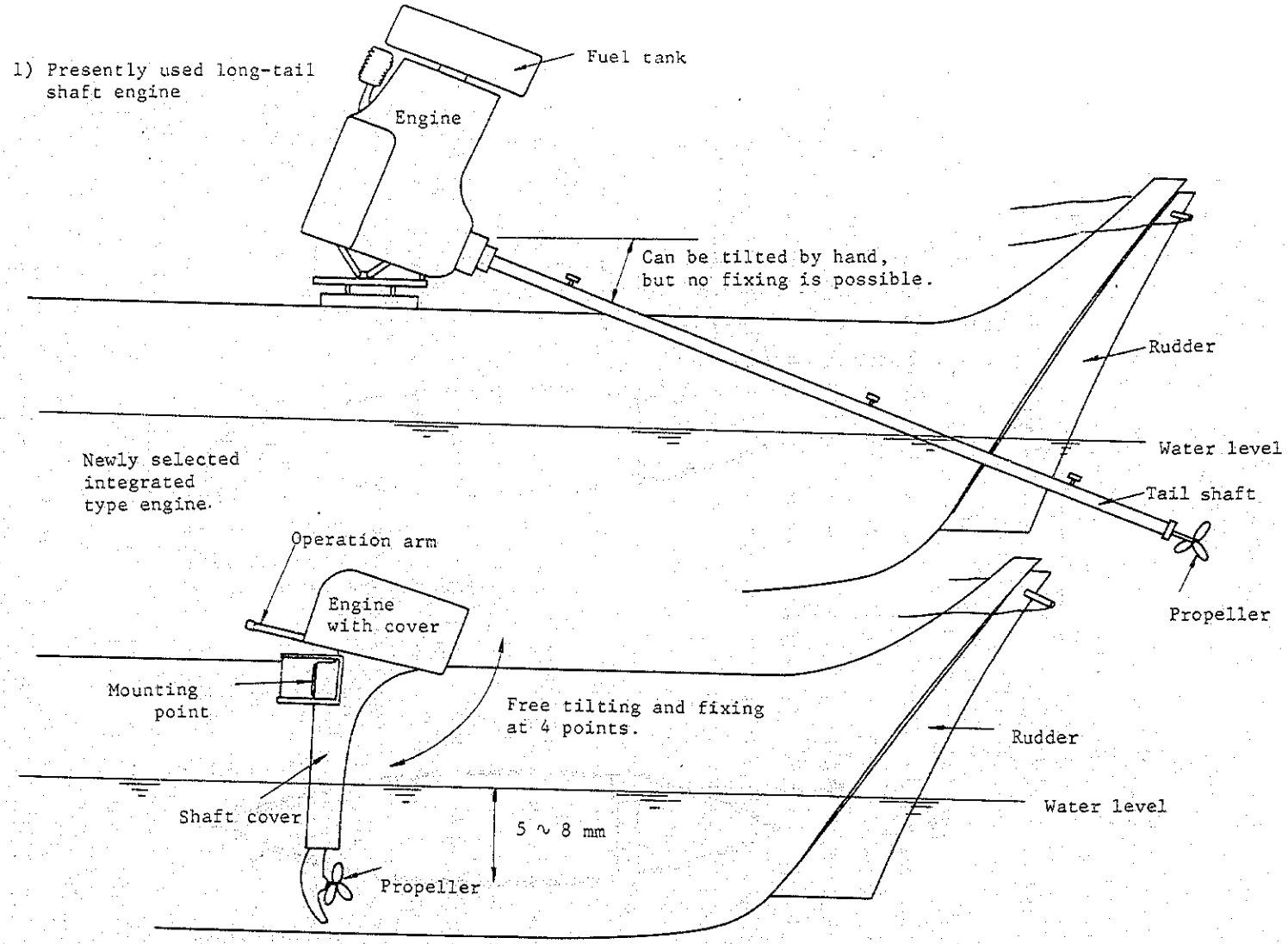
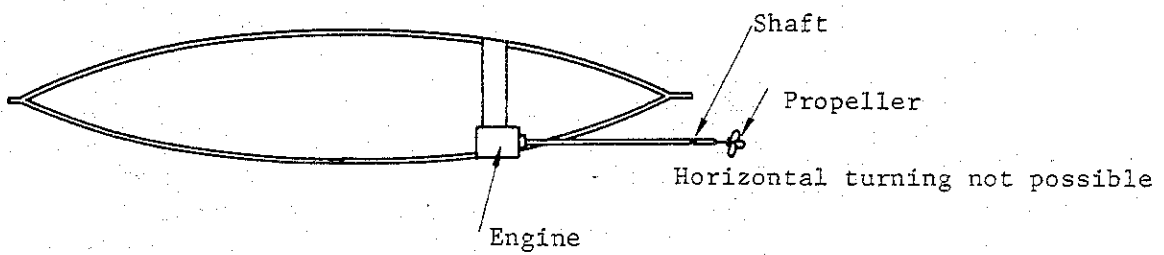


Fig. 12 Side Views Illustrating Installation and Operation of Two Types of Engines

1) Presently used long-tail shaft engine.



2) Newly selected integrated type engine

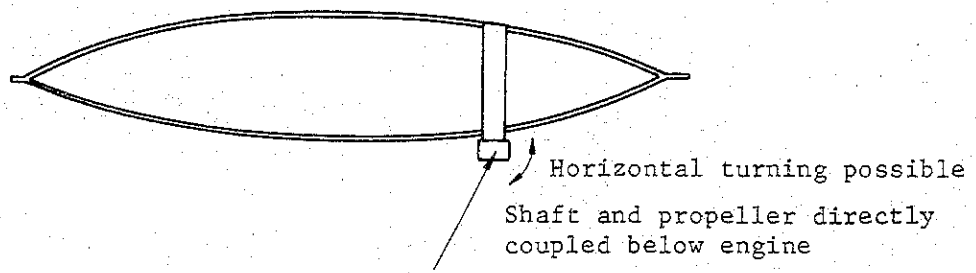


Fig. 13 Plans Illustrating Installation and Operation of Two Types of Engines

As can be seen in Table 34, the newly selected integrated type engine excels the presently used engine in both output and efficiency.

Table 34. Comparison of Output and Efficiency between Two Types of Engines

Presently Used Long-Tail Shaft Type Engine	Newly Selected Integrated Type Engine
Engine rotational force is transmitted directly to propeller without reduction, so that speed is as high as 3,200 - 3,600 RPM and propeller cause cavitation. As a consequence, a very small portion of transmitted power is actually used for propulsion.	Engine rotational frequency, 5,500 RPM, is transmitted to propeller after reducing it to one-half or 2,750 RPM which is lower than the speed of the presently used engines and in addition, propeller is designed properly to match with engine. Engine efficiency is therefore very high.

The efficiency comparison shown in Table 34 justifies the aforementioned adoption of two output ratings for the newly selected integrated type engine. Specifically, it can be said that 7 p.s. and 12 p.s. selected for the integrated type engine will more than suffice to provide the desired horsepower range of 6 - 16 p.s. of the presently used engines.

Table shows the differences in the method of use between the two types of engines.

Table 35. Comparison of Operational Method between Two Types of Engines

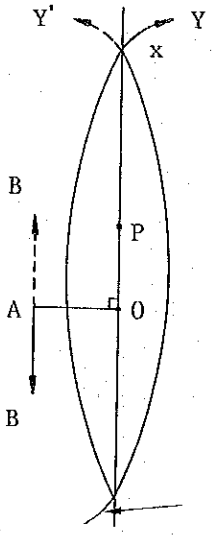
	Presently Used Long-Tail Shaft Type Engine	Newly Selected Integrated Type Engine
1. Starting	Rope is wound on starter wheel and then pulled.	Rope wound on starter wheel in advance is pulled out.
2. Fuel for Starting	Gasoline	- do -
3. Fuel after starting	Kerosene	- do -
4. Starting on sand beach	Possible because of water-cooled system. However, due to extremely poor design of shaft lubricating mechanism, failures such as seizure occur frequently not only in the air but in water.	Possible for a short time because of water-cooled system.
5. Propeller usability in shallow waters	Usable if propeller is prevented from touching seabed by holding shaft at a suitable angle by hand. However, propeller may be damaged if it comes in contact with seabed.	Can be used effectively even in shallow waters by fixing engine at a proper tilting angle.
6. Speed adjustment during cruising	Revolutions can be adjusted, but propeller must be raised above water level for stopping because clutch ON-OFF operation is not possible.	Revolutions can be adjusted freely. In addition, propeller rotation can be stopped or reversed with engine running by ON-OFF operation of clutch, so that boat can be stopped or backed freely.

- Cont'd -

	Presently Used Long-Tail Shaft Type Engine	Newly Selected Integrated Type Engine
7. Manoeuvering	Boat's advancing direction can be changed only by rudder at stern.	Boat's advancing direction can be changed freely by adjusting the engine horizontal direction.
8. Use of rudder during straight advancing	For constant straight advancing, rudder must be held at a certain angle to cancel boat's turning force resulting from deviation of propeller position from boat's center line.	Constant straight advancing can be ensured without using rudder by maintaining propeller horizontal direction at a certain angle apart from boat's center line (See illustration in Fig. 13).
9. Seizure of engine or shaft	Seizure of shaft bearing is liable to occur due to its poor design.	Practically free from seizure because of complete water-cooled system.

As can be seen in the above table, the integrated type engine can be handled without any difficulty as it is identical in structure to the presently used type. The only difference exists between the long-tail shaft and the integrated vertical shaft and propeller which adds to the ease of boat manoeuvering.

As explained in Fig. 13, a boat equipped with one integrated type engine which is installed to one side just as the presently used engine will move straight forward without the aid of rudder if the engine horizontal direction is maintained at angle α with the boat's center line. Angle α can be calculated by the method explained in Fig. 13, but its calculation is not necessary in actual crusing because the correct angle for sailing straight can be obtained by ajusting the engine angle at sea. For satisfactory crusing with one integrated type engine, it is advisable to install it as close to the stern as possible.



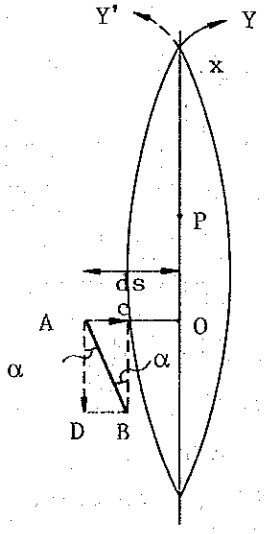
(a) When turning boat with propeller direction maintained parallel with center line from bow to stern:

AB is direction of propulsion force. P is center of turning of boat. Bow will turn to the right. If engine is installed at right side, bow will turn to the left. If XY is turning force of bow, boat will not move straight unless left turning force XY' required for cancelling XY is not created by rudder.

Couple of forces: $M = \vec{AB} \times AO$

NOTE: As direction of AB, direction shown by dotted line is correct but it is shown by solid line for the purpose of easier explanation.

Using of rudder (rudder is used to create $\overset{\frown}{XY}'$ for cancelling turning force $\overset{\frown}{XY}$ and moving the boat straight)



(b) When turning boat by maintaining angle α between horizontal propeller direction and center line of boat:

AB is direction of propulsion force. By decomposing this force, thrust $\vec{AD}$ and lateral thrust $\vec{AC}$ are obtained.

(1) As stated previously, $\vec{AD}$ will turn the bow to the right, and couple of force ($\overset{\frown}{XY}$ is resulted by distance d_s.

(2) $\vec{AC}$ creates couple of forces which will turn the bow in $\overset{\frown}{XY}'$ direction about turning center point P.

(3) Thus, if $\overset{\frown}{XY}=\overset{\frown}{XY}'$ is maintained, boat will move straight without using rudder at stern.

Since $\overset{\frown}{XY}$ corresponds to $\vec{AD} \times AO$
and $\overset{\frown}{XY}'$ corresponds to $\vec{AC} \times PO$

therefore, following relation must occur:

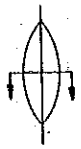
$$\vec{AB} \times AO = \vec{AC} \times PO$$
$$= \vec{BC} \cdot \tan\alpha \cdot PO$$
$$\vec{AD} \cdot \tan\alpha \cdot PO$$

If $\vec{AB}$ of figure (a) is approximately equal to $\vec{AD}$ of figure (b), above formula is expressed by $\tan\alpha = \frac{AO}{PO}$

$$\alpha = \text{Arc tan } \frac{AO}{PO}$$

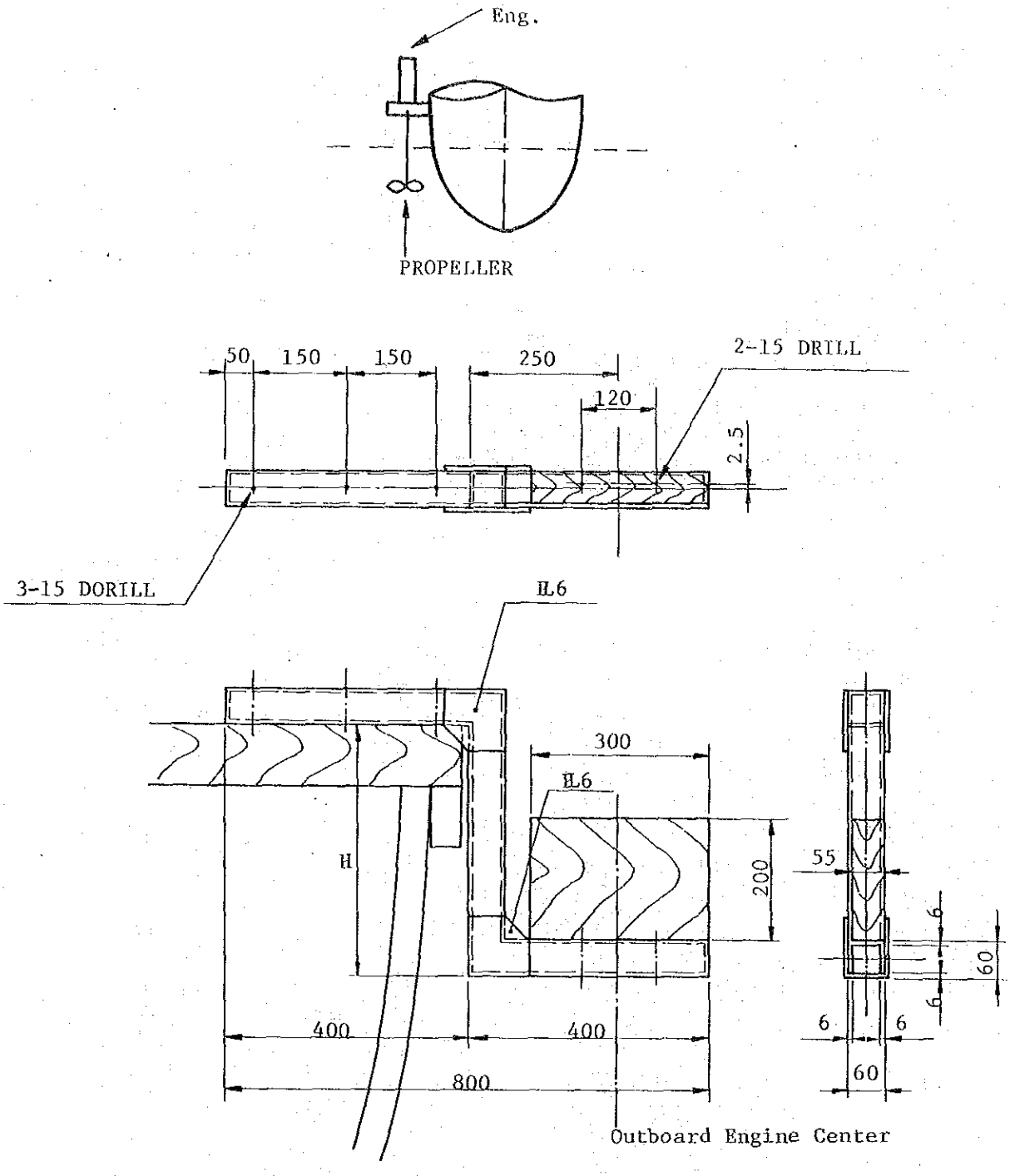
Thus, angle α of direction of engine (=propeller) can be obtained since both AO and PO are known.

Fig. 14. Maneuvering method for boat equipped with a single engine at one side



In this case, boat moves straight. But boat can be turned by changing either direction or RPM of one of engines.

When turning boat with two identical engines (same horsepower) installed symmetrically at each side with propeller directions in parallel with center line of boat:



Remarks: H : To be decided at site
Main material: Carbon steel (Thickness 6 mm)
Weight : About 12 kg

Fig. 15. Outboard Engine Mounting Base

To provide against the possible case where sufficient water depth cannot be secured for propeller due to large boat size, it is planned that the engine will be installed by means of the mounting base shown in Fig. 14 which will be manufactured in Pakistan and fitted to a side of boat whenever such shortage of water depth occurs.

b) Inboard Engine

The inboard engine selected by the Team is a 4-cycle, vertical water-cooled Diesel engine.

22 p.s. : Diesel engine complete with shaft and propeller, but not having an intermediate shaft. Manual starting using Diesel oil.

33 p.s. : Same as 22 p.s.

45 p.s. : Same as 22 p.s. except that 1 m long intermediate shaft will be provided.

c) Spare Parts

The Pakistani Government requested to be supplied with spare parts equivalent to 20% of the total engine cost.

The quantity of each individual spare part to be supplied for a plural number of engines usually differs from the quantity of the same spare part required for a single unit of engine. Specifically, it is not increased according to increasing number of engines and the common practice is to reduce the quantity of those spare parts which are not frequently required for replacement. However, 20% of the engine cost was appropriated to spare parts as it was strongly requested by the Pakistani Government.

Spare parts of the outboard engine are listed in Table 36, and those of the inboard engine in Table 37. The quantities shown in the two tables were determined with the average replacement interval set at about 3 years for each spare part.

d) Workshop Machinery and Tools

In order to ensure longeval and fault-free operation of the engines, it was considered necessary to supply machinery and tools to 4 workshops in Baluchistan Province and 3 workshops in Sind Province. Supply of such workshop machinery and tools was not only considered necessary by the Team but also requested by the two Provincial Governments. Machinery and tools for one workshop, costing ¥2.5 million, are listed in Table 38. Motor-driven tools and machinery must be operated at power rating of 200 V, single pole, 50 Hz.

Table 36. List of Spare Parts of Outboard Engine
(For repair of 50 engines within 3 years)

No.	Name	Quantity	
		7 p.s.	12 p.s.
1.	STOP SWITCH ASSY	15	18
2.	CASE, STARTER	6	6
3.	PAWL, DRIVE	90	60
4.	STRING, PAWL DRIVE	60	60
5.	STARTER ROPE 50 M	9	18
6.	CIRCRIP	60	60
7.	COIL, IGNITION	12	12
8.	CONTACT BREAKER ASSY	60	60
9.	CONDENSER	15	24
10.	IGNITION COIL ASSY 1	30	30
11.	IGNITION COIL ASSY 2	30	30
12.	PLUG CAP ASSY	30	
13.	CRANK CASE ASSY	9	6
14.	GASKET SYLINDER HEAD	60	60
15.	GASKET THERMOSTAT	60	
16.	GASKET EXHAUST INNER COVER	90	90
17.	ANODE	30	30
18.	PLUG, SPARK	300	240
19.	CRANK ASSY	15	18
20.	BRG, R-B 6240 47 MM 106G KY	30	
21.	WASHER, PRATE	60	60
22.	PIN DOWEL	600	600
23.	PISTON (S.T.D.)	15	18
24.	PISTON	15	18
25.	PISTON RING SET	60	30
26.	PIN, PISTON	30	30
27.	CIRCRIP	60	120
28.	O-RING	60	60
29.	OIL SEAL	30	30
30.	OIL SEAL	30	60

No.	Name	Quantity	
		7 p.s.	12 p.s.
31.	KEY, WOODRUFF	60	60
32.	SEAL	30	30
33.	O-RING	60	60
34.	PACKING VALVE SEAT 1	45	60
35.	GASKET	45	60
36.	PIN, HAIR	60	
37.	CARBURETOR ASSY	12	6
38.	VALVE SEAT ASSY	30	60
39.	GASKET, FLOAT CHAMBER	60	60
40.	GASKET, FLOAT CHAMBER	60	60
41.	GASKET, UPPER CASING	60	60
42.	COVER, UPPER CASING 1	15	
43.	PACKING, LOWER CASING	60	60
44.	GASKET	150	60
45.	SCREW, DETENT	30	
46.	GASKET	60	30
47.	ANODE	60	60
48.	CAP, LOWER CASING	9	
49.	O-RING	60	60
50.	DRIVE SHAFT COMP.	15	18
51.	KEY WOODRUFF	60	60
52.	OIL SEAL	60	60
53.	PINON	15	18
54.	CIRCLIP	60	60
55.	BRG R-B	15	18
56.	GEAR 1 ASSY	15	18
57.	DOG, CLUTCH	15	18
58.	PIN DOWELB	30	
59.	SHAFT, PROPELLER	9	6
60.	PIN	300	120
61.	GEAR 2 ASSY	15	18
62.	BRG, R-B	15	18

No.	Name	Quantity	
		7 p.s.	12 p.s.
63.	OIL SEAL	60	60
64.	PROPELLER ASSY A	15	18
65.	PROPELLER ASSY B	15	18
66.	NUT PROPELLER	60	60
67.	PIN, COTTER	90	120
68.	HOUSING, WATER PUMP	15	18
69.	INSERT, CARTRIDGE	60	30
70.	IMPELLER	60	60
71.	OUTER PLATE, CARTRIDGE	60	30
72.	GASKET, WATER PUMP	60	60
73.	RUBBER, WATER SEAL 2	60	30
74.	RUBBER, WATER SEAL 1	60	60
75.	SET PLATE, WATER TUBE	60	
76.	SCREW 6204311600	15	
77.	PAD, TRANSOM CLAMP	15	
78.	TILT ROD ASSY	6	
79.	HANDLE, STEERING 2	9	
80.	BUSSING	30	30
81.	THROTTLE WIRE ASSY	30	30
82.	HANDLE, GEAR SHIFT	9	
83.	SHIFT, CHANGE	9	
84.	O-RING	90	60
85.	BOOT, SHIFT ROD	15	
86.	BALL	30	
87.	FUEL PUMP ASSY	15	18
88.	DIAPHRAGM	30	
89.	DIAPHRAGM	30	
90.	GASKET, BODY 1	30	60
91.	GASKET, BODY	30	
92.	GASKET, FUEL PUMP 2	30	
93.	GASKET, FUEL PUMP	60	
94.	PACKING, FILTER	60	

No.	Name	Quantity	
		7 p.s.	12 p.s.
95.	ELEMENT, FILTER	60	
96.	O-RING	60	60
97.	PRIMARY PUMP ASSY	15	30
98.	FUEL PIPE JOINT COMP 2	15	18
99.	FUEL PIPE JOINT COMP 1	15	
100.	GREASE A (250 G)	180	72
101.	BOND #4 (200 G)	30	18
102.	BOLT	30	120
103.	BOLT HEXAGON	30	60
104.	BOLT, HEXAGON	45	60
105.	BOLT, HEXAGON	45	60
106.	BOLT	50	60
107.	BOLT	45	60
108.	BOLT HEXAGON	60	60
109.	BOLT HEXAGON	60	60
110.	SCREW, PAN HEAD	60	60
111.	SCREW, CYLINDER HEAD	30	
112.	SCREW, SLOTTED	30	
113.	PLUG, STRAIGHT	30	60
114.	GASKET KIT FOR POWER UNIT	30	30
115.	GASKET KIT FOR POWER UNIT	30	30
116.	WATER PUMP REPAIR KIT	30	30
117.	THERMOSTAT		30
118.	REED VALVE ASSY		12
119.	BUSHING		12
120.	PIN STRAIGHT		240
121.	INNER PLATE, CARTRIDGE		30
122.	MOUNT RUBBER, UPPER FRONT		30
123.	MOUNT RUBBER, UPPER SIDE 1		30
124.	MOUNT RUBBER, UPPER SIDE 2		30
125.	MOUNT RUBBER, LOWER SIDE		30
126.	MOUNT RUBBER, LOWER FRONT		30

No.	Name	Quantity	
		7 p.s.	12 p.s.
127.	SPRING, STARTER		18
128.	FILTER ASSY		30
129.	WATER PUMP REPAIR KIT		30
130.	BOLT		120
131.	BOLT HEXAGON		60

Table 37. List of Spare Parts of Inboard Engine

No.	P.S.	Part Name	Q'ty/1 Unit	Q'ty/50 Units
1.	For 22 & 33 p.s. and 45 p.s.	Packing (Copper)	3	15
2.	"	Packing (Rubber)	6	30
3.	"	Packing (Copper)	3	15
4.	"	O-Ring	6	30
5.	"	O-Ring (12-p)	6	30
6.	"	Zinc	3	15
7.	"	Packing	3	15
8.	"	Seal	1	5
9.	"	Oil seal	1	5
10.	"	Handle W/shaft	1	5
11.	"	Circlip	3	15
12.	"	Valve	3	15
13.	"	Valve	3	15
14. 15.	"	Spring (A) (B)	1, 1	5, 5
16.	"	Retainer	3	15
17.	"	Cotter	3	15
18.	"	Guide valve	2	10
19.	"	Screw	3	15
20.	"	Packing	3	15

No.	P.S.	Part Name	Q'ty/1 Unit	Q'ty/50 Units
21.	For 22 & 33 p.s. and 45 p.s.	Zinc, anti-corrosive	3	15
22.	"	Circlip	3	15
23.	"	Piston ring set	3	15
24.	"	Bush for piston pin	1	5
25.	"	Bearing for crank-pin	1	5
26.	"	Bolt W/nut	1	5
27.	"	Pre-combustion chamber	1	5
28.	"	Cotter pin	10	50
29.	"	Washer	1	5
30.	"	Oil seal	1	5
31.	"	O-ring, 16-p	10	50
32.	"	O-ring, 18-p	10	50
33.	"	O-ring, 11-p	10	50
34.	"	Spring	1	5
35.	"	Strainer	1	5
36.	"	Strainer	1	5
37	"	Pipe for fuel injection	1	5
38.	"	Anti-corrosive zinc	3	15
39.	"	Element	1	5
40.	"	Valve	2	10
41.	"	Spring	2	10
42.	"	Packing	3	15
43.	"	Packing	3	15
44.	"	Packing	1	5
45.	"	Valve	2	10
46.	"	Spring	2	10
47.	"	Gasket	3	15
48.	"	Gasket	3	15
49.	"	Plunger W/barrel	1	5
50.	"	Spring	1	5

No.	P.S.	Part Name	Q'ty/1 Unit	Q'ty/50 Units
51.	For 22 & 33 p.s. and 45 p.s.	Retainer	3	15
52.	"	Valve W/seat delivery	2	10
53.	"	Spring	2	10
54.	"	Packing	3	15
55.	"	Packing	3	15
56.	"	Valve W/case	3	15
57.	"	Spring	2	10
58.	"	Packing	3	15
59.	"	Shim set	3	15
60.	"	Packing	3	15
61.	"	Ball bearing	1	5
62.	"	Ball Bearing	1	5
63.	"	Seal	1	5
64.	"	Packing	3	15
	Price	For 22 p.s. and 33 p.s.	¥131,000	¥6,550,000
		For 45 p.s.	¥158,000	¥7,900,000

Table 38. List of Workshop Machinery and Tools (For One Shop)

Item No.	Description & Specifications	Q'ty
1.	Vernier caliper / 0 - 200 mm	4
2.	Micrometer / Out side, 0 - 500mm	2
3.	Caliper / 200 mm	2
4.	Dial gauge / 1/100, 10 mm stroke	2
5.	Cylinder gauge / 50 - 150 mm	2
6.	Feeler gauge (Thickness gauge) / 0.03 - 1.0 mm, 19 pcs./set	4
7.	Digital tachometer / 0 - 10,000 rpm.	1
8.	Hand tachometer (Hasler type) / 0 - 10,000 rpm.	2
9.	Torque wrench / 0 - 30 kg-M	2
10.	Thermometer / 0 - 500°C	2
11.	Measure with stop / 2 m	2
12.	Nozzle tester / 0 - 500 kgs/cm^2	1
13.	Tap & Dies / 2 - 20 mm	1
14.	Gear puller / 100 mm & 200 mm	1
15.	Wheel puller / 10"	1
16.	Screw extracter / 1/16" - 3/8", 6 pcs./set	1
17.	Combination plier/200 mm	2
18.	Nipper / 150 mm	2
19.	Cutting plier / 175 mm	2
20.	Adjustable wrench / 200 mm & 300 mm	2
21.	Pipe wrench / 350 mm	2
22.	Box wrench (T type) / 10 - 36 mm	4
23.	Open-ended wrench / 8 - 23 mm, 6 pcs./set	6
24.	Off-set wrench / 10 - 26 mm, 6 pcs./set	4
25.	Socket wrench / 9 - 32 mm, 15 pcs./set	4
26.	Screw driver / (-), 50 - 200 mm	4
27.	Scraper / 250 mm	4
28.	Wooden hammer	4
29.	Plastic hammer / Small & Large	4
30.	Brass hammer / Small & Large	4

Item No.	Description & Specifications	Q'ty
31.	Machinist hammer / Small & Large	4
32.	Piston ring compressor / 50 - 125 mm	4
33.	Piston ring tool / 150 mm	4
34.	File	4
35.	Center punch set / 9 pcs./set	4
36.	Flat chisel / 19 mm	4
37.	Vise / 75 mm & 125 mm	2
38.	Hacksaw frame with blade / 250 mm	2
39.	Electric bench grinder / 205 mmø AC 220 V 50 Hz. Single phase	1
40.	Portable electric drill / 10 mmø AC 220 V 50 Hz. Single phase	1
41.	Chain block / 0.5 ton 2.5 m lift	1
42.	AC Arc welder / AC 220 V 50 Hz. Single phase	1
43.	Diesel engine generator / 3 kVA AC 220V 50 Hz Three phase	1

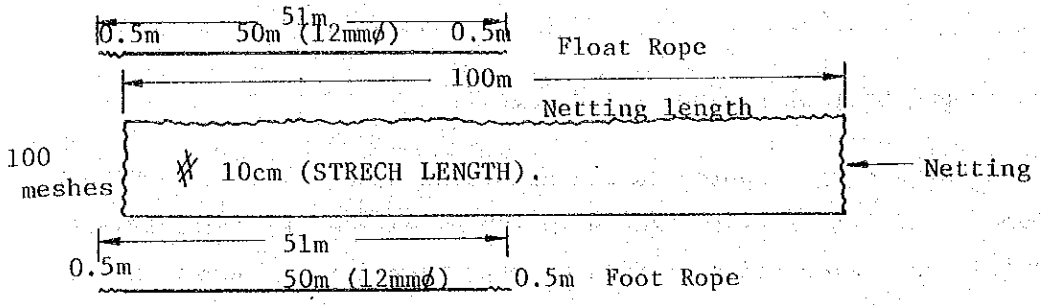
(2) Materials for Fishing Gear

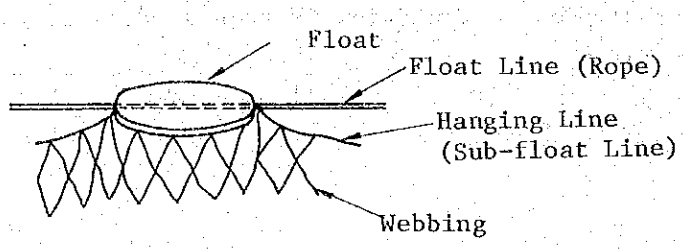
Specifications and unit quantity of netting twine, float line, float rope, hanging line (sub-float line) and float required for each piece of the four nets of the design and structure shown in Fig. 15 were obtained. The four nets were large and medium size gill-nets, shrimp fishing gillnet and beach seine. On the basis of the unit quantity thus obtained and its CIF price, the quantity of each material to be supplied was determined within the limit of budget.

Table 39 and Fig. 15 show the structures of fishing gear designed by the Team for rational improvement of the gear observed in different parts of the two provinces. The fisheries authorities of the two Provincial Government agreed to the Team's proposal to adopt these newly designed structures.

Table 39. Structure of Fishing Gear Designed by the Team

Kind of Gear	Float Line		Netting (Single English knot)			Webbing Twine		Float		Sinker Line	
	Length	Specifications	Mesh Size and Meshes Deep	Twine Specifications	Shrinkage	Twine Specifications	Quantity	Buoyancy/ Piece	Specifications	Length	Specification
1) Gillnet											
(a) Large size gillnet	50 + 1 = 51 m	Nylon rope, 12 mmø	10 cm 100	210 D/3/39 Nylon twine	50%	210 D/3/39 Nylon twine	Float line length x 4 = 200m	236g x 24 = 5904g/ piece	L x D x H.D = 197 x 60.5 x 39.5mm PVC	50 + 1 = 51 m	Nylon rope, 12mmø
(b) Medium size gillnet	50 + 1 = 51 m	Nylon rope, 10 mmø	4 cm 50	210 D/3/12 Nylon twine	50%	20 S/3/18 Vinylon twine	Float line length x 4 = 200 m	10g x 70 = 700g/ piece	L x D x H.D = 70 x 18 x 4.5 mm	50 + 1 = 51 m	Nylon rope, 10 mmø
(c) Gillnet for shrimp fishing	50 + 1 = 51 m	Nylon rope, 4 mmø	2 cm 35	210 D/3/4 Nylon twine webbing	50%	20 S/3/18 Vinylon twine	Float line length x 4 = 200 m	10g x 95 = 950g/ piece	L x D x H.D = 70 x 18 x 4.5 mm	50 + 1 = 51 m	Nylon rope, 4 mmø
2) Beach seine	145 + 10 = 155 m	Nylon rope, 20 mmø	18 cm 100	210 D/3/45 Nylon twine	50%	210 D/3/60 Nylon twine	Float line length x 4 = 290 m	250g x 38 = 9,500g/ piece	L x D x H.D = 197 x 60.5 = 33.5mm	145 + 10 = 155 m	Nylon rope, 20 mmø

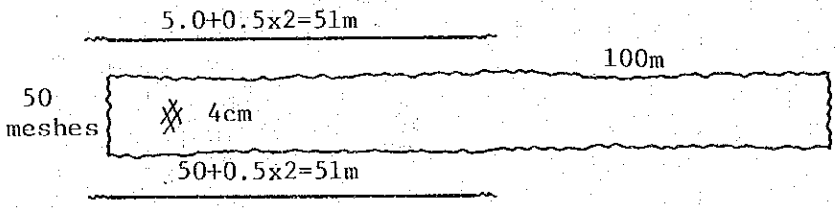




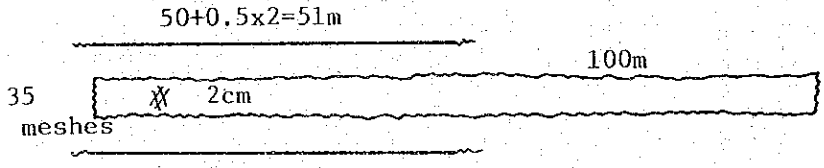
Float Fastening Method

Float Intervals: About 2m

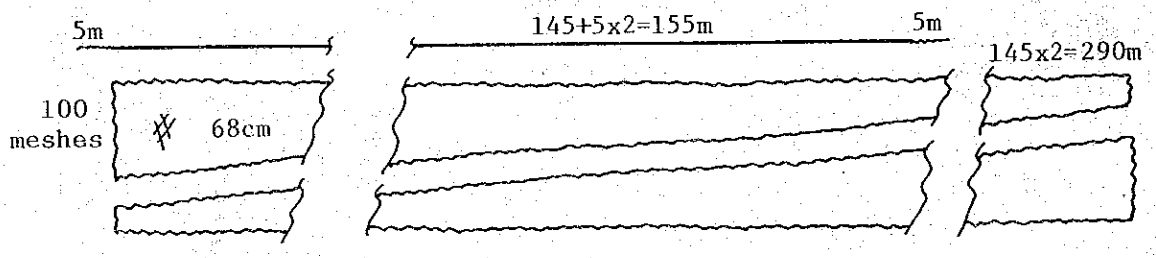
(a) Large size gillnet



(b) Medium size gillnet



(c) Shrimp fishing gillnet



(d) Beach Seine

Fig. 15 Newly Designed Structure of Fishing Gear

2) Quantity and Cost of Equipment and Materials

Comprehensive budget appropriation and total quantity of each kind of equipment and materials are shown in Tables 41 and 42, respectively, and detailed cost calculation of fishing gear materials is shown in Table 43.

Unit cost employed in the cost calculation of each kind of equipment and materials is shown in Table 40.

Table 40. Unit Cost of Each Equipment and Material

Equipment/ Material	Specifications	Unit Cost	CIF	Unit CIF	Remarks
Engine:					
Outboard engine	7 p.s. Integrated kerosene engine with directly coupled shaft and propeller, spark ignition type	¥120,500	¥12,000 (Est.)	¥132,500	
	12 p.s. - do -	¥166,000	¥13,000 (Est.)	¥179,000	
Inboard engine	22 p.s. Diesel engine complete with shaft and propeller, not equipped with an intermediate shaft			¥76,000	
	33 p.s. - do -			¥1,110,000	
	45 p.s. Same as above, but provided with a 1 m intermediate shaft			¥1,350,000	
Fishing gear materials:					
Twine	210 D/3/60 (Nylon twine)	¥800/kg	¥137.2/kg	¥937.2/kg	
	210 D/3/45 (Nylon twine)	¥850/kg	¥137.2/kg	¥987.2/kg	
	210 D/3/39 (Nylon twine)	¥900/kg	¥137.2/kg	¥1,037.2/kg	
	210 D/3/12 (Nylon twine)	¥950/kg	¥137.2/kg	¥1,087.2/kg	
			¥137.2/kg	¥1,187.2/kg	

Equipment/ Material	Specifications	Unit Cost	CIF	Unit CIF	Remarks
Webbing	210 D/3/4 (Shrimp fishing net) Nylon twine	1,050 x "17"/13 ¥1,370.07/kg		¥1,510.28/kg	Netting requested to be supplied because of small mesh size
Nylon twine	20'S/3/18	¥1,300/kg	¥137.2/kg	¥1,437.2/kg	
Rope	20 mmφ Nylon rope	¥1,000/kg	¥137.2/kg	¥1,137.2/kg	
	12 mmφ	¥1,000/kg	¥137.2/kg	¥1,137.2/kg	
	10 mmφ	¥1,000/kg	¥137.2/kg	¥1,137.2/kg	
	4 mmφ	¥1,000/kg	¥137.2/kg	¥1,137.2/kg	
Float	Material: PVC				
	L x D x HD 190 x 60.5 x 39.5 236 g/piece (Buoyancy)	¥91	¥22.7	¥91 + ¥22.7 = ¥113.7	Breakdown of CIF $18.57/case, 200 floats/case
	190 x 60.5 x 33.5 250 g/piece (Buoyancy)	¥87	¥105.4	¥87 + ¥18.4 = ¥105.4	$18.57/case, 250 floats/case
	70 x 18 x 4.5 10 gr/piece (Buoyancy)	¥27	¥1.06	¥27 + ¥1.06 = ¥28.06	$8.87/case, 2,000 floats/case

As stated already, 10% (¥40 million) of the budget was earmarked to provide for the possible rise in the unit price of the equipment and materials between the Team's determination of their quantities and their supply to Pakistan.

If no such price escalation occurs or the total price increment is smaller than ¥40 million, it is proposed that the said earmerked amount or the remainder thereof be appropriated for increased supply of the following equipment and materials.

Equipment/Material	Appropriation Rate	Breakdown of Appropriation Rate (Baluchistan)	(Sind)
Engine:	70%		
Outboard engine	(70%) 35% -- 7 p.s.	((70%))	((30%))
	35% -- 12 p.s.		
Inboard engine	(30%) 10% -- 22 p.s.	((20%))	((80%))
	10% -- 33 p.s.		
	10% -- 45 p.s.		
Fishing Gear Materials:	30%		
Twine for shrimp fishing net (2/0 D/2/4)	(40%)	((0%))	((40%))
Float for beach seine, (197 x 60.5 x 33.5, buoyancy 250 g/float)	(20%)	((0%))	((20%))
Rope for shrimp fishing net (nylon rope,44 mmø)	(40%)	((0%))	((40%))

Table 41. Comprehensive Table of Budget Appropriation (In thousand yen)

Total Amount of Budget	:	¥400,000
Budget after 10% Earmarking for Price Escalation	:	¥360,000 (See Table 29)
Budget Appropriated to Baluchistan Province	:	¥162,000 (= 360,000 x 0.45)
Budget Appropriated to Sind Province	:	¥198,000 (= 360,000 x 0.55)

	Baluchistan Province (162,000)	Sind Province incl. Karachi (198,000)
1. Workshop machinery & tools	¥10,000 (= 2,500 x 4)	¥7,500 (= 2,500 x 3)
2) Remainder of Budget	152,000 (= 162,000 - 10,000)	190,500 (= 198,000 - 7,500)
3) Appropriation rate and amount	Engine 100% ¥152,000 Fishing gear materials 0% Spare parts 30,400 Budget for engine 121,600 (= 152,000 - 30,400)	Engine 60% ¥114,300 Fishing gear materials 40% ¥76,200 Spare parts 22,860 Budget for engine 91,440
4) Appropriation rate, amount and quantity of each equipment & material	Outboard engine 92.3% 112,250 7 p.s. 60% 67,350 508 units 12 p.s. 40% 44,900 251 units Total 759 units Inboard engine 7.7% 9,350 22 p.s. 40% 3,800 5 units 33 p.s. 60% 5,550 5 units	Outboard engine 65% 59,436 7 p.s. 30% 17,830.8 134 units 12 p.s. 70% 41,608.2 232 units Inboard engine 35% 32,004 22 p.s. 0% 0 33 p.s. 0% 0 45 p.s. 100% 32,004 24 units Nylon twines 2/OD/3/60 33.8 36 kg " 45 5,580 5,656 " " 39 23,800 22,943 " " 12 7,800 7,176 Webbing nylon 2/OD/3/4 1,766.2 kg Vinylon hanging twine 20'S/3/18 636 441.0 kg Total : Part of 2/OD/3/39 to be used as hanging twine Nylon rope 20 mmφ 5,550 4,884 kg 12 mmφ 5,500 4,841 " 10 mmφ 11,590 10,195 " 4 mmφ 2,500 2,196 " Float 197 x 60.5 x 39.5 1,470 12,870 pcs. 70 x 18 x 4.5 9,020 321,356 " 197 x 60.5 x 33.5 260 2,448 "

Table 42. Totalization of Each Equipment and Material

Equipment/Material	Total Quantity		Amount (Thousand Yen)	
1) Engine:	1,159 units		¥283,800	
Outboard engine	1,125 units	Integrated air-cooled kerosene engine, spark ignition type,	¥1,716,860	
	642 units	with an extended shaft length of 70 cm		
7 p.s. (Integrated kerosene engine, spark ignition type)			¥8,518,080	
12 p.s. (")	483 units	"	¥865,520	
Inboard engine	34 units	4-cycle horizontal water-cooled Diesel engine	¥413,540	
22 p.s. (Diesel engine)	5 units	(Average of 20 - 25 p.s.)	¥3,800	
33 p.s. ("	5 units	(Average of 30 - 35 p.s.)	¥5,550	
45 p.s. (")	24 units		¥320,040	
Spare parts	Equivalent to 20% of engine cost		¥53,260	(15,200x0.2+11,430x0.2)
Workshop machinery and tools	For 7 workshops		¥17,500	
2) Fishing Gear's Materials			¥76,200	(Difference with the calculated total of ¥76,476 thousand is caused by the way of counting fractions of each figure)
Netting	1766.2 kg	(Nylon twine partly including hanging twine)	¥1,142,960	
Twine (Nylon twine partly including hanging twine)	25,288kg - 2309.7 kg = 22978.3kg Netting for shrimp fishing net		Approx. ¥2,824.440	
Hanging twine (Vinylon twine)	441 kg		Approx. ¥6,360	
Rope (Nylon)	17,275 kg		Approx. ¥25,140	
Float	336,674 pcs.		Approx. ¥10,750	

Table 43. Details of Cost Calculation of Fishing Gear Materials for Sind Province (incl. Karachi)(Note: Budget for Baluchistan Province appropriated to engines)

Classification / Item / Size/Type of gear	Material	Specification	Weight/number per Piece	Budget Appropriation Rate	Amount Appropriated	Unit Cost (incl.IF) ($1=¥245)	Cost per Piece (incl.CIF)	Total Amount per Piece	Total Quantity within Budget	Quantity and Cost of Individual Material: Q'ty	Quantity and Cost of Individual Material: Cost	Remarks
Gill-net / Large size gillnet				40%	¥76,200 thousand x 0.4 = ¥30,480 thousand			Approx. ¥573,740 thousand	536.25 pcs	42,575(kg) x536.25pcs =22.830.8 kg	4,4159 x 536.25 pcs =¥23,680.3 thousand	
	Netting twine	Float line length 50m Shortening 50% Mesh size 10cm Meshes deep 100 Twine 2/OD/3/39	Netting weight of 2/OD/3/39, 100 meshes, 151.5m: 42.575kg/ piece			99+137.2 =¥1037.2kg	1037.2 x 42575kg =¥44,159 thousand					
	Hanging twine	2/OD/3/39 Same nylon twine as netting twine	Length: 4 times the float line length 200mx1,053x10^{-3}(kg/m) = 0.211/Pce			¥1037.2kg	¥1037.2x 0.211 ¥218.85 ¥0.219 thousand			0.211kg x 536.25pcs = 113.15kg	¥0.219 thousand x 536.25pcs =11.744 thousand	
	Rope	12mm Float line 12mm Sinker line	(50+1)x2=102m $17.7 \times \frac{102(m)}{200(m)} = 9,027kg$ (kg)			1000+137.2 =¥1137.2kg	¥1137.2x9.0 x9.027 =10265.5 =¥10,266 thousand			9.027kg x 536.25 = 4840.7kg	¥10,266 thousand x 536.25 =¥5,501.43 thousand	
	Float	L x D x H.D =197x60.5x x39.5 236g/float (buoyancy)	24 floats/pcs			¥91 CIF:$18.57/ case= ¥4549.7/case (200 floats) ∴¥22.7/float	¥91x24+ ¥22.7(CIF)x 24=¥2,730= ¥2.73 thousand			0.24pcs x 536.25 =12870pcs	¥2.18 thousand x536.25+ ¥298.98 thousand (CIF) = ¥1,468 thousand IF:¥4.5997x65=¥298.98 thousand	

Medium size gillnet	Netting twine	Float line length 50m Shortening 50% Mesh size 4 cm Meshes deep 50 Twine 2/0D/3/12	8 (43mm) 43-38=5mm 9 (38mm) 8 :100 meshes, 151.5m - 13.163kg 9 :100 meshes, 151.5m - 13.688kg ∴ 13.688-13.163 =0.525 kg 0.525x2/5=0.21kg 13.163+0.21 =13.373kg Weight per piece: 13.375x100/151.5 x 50/100 = 4,414 kg	30%	¥76,200 thousand x 0.3 = ¥22,860 thousand	950+137.2 =¥1087.2/kg	¥1087.2 x 4.414 =¥4,799 =¥4.799 thousand	¥14.066 thousand	16252 pcs	4,414x 1625.2 =7173.6kg	0.4799x1625.2 =¥7,799.3 thousand	
	Hanging twine	20's/3/18 Vinylon twine	Length: 4 times the float line length 50x4mx0.5796x10^{-3} (kg/m) =0.116kg/pce			1300+137.2 =¥1437.2kg	¥1437.2 x 0.116 =166.72 ¥0.167 thousand			0.116x 1625.2 =188.52kg	¥0.167 thousand x 1625.2= ¥271.4 thousand	
	Rope	10mm(Float line) 10mm(Sinker line) (Nylon rope)	(50+1)x2=102m 12.3kgx$\frac{102}{200}$=6,273kg			1000+137.2 =¥1137.2kg	¥1137.2x =¥7133.66 =¥7.134 thousand			6.273x 1625.2kg =10194.879 kg	¥0.7134x 1625.2 =¥11,594.2 thousand	
	Float	L x D x H.D =70mm x 18mm x 4.5mm 10 g/float (buoyancy)	70 floats/pce			¥27 CIF:$8.87/case =¥2,128.8/ case (2,000 floats)	¥27 x 70 +¥1.0866 x70= ¥1,966.1= ¥1.966 thousand			70 pcs x 1625.2 =113764 pcs	¥0.1966 x 1625.2 =¥3,195.14 thousand	

	Shrimp fishing gill net	Netting twine	Float line length Shortening Mesh size Meshes deep Twine	$4.575\text{kgx}\frac{100}{151.5}\text{x}\frac{35}{100}$ = 1.057kg	15%	¥76,200 thousand x 0.15=¥11,430 thousand	¥11,872 thousand/pce	1.255 thousand	¥5.2307 thousand x 17/13=¥6.84 thousand N.B. Shrimp fishing net is requested to be supplied in netting. 17/13 is cost conversion rate from netting twine to netting.	1671pcs	1.054kg x 167pcs= 1766.2kg	1.684x1671 =¥11,429.6 thousand	Shrimp fishing net alone is to be supplied in netting. In the calculations shown, showever, the quantities are expressed in pieces of gillnet, not in pieces of netting (1 piece of netting=100 meshes x 151 m).
		Hanging twine	20'S/3/18 Vinylon twine	Same as medium size gillnet, i.e., 0.116 kg/pce			¥1,437.2kg	¥1,437.2m x 0.116=166.72 =¥0.1667 thousand/pce			).116 x 2185.18= 253.5kg	0.01667 x 2185.18= ¥364.27 thousand	
		Rope	4mm(Float line) 4mm(Sinker line) Nylon rope	(50+1)x2=102m $1.97\text{kgx}\frac{102}{200}$ =1,005 kg/pce.			1000+¥137.2 =¥1137.2kg	¥1137.2x1.005 =¥1142.886 =¥1.143 thousand/pce			1.005 x 2185.18 =2196.1kg	0.1143 x 2185.18 =¥2.497.66 thousand	
		Float	LxDx H.D =70x18x4.5 mm 10 g/ float (buoyancy)	95 floats/pce			¥27 IF: $8.87/ case=¥2,128/ case(2,000 floats)	¥27x95+¥1.06 (IF)x95=2,565 +101.12=¥2.666 thousand/pce			95pcs x 2185.18 =207592.1 pcs	¥2.666 x 2185.18= ¥5,825.69 thousand	
Beach seine	Beach seine	Netting twine	Float line length 145m Shortening 50% Mesh size 18cm Meshes deep 100 Twine 2/OD/3/45	Weight of netting:100 meshes, 151.1 m ——45.763kg Twine weight per piece: 45.863x195x 2/151.5=87.79kg/pce	15%	¥76,200 thousand x 0.15=¥11,430 thousand	¥850+¥137.2 =¥987.2 (Graphic estimation)	¥987.2x87.79 =¥86,666 thousand/pce	¥177.396 thousand	64.43pcs	87.79kg x 64.43 =5656.36 kg	¥86.666 thousand x 64.43= ¥5,583.89 thousand	
		Hanging twine	2/OD/3/60 (Calculation worked out by doubling the value of 2/OD/3/30) Nylon twine	$1.45\text{x}4\text{x}0.966\text{x}10^3$(kg/m) =0.56kg/pce			¥800+¥137.2 =¥937.2kg (Graphic estimation)	¥937.2x0.56 =524.8 =¥0.525 thousand/pce			0.56 x 64.43 =36.08kg	¥0.525 x 64.43= ¥33.83 thousand	
		Rope	20mm(Float line) 20mm(Sinker line) Nylon rope	(145+10)x2=310m $48.9\text{kgx}\frac{310}{200}$ =75.8kg /pce			¥1000+137.2 ¥1137.2kg	¥1137.2x75.8 =86199.76 =¥86.2 thousand/pce			75.8kg x 64.43= 4383.79kg	¥86.2 thousand x 64.43= ¥5,553.89 thousand	
		Float	LXDXH.D =179x60.5x33.5 =250g/float (buoyancy)	38 floats/pce			¥87 IF:$18.57/ case=¥4,549.7 /case(250 floats)	¥87x38+¥18.4 (IF)x38=3,306 +699.2=¥4.005 thousand/pce			38pcs x 64.43 =2448.3 pcs	¥4.005 thousand x 64.43= ¥258.04 thousand	

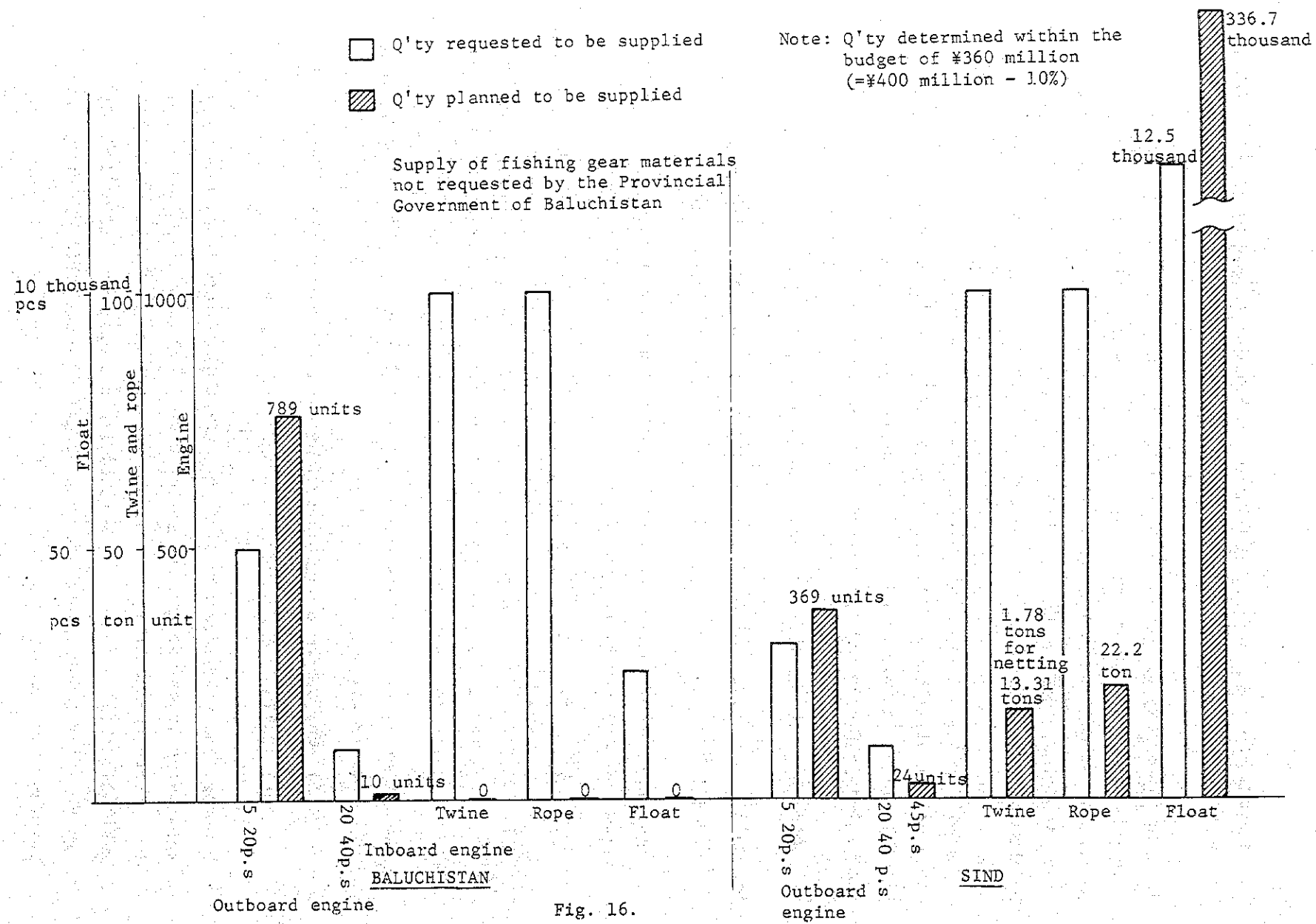

Q'ty requested to be supplied
Q'ty planned to be supplied
Note: Q'ty determined within the budget of ¥360 million (=¥400 million - 10%)
Supply of fishing gear materials not requested by the Provincial Government of Baluchistan
10 thousand pcs
100
1000
Float
Twine and rope
Engine
50
50
500
pcs
ton
unit
789 units
10 units
0
0
0
369 units
24units
1.78 tons for netting
13.31 tons
22.2 ton
12.5 thousand
336.7 thousand
5 20p.s
20 40p.s
Twine
Rope
Float
Inboard engine
BALUCHISTAN
Outboard engine
5 20p.s
20 40 p.s
45p.s
Twine
Rope
Float
SIND
Outboard engine

Fig. 16.

9. Measures for Satisfactory Distrubution, Management and Repairs of Equipment and Materials

The planned supply of equipment and materials can yield the expected development effect only if it is followed by rational distribution and management as well as prompt and satisfactory maintenance services. From this viewpoint, the Team studied the plans mapped out for the said purposes by the Pakistani authorities and found them to be generally satisfactory.

The Provincial Governments of Baluchistan and Sind had a clean-cut plan designed for distribution of the equipment and materials. However, no explicit opinion was expressed in this respect by the Livestock Division of the Ministry of Food and Agricultural Cooperatives.

9-1 Distribution of Equipment and Materials

1) Opinions of Livestock Division, Ministry of Food and Agricultural Cooperatives

The Team enumerated the following alternative plans for choice and consideration by the Livestock Division.

i) Distribution on a complete grant-in-aid basis.

ii) Distribution on a partial grant-in-aid basis (Distribution against collection of part of the cost of each equipment and material from recipient fishermen).

iii) Distribution against collection of total cost of each equipment and material.

a) Collection of actual cost excluding insurance and freight.

b) Collection of cost, insurance and freight.

However, the Livestock Division gave no definite answer to the Team, expressing to opinion on any of the plans proposed. The Team was unable to clarify whether this attitude on the part of the Livestock Division was assignable to the delay in eliciting the opinions and desires of the two Provincial Governments, or the need for coordinating the pertinent government offices.

2) Opinions of Director of Fisheries, *rovincial Government of Baluchistan

The Director of Fisheries, Provincial Government of Baluchistan, made it clear that 50% of the actual cost would be collected from recipient fishermen and insurance, ocean freight and domestic transportation cost would be borne by the Provincial Government. Regarding the mode of payment of the actual cost, he explained that the recipient fishermen would be required to pay the full amount in cash if they are financially capable or by a loan from the Agricultural Bank to be arranged by the Provincial Government if they are not capable of such lump sum payment.

Asked about the reason for selecting this plan, the Director explained that free distribution is liable to discriminatory screening of recipient fishermen. It seems, however, that this plan was devised not for this specific reason alone, but for collection of working fund as well.

3) Opinions of Director of Fisheries, Provincial Government of Sind

The Provincial Government of Sind had the plan collect the actual cost, insurance and ocean freight from the recipient fishermen, but not the domestic transportation cost. The mode of repayment, loan arrangements and reasons for paid distribution were the same as explained by the Provincial Government of Baluchistan.

9-2 Management of Equipment and Materials

Management of the equipment and materials naturally involves all procedures to be taken before distribution to recipient fishermen is completed, and these will include:

(1) Customs clearance

(2) Storage at Karachi Port before distribution

(3) Transportation to and storage at each fishing village

As regards Item (1) (Customs clearance), the Pakistani Government expressed its intention to take measures for prompt completion, and the Team noted

that Item (2) (Storage at Karachi) would involve no specific problems because of the large number of warehouses in Karachi Port area. It appears, therefore, that care would have to be taken only for Item (3) (Internal transportation and storage).

1) Internal Transportation to Fishing Villages

Sind Province is relatively close to Karachi, but most fishing villages in Baluchistan Province, including Gwadar and Pasni, are not only far from the city but severed by a desert. The airway route between Karachi and Baluchistan Province is utilized for transportation of small cargoes, but bulk transportation must resort to trucks. About 4 days are required for a one-way trucking service between Karachi and Baluchistan Province, and it takes about 2 hours by truck to reach Sommiani, the nearest fishing village from Karachi.

Nevertheless, the Team noted that such long-distance trucking service in Pakistan has had few troubles of any significance.

9-3 Maintenance Services for Equipment and Materials

Of all articles to be supplied under the present aid plan, engines are the only item that could develop malfunction or failure.

Since workshops capable of simple repair service were not available in all fishing villages, the Team considered it necessary to supply the minimum required machinery and tools to the 3 workshops in Sind Province and to the 4 workshops in Baluchistan Province. It may as well as added that the supply of such machinery and tools was also requested by the two Provincial Governments.

These workshop machinery and tools, listed in detail in Table 38, will be instrumental in improving the fishing efficiency as they will serve for early repair of engine troubles and extension of engine service life. The Team learned that engines having any serious trouble had to be carried to Karachi for repair in the past, and this incurred a considerable economic loss resulting from the suspension of fishing operation.

10. Promotional Impacts of Equipment and Materials Supply on Pakistani Fisheries

The planned supply of the equipment and materials is expected to yield the following development effects.

1) Engines

a) Time required for reaching the fishing ground will be reduced, and this will make it possible to engage in actual fishing operations for a longer time than before.

b) Fishing grounds located far will become accessible, and the resultant wider selectivity of fishing grounds will lead to greater fish catches.

c) Maximum loadage of netting gear (gillnet) will be increased to some extent, and this will work, combinedly with the effect mentioned in Item a), to increase the daily catch.

d) Freedom in selecting the cruising course will become greater and less vulnerable to sudden changes in weather condition and wind direction, and this will assure greater safety for both fishing boats and crew. However, marine disasters are rare even at present because non-motorized boats refrain from sailing far into the offing for the sake of safety.

e) Time required for return voyage will be reduced, and this will serve for better maintenance of freshness.

2) Fishing Gear Materials

The Team noted that fishing gear materials were not in short supply. This is because there is a stock of materials supplied in the past with loans or under projects financed by ADB and other international financing institutions, and also because the materials offered under a Japanese yen credit agreement are on the way to Pakistan. The existing availability of fishing gear materials was evidenced by the request of the Provincial Government of Baluchistan to appropriate the budget only for engines.

Nevertheless, the planned supply of fishing gear materials will produce appreciable development effects for the following reasons.

a) Materials supplied in the past including twine, rope and float were not necessarily suited to the netting gear presently in use, so that it was frequently noted that structure of netting gear was extremely poor and irrational. It appeared that fishing gear materials of any specifications were used just because they were available in stock, and the Team felt strongly that the materials currently available in stock were not necessarily adeauate and contributive to higher fishing efficiency.

b) With special attention paid to the above fact, the Team determined the specifications of all materials on the basis of its own design of netting gear which it considered to be compatible with the actual situation in Pakistan, without being confined by the specifications presented by the Pakistani Government.

   Among the many inadequate materials, the Team found that floats were particularly irrational in both design and the way of use. In many places floats were used in such a way as will give excessive buoyancy to the net, and large floats were cut into small slices. They were not attached to the float line at regular intervals, and the buoyancy given to the net was either too large or too small, thus reducing the gillnet performance to a large extent. The Team therefore selected floats of suitable size, design and buoyancy for each kind of gillnet, and determined their quantities within the appropriated budget.

   It is considered that the above design of rational gillnet and the supply of their materials will contribute largely towards improvement of gillnet fishing efficiency.

11. Acknowledgement

The Team wishes to express its deep gratitude to the Government of Pakistan and to the Provincial Governments of Baluchistan and Sind for the helpful assistance and well-planned arrangements which made it possible for the Team to cover the extensive project area within the extremely limited survey period. Special acknowledgement is due to Mr. Burney, Director of Fisheries, Baluchistan Province, and his staff members as well as to Mr. Ahmed, Director of Fisheries, Sind Province, and his staff members who accompanied the Team in their respective provinces for smooth execution of the survey.

The two directors took the trouble of summarising for the Team the desires expressed by the respresentatives of local areas, and always responded to the Team's proposals with a quick and explicit answer. Without their unlimited cooperation, the Team would never have been able to complete its mission smoothly as scheduled.

The Team also wishes to express its appreciation to H. E. Mr. Matsumoto, Japanese Ambassador to Pakistan, Mr. Matsumoto, First Secretary of the Japanese Embassy in Islamabad, and Mr. Imagawa, Senior Consul at the Japanese Consulate-General in Karachi for all kind arrangements and assistance offered to the Team.

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