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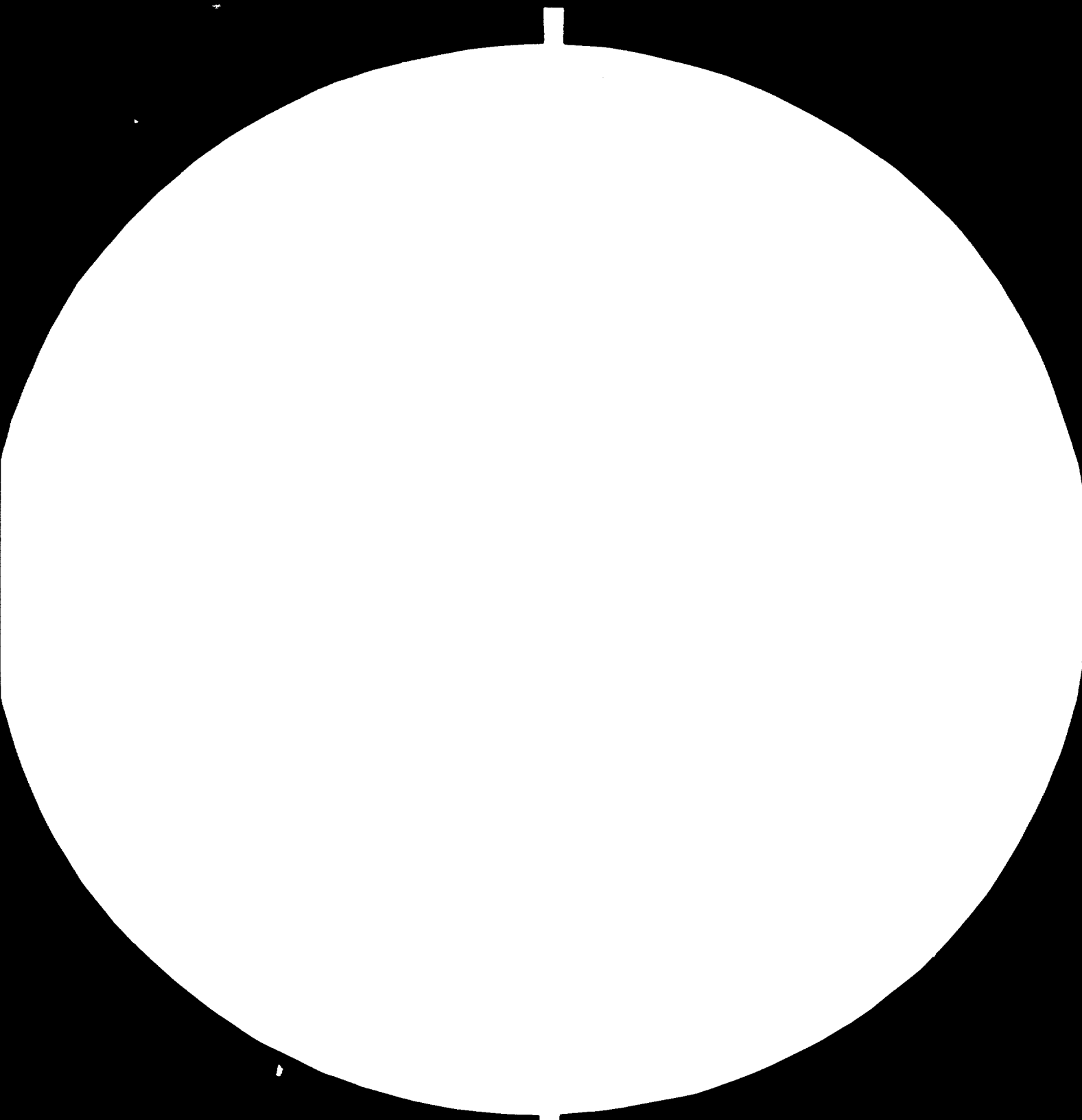

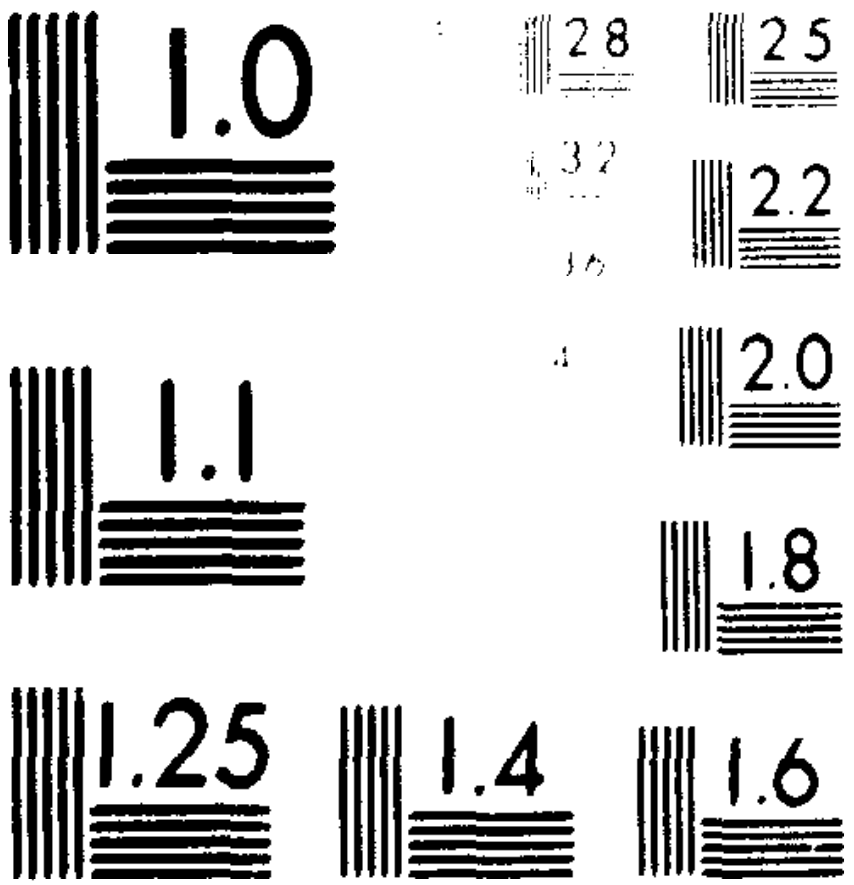
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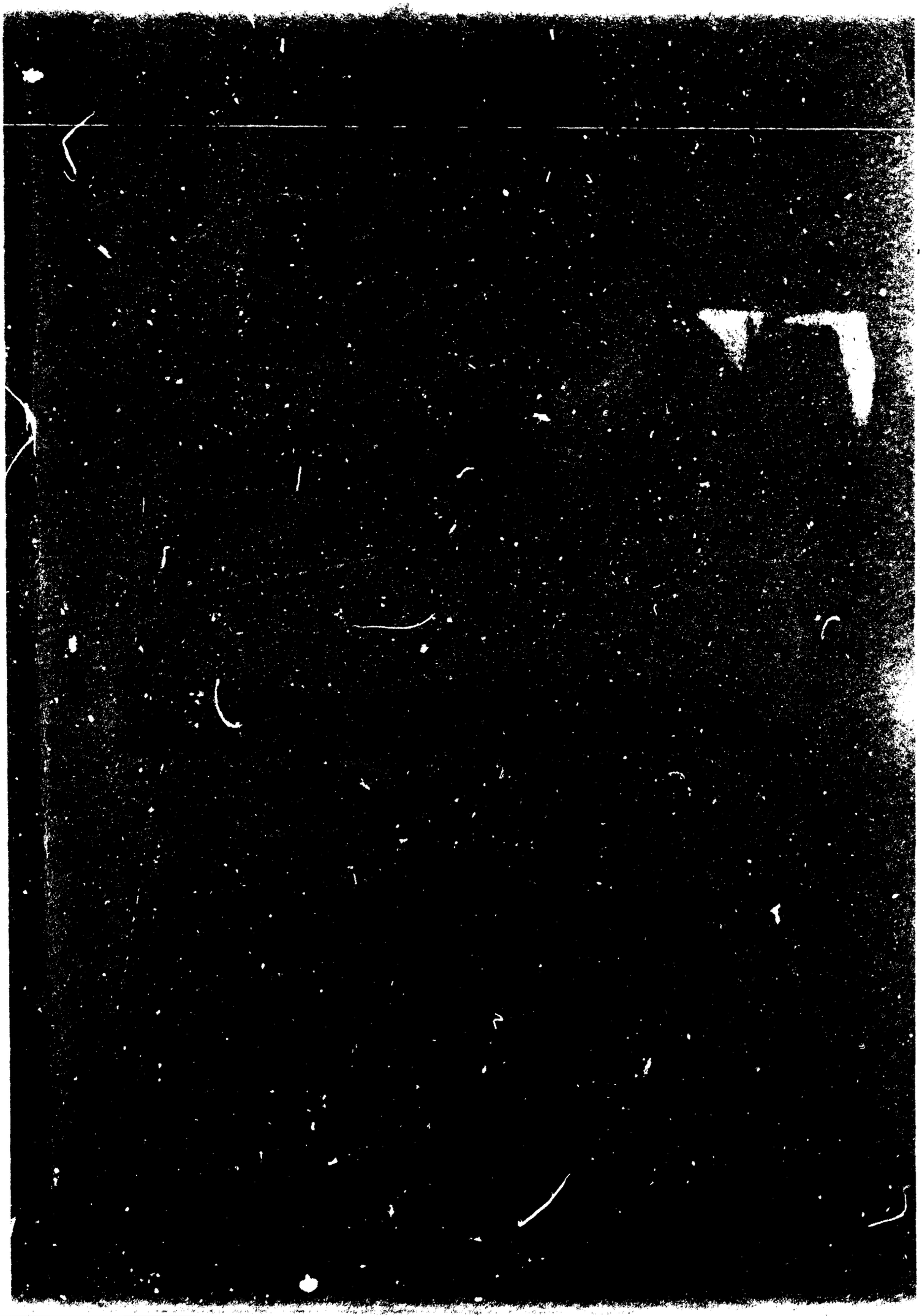

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ANNEXES

SUMMARY AND CONCLUSIONS

1. Demand for shipbuilding of ocean-going vessel:

No great demand is expected in Fiji for vessels of ocean-going and inter-island seatraffic because of:

(1) Lack of production facilities in Fiji for such a type of ships

(2) No government policies to assist development of ship-building industries in Fiji and other Pacific Forum Ccuntries

(3) Limited seaborne trade in this area

(4) Easy availability of second-hand vessels obtainable from South Korea, Japan, etc.

2. Demand for shipbuilding of vessel of off-shore transportation:

A fairly sizable demand of shipbuilding exists for type of vessels of off-shore transportation:

(1) For ship size of less than about 500 DWT.

(2) Special types of vessels such as landing craft, barges, pilot boats, etc, which could be used without jetties.

(3) Demand for cargo and passenger traffic between islands.

(4) A sizable amount of money available (grant-in-aid, soft loan, etc. spent yearly in South Pacific countries approximately $550 million, bilateral or multi-lateral).

(5) Need for government operation of sea transport system for areas where no private shipping companies can profitably operate.

(6) Adequate production capabilities existing in Fiji.

(7) Marine Department, Government of Fiji, has a fleet of 48 ships used for government operated sea transport in Fiji, and many of them are built in 1950's; replacement demand exists for a couple of years for Government Ship Yard.

(8) Major problems of shipping companies are lack of investment fund; Development Bank of Fiji does not have any concessional credit facilities provided to local ship owners/operators; interest of long term loan is 10.5%.

3. Greater Demand Existing for Shiprepair Services in Fiji:

It is judged that demand for shiprepair services is great/or at least promising in Fiji:

(1) A strategic location of Fiji in South Pacific.

(2) A large fishing fleets operating in South Pacific; e.g., tuna/skipjack fishing vessels of South Korea, Taiwan, Japan, etc.

(3) Fairly adequate level of repair facilities/technical skills available in Fiji, mainly provided by Carpenters Industrial, Bish Ltd., Pacific Engineer Ltd.

(4) But no large scale of dry docks in Fiji.

(5) A major slipway is owned and managed by Government of Fiji, i.e., Marine Dept., Ministry of Transport. This slipway has the following facilities but all of them are fully booked almost two months ahead of time:

1. A repair berth of 1,000 tonnage
2. " 500 "
3. " 200 "
4. " 100 "

(6) Repair services is carried out on the basis of five pitches per month for each berth on average.

(7) In the early 1970's even purchase of floating dock of lifting capacity of 5,000 tons was recommended by Mr. Sannergren.

(8) Limited berthing space.

Shiprepair Facilities of Government Slipway Operated and Managed by Government Shipbuilding Yard (hereafter abbreviated as GSY), Marine Dept., Ministry of Transport

- Limited capacities of slipway in terms of size and repair operation; each berth has two month backlogs
- Worn out cradles
- Inadequate maintenance
- Mechanical time schedule of repair services prior to actual inspection

- Separation of management of slipway and actual repair services; Management of slipway ... GSY, Marine Dept., Ministry of Transport

  Repair work contracted with: Carpenters Industrial (Australian management), Bish Ltd. (U.K. management), and Pacific Engineer Ltd., (Foreign based), etc.

- Relatively large amount of stockpile required for parts and materials, equipments

- A relatively long lead time of delivery of required materials/equipments, etc.

- A large varieties of ships (many of them are quite old) to be repaired whose technical specifications, parts and equipments (used) greatly differ from one to another.

4. Technical Problems of the Government Shipyard

The following technical problem areas were identified during the course of field survey conducted by the Study Team:

(1) Shipbuilding of GSY

- Low physical productivity of workers; three times man hours spent on steelwork per ton; i.e., 80-100 hours/ton

- Generally low level of technical training and skills, particularly in the field of design, steel works, block assembling, etc.

- High dependency on imported materials, namely steel, main engine, equipments, outfitting materials which altogether will comprise over 60% of shipbuilding cost. Presently GSY uses steel plates obtained from Australia as gift in aid
- Low level of mechanical engineering knowledge and skill
- Low utilization of a building berth of GSY
- Smaller area of GSY plant site
- Inadequate physical layout
- Scarcity of skilled manpower, particularly at foreman/ middle-management level
- Lack of development of related manufacturing industries

5. Management Problems

As for management problems the following is observed:

(1) GSY

- General and negative characteristics prevalent among any kind of government operation/enterprises; e.g., low incentives, idling time, etc.
- Lack of development of GSY management system; viz., lack of development of:
  - Marketing
  - Production planning
  - Material acquisition & inventory control
  - Progress control
  - Manufacturing cost accounting and management

- Scarcity of middle-management personnel
- Apparent gaps existing between GSY and private sector; i.e., Carpenter, Bish, etc.
- Polico-socio-cultural problems in Fiji reflected in GSY; viz., inter-racial problems
- No cost accounting system

(2) Government Slipway

- Jurisdictional problems of management of:
    * Operation of government fleet
    * Slipway
    * GSY
- Generally low level of management skill, training, know-how of Marine Dept., staff who are in charge
- Jurisdictional rivalry with Port Authority of Fiji
- Long waiting
- Lack of institutionalized communication channels between:
    * Ship owners/operators, their agents
    * Repair companies, i.e., Carpenter, Bish, Pacific Engineer, etc.
    * Marine Dept.

6. Main Recommendation Concerning Development Policy Objectives of GSY

It is advised that the following should be set forth as development objectives of GSY:

(1) Establishment of shipbuilding and repair industry in Fiji which is internationally competitive, cost-effective, and utilizes fully local resources readily available in Fiji.

(2) Establishment of a local enterprise for, by and of the indigenous Fijians.

(3) Employment generation

(4) Industrial linkage effects and import substitution

(5) Establishment of Fiji as a major depot in South Pacific

7. Development Strategies Recommended:

(1) GSY specializes in construction of type of vessels which are not built elsewhere, and less expensive than second hand ships.

(2) GSY will venture into ship repair business step by step approach.

(3) Resources (human, capital, and technological) accumulated in Fiji, private or public, should be effectively combined and mobilized.

(4) Gradual improvement of GSY's marketing, production, management/financial planning/control.

8. Scenario of Assistance Program Recommended to Shipbuilding Industry in Fiji

(1) Within the period of 6 - 8 years, GSY should be incorporated into a private or semi-public enterprise.

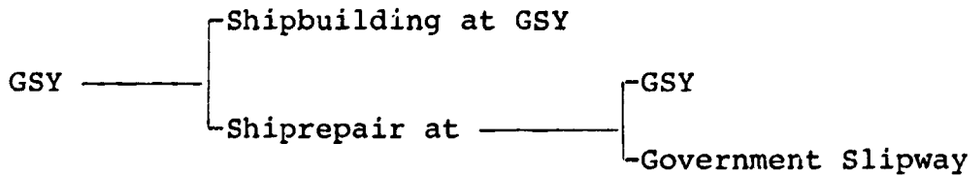
(2) GSY will actively engage in both shipbuilding and shiprepair in the initial few years. While GSY will receive shipbuilding order from government sector, it should concern itself with the following tasks:

1 Improvement of production/management capability of the shipbuilding

2 Acquisition of shiprepair skill and know-hows

(3) An institutional system of cooperation and communication between public and private sector should be established in Fiji such as "Maritime Industry Review Board" so as to jointly plan, manage and control its shipbuilding and repair industry in Fiji.

(4) After the preparation period, GSY should gain a management control power over two main activating areas:



(5) In the meantime operational and management capability over government alipway should be reinforced.

9. Assistance Program/Project Components

(1) GSY

Investment of capital outlay required

- Improvement of a building berth
- Reconstruction of two building berths into repairing use
- Extension of GSY's slipway
- Rails, cradles, winches, civil works
- Other investments to facilitate steel work process of GSY

(2) Acquisition of industrial machines/tools required for ship-repair and shipbuilding

* A list of machines/tools required for GSY was drawn up

The estimated investment required for (1) and (2) will be approximately F$1,270,000.

(3) Technical training of GSY staff

- Consultants/experts stationed at GSY at least one year
  * One production planning and management expert
  * One marine engineer/architect for shipbuilding
  * " shiprepair , etc.
- Overseas training of key staff of GSY for the period of 6 months to one year (several candidates carefully chosen)

Estimated Cost:

- Foreign Consultants $50,000 - $80,000/year per person
  5 foreign consultants $250,000 - $400,000

- Training cost of key staff of GSY

  The cost estimated is approximately $40,000 - $50,000/ year per person

(4) Government Slipway

No major investments required but careful examination will be given to the following:

- Type of repair services most required in Fiji
- Machines/tools necessary for the job
- Safety and efficiency of berths, mostly O/M problems

1. INTRODUCTION AND STUDY OBJECTIVES

1.01 According to the objectives and scope of study set forth in the Terms of Reference 1/ the present study was carried out by the Study Team of Mitsubishi Research Institute, Inc. on behalf of UNIDO 2/. A total scheduled duration of the study is intended by UNIDO for two months. The Terms of Reference also defines the present study as a full-fledged feasibility study of a shipbuilding industry in Fiji. However, the Study Team interpreted the primary objective of the present study as the one limited to the level of pre-feasibility study, mainly due to the time constraint imposed upon the study. It was judged that the feasibility study of full scale requires at least a detailed survey of several months which is beyond the present scope.

1.02 In the present study the following points were examined in depth:

(1) Current demand and the future prospect of shipbuilding industry in Fiji

(2) Technical capabilities of the shipbuilding in Fiji

(3) Development program(s)/project(s) of the government shipyard

(4) Technical and financial evaluation of the program(s)/project(s)

1/ See Annex 1 for abridged Terms of Reference issued by UNIDO on "Shipbuilding Industry in Fiji"

2/ A Study Team consists of Dr. Morimitsu INABA, senior project economist; Mr. Yoshisuke GOYO, Authorized Consulting Engineer of Naval Architecture, and Mr. Kenichiro YANAGISAWA, transportation economist.

1.03 The major research items and logical framework of the analysis were carefully examined prior to the departure of the Study Team for their field survey in Fiji. They are indicated in Annex 2 and 3.

1.04 The field survey was conducted in Fiji for a period of 10 days; from July 15th to 25th, 1980. During their stay in Fiji, the Study Team interviewed with more than 35 persons; government officials and private businessmen who are directly or indirectly related to the shipbuilding industry in Fiji 1/. Due to heartfelt welcome and cooperation extended to the Study Team by UNDP and UNIDO personnels, government officials and people in Fiji, field survey in Fiji was quite productive one. Nevertheless, the Team had some difficulty in obtaining the information and statistical data necessary for the study 2/.

1.05 Mr. Sannergren, a naval architect and shipbuilding manager hired under an OPAS contract of UNIDO, had assisted the Fiji Government shipyard to improve its technical capabilities. The accomplishments which was brought forth by Mr. Sannergren for the eight years of his work in Fiji should never be belittled. Primarily owing to his technical expertise extended to the Government shipyard, at least it has become capable of building several steel ships a year.

1/ See Annex 4 for the list of persons interviewed in Fiji.

2/ See Annex 5 for the data and information required for the study.

1.06 The present study was carried out by taking into a careful consideration a set of recommendations made by Mr. Sannergren as to how the shipyard can be improved in coping with the roles and tasks prescribed by the Fiji government. At termination of OPAS contract with UNIDO, Mr. Sannergren submitted to UNIDO a "Final Report on the Project; Expansion and Improving the Ship and Boatbuilding in Fiji" in April 1978. His report is summarized in Annex 6. It is the Study Team's opinion that Mr. Sannergren's recommendations and conclusions are derived from his positive evaluation of market environment and technical capabilities of the Government Shipyard.

1.07 The current conditions of the Government Shipyard of Fiji is briefly explained in the 1979 Annual Report on the Shipbuilding Section written by Mr. Apenisa Naigulevu, the Acting Shipyard Manager, in April 1980 (see Annex 7). Some of the main features are to be described as follows:

(1) A total size of workers - 373 (27 staff and 307 employees)

(2) Ships built - 4 ships completed and delivered and 3 ships laid down and launched.

(3) Annual operating budget - F$1,530,000.00 budgeted for the shipyard by the Government by the 1979 Appropriation Act.

(4) Jurisdictional responsibilities of the shipyard:

- Designing and construction of new vessels
- Maintenance of Marine Department fleet

- Operating and maintaining of government slipways
- Construction and maintenance of navigational aids such as beacons, buoys, lighthouses, etc.

(5) Utilization of the government slipways - The utilization of four slipways was 85.4% in 1979. Totally 305 vessels used the slipways spending 4.09 days on average with a total gross tonnage of 43,657.81.

1.08 It is our belief that demand for shipbuilding in the South Pacific Region is rather limited due to the reasons; (1) second hand vessels are readily available to ship operators at relatively lower price; (2) seaborne trade in the South Pacific Area does not expand so quickly as to justify an existence of shipbuilding industry of a large scale; (3) no government policy of subsidy and aids have enacted for the promotion of shipbuilding industry in Fiji; (4) many ship operators went into bankruptcy because of lack of trade in the Region. Because of these reasons, it is viewed that the government shipyard should gradually shift from the shipbuilding business to ship-repair business in the future.

1.09 In Fiji sugar crop is the major product and source of foreign exchange earning, and the secondary industry is relatively retarded mainly due to limited demand and supply condictions of industrial goods. In view of this, a strategic and policy consideration ought to be given to what kind of industry should be developed in Fuji taking into account the optimum obligation of

resources existing in Fiji. On this score, shipbuilding industry must be seriously considered as one of the potential industries to be developed in the future.

1.10 However, it would be highly desirable that industrial development policy needs to be framed according to a much larger regional industrial development plan covering a whole area of the South Pacific because of; 1) resource base in the South Pacific region is limited, 2) there is a need for intra-regional division of labor in developing a type of industry most suited to the country situated in the South Pacific region, 3) and there is a strong need for the development of seaborne transport system in which Fiji should play a very important role in the future. Hence the development of a shipbuilding industry in Fiji should be approached from a long term development perspective of the South Pacific region as a whole.

1.11 In the following pages, main research findings and results of analyses are briefly presented. Chapter 2 describes in the very general terms economic and social background of the Fiji economy. Chapter 3 explains the conditions prevailing in the shipbuilding industry in Fiji. In Chapter 4 demand for shipbuilding and shiprepair is analized and projected in the quantitative terms by taking recourse to simpler methods of regression and elasticity analysis. In Chapter 5 a set of technical recommendations is presented as to how the Government Shipyard needs to be improved in the future. As a feasibility study, it is highly essential that financial

analysis will be made upon how capital investment will bring about acceptable level of return in the future. Nevertheless due to lack of cost and financial data pertaining to operation of the Government Shipyard, a simpler method of financial evaluation is used in the present work. The result of evaluation is summarized in Chapter 6. In addition, organizational recommendations are made as to how the Government Shipyard ought to be restructured in the future so as to raise its productivity level of operations.

Finally, brief statements are made in Chapter 8 Conclusions and Recommendations addressing to the Government of Fiji and United Nations Industrial Development Organization with regard to what kind of actions needs to be taken in the future in order to modernize the Government Shipyard in Fiji.

1.12 It must be noted however that the opinions expressed in the present paper must not by all means be interpreted as the official policy or opinions of the United Nations Industrial Development Organization. The paper has been prepared by professional staff of Mitsubishi Research Institute, Inc., a private research and consultancy organization, Tokyo, Japan.

The Study Team members of the present work wishes to express with deep gratitude thank for the heartfelt cooperation and welcome it has received from all persons, private or public, in Fiji.

2. ECONOMIC AND SOCIAL BACKGROUND

2.1 Introduction

2.01 Fiji is an independent dominion within the British Commonwealth of Nations. It comprises about 320 islands and had a population of 612,000 (end-1978) with a total land area of 18,270 square kilometres.

Fiji's main agricultural crops are sugar cane, coconuts and root vegetables. It is rich in timber resources. The country exports sugar, fish gold copra and ginger. Its other activities are dairying, rice, fruits and vegetables growing and copper mining.

Fiji's gross domestic product at current factor cost was F$729.2 million in 1978.

2.2 Population

2.02 The change of population of Fiji by ethnic origin is shown in Table 2-1. The population has steadily grown every year after 1901. The annual growth rates from 1946 to 1973 were over 2%, and recorded 1.8% in 1978. The high rates of annual growth from 1946 to 1973 were caused by the high birth rate together with the decline in the death rate (see Fig.2-1). The decline in the birth rate since 1960's can be attributed to the success of Fiji's family planning measures, and it resulted in the low growth rate of population. As is seen in Tab. 2-1 and Fig. 2-2, Indians contributed most to the population growth, and the population of Indian has been surpassing that of Fijian, since 1946.

Table 2-1 Population of Fiji

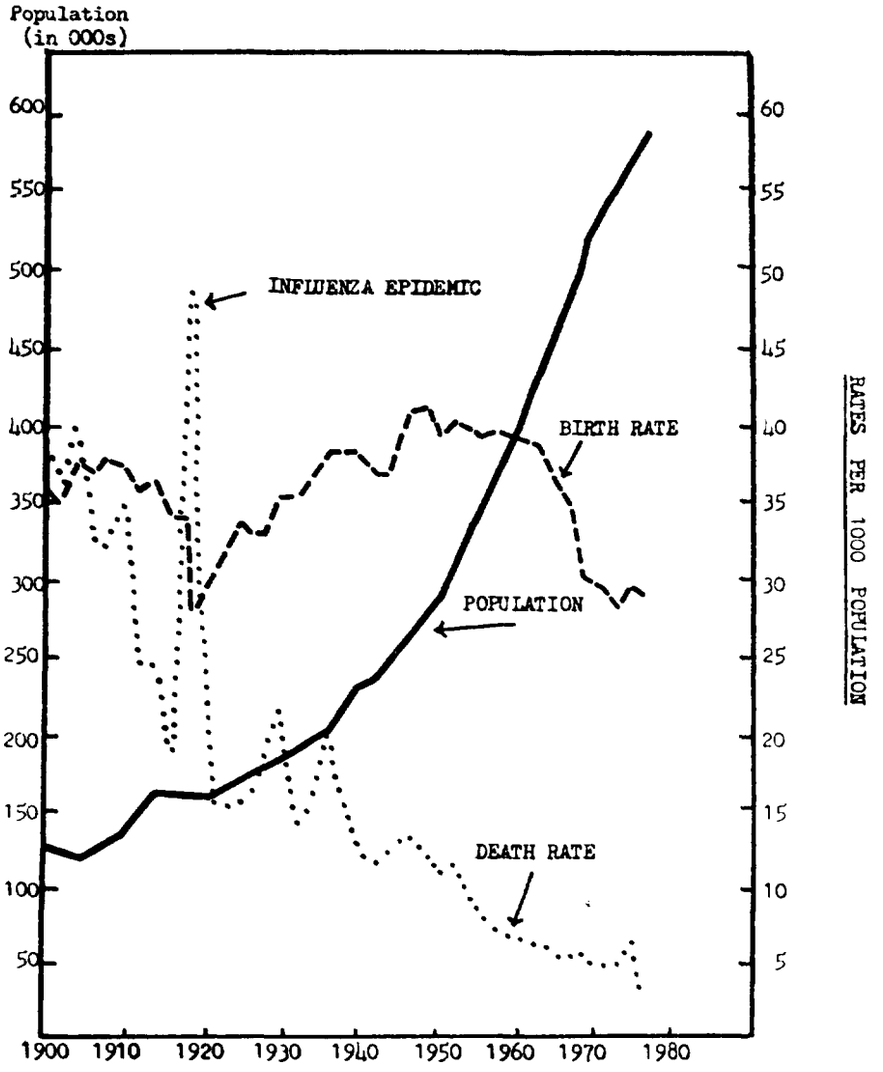
YEAR	CHINESE		EUROPEAN		FIJIAN		INDIAN		PART EUROPEAN		ALL OTHERS		TOTAL (b)	ESTIMATED EQUIVALENT ANNUAL GROWTH RATE
	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%
1881 Census (4.4.81)	-	-	3	2	115	90	1	1	1	1	8	6	127	...
1891 Census (5.4.91)	-	-	2	2	106	88	7	6	1	1	5	4	121	- 0.5
1901 Census (31.3.01)	-	-	2	2	94	78	17	14	2	2	5	4	120	- 0.1
1911 Census (2.4.11)	-	-	4	3	87	62	40	29	2	1	7	5	140	+ 1.5
1921 Census (24.4.21)	1	1	4	2	84	54	61	39	3	2	4	3	157	+ 1.2
1936 Census (26.4.36)	2	1	4	2	98	50	85	43	5	2	4	2	198	+ 1.6
1946 Census (2.10.46)	3	1	5	2	118	45	120	46	6	2	8	3	260	+ 2.7
1956 Census (26.9.56)	4	1	6	2	148	43	169	49	8	2	10	3	345	+ 2.9
1966 Census (12.9.66)	5	1	7	2	202	42	241	51	10	2	12	3	477	+ 3.3
1976 Census (13.9.76)	5	1	5	1	260	44	293	50	10	2	15	3	588	+ 2.1
Mid 1970 Estimate	5	1	7	1	225	43	264	51	9	2	11	2	521	+ 3.0 (a)
Mid 1971 Estimate	5	1	6	1	231	43	270	51	9	2	12	2	533	+ 2.3 (a)
Mid 1972 Estimate	5	1	6	1	237	43	275	51	9	2	12	2	544	+ 2.1 (a)
Mid 1973 Estimate	5	1	5	1	243	44	280	50	10	2	13	2	556	+ 2.2 (a)
Mid 1974 Estimate	5	1	5	1	248	44	284	50	10	2	13	2	565	+ 1.6 (a)
Mid 1975 Estimate	5	1	5	1	254	44	289	50	10	2	13	2	576	+ 1.9 (a)
Mid 1976 Estimate	5	1	4	1	259	44	292	50	10	2	16	2	585	+ 1.7 (a)
End 1976 Estimate	5	1	4	1	261	44	295	50	10	2	15	2	590	+ 1.7 (a)
Mid 1977 Estimate	5	1	5	1	264	44	297	50	10	2	15	2	596	+ 1.9 (a)
End 1977 Estimate	5	1	4	1	267	44	301	50	10	2	14	2	601	+ 1.9 (a)
Mid 1978 Estimate	5	1	4	1	270	44	303	50	10	2	15	2	607	+ 1.8 (a)
End 1978 Estimate	5	1	3	1	272	44	307	50	11	2	14	2	612	+ 1.8 (a)

Note: (a) Based on revised mid year estimates.

(b) Subject to rounding errors.

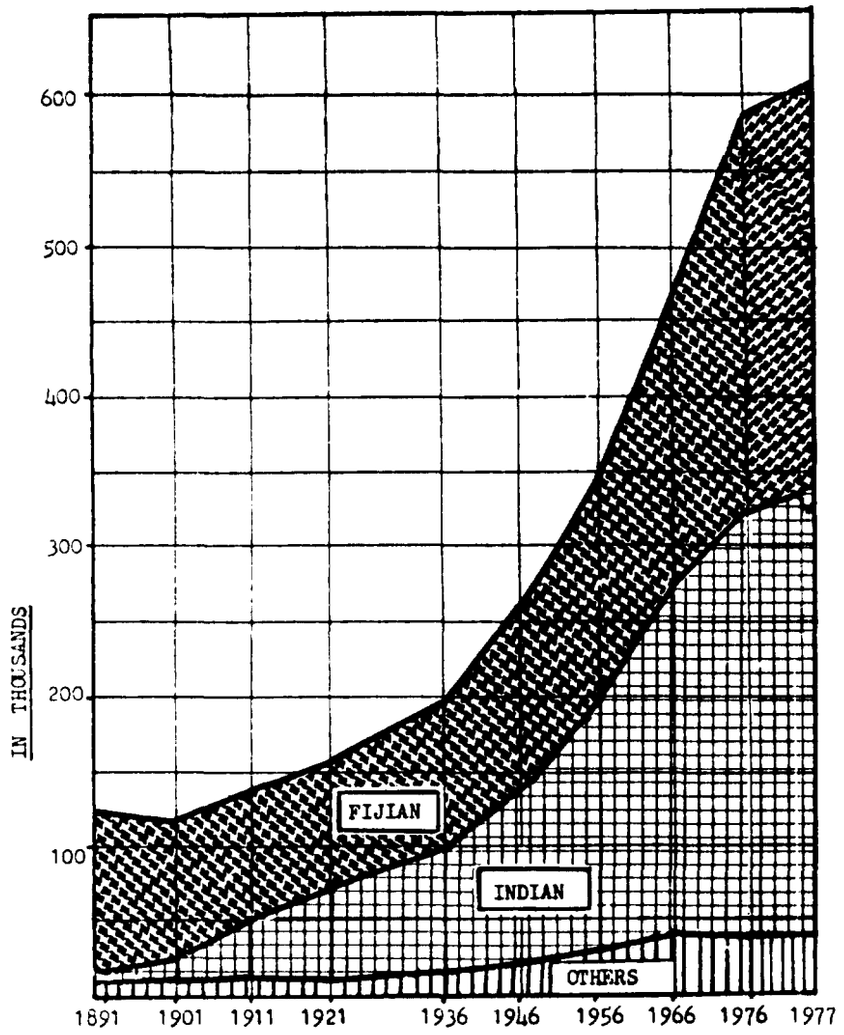
Population Growth

Figure 2-1



REMARKS: The decline in the birth rate since 1963 is attributed to the success of Fiji's family planning measures.

Figure 2-2



2.3 Industry

2.03 Table 2-2 shows Gross Domestic Product by industrial origin at factor cost at constant 1968 prices. The growth rate of GDP was 12.7% in 1973 which was the highest rate among these years, and 0.1% in 1975 which was the lowest. After 1976, the growth rates were recorded over 2.5%. The average growth rate through 1972 to 1978 was 4.1% per annum.

2.04 Among the industries (industrial groups), output of distribution industry including tourism recorded the highest value (F$45.8 million) and was followed by agriculture, forestry & fishery industries (F$45.2 million). Output of manufacturing industry was F$24.4 million in the same year. Table 2-2 is re-organized into Table 2-3, which shows proportion of primary, secondary and tertiary industries. The GDP proportion of primary industry was 20.9%, secondary industry was 11.6% and tertiary industry was 67.5% in 1978. It is Fiji's distinctive feature that tertiary industry has by far the biggest share and secondary industry has the smallest share of the output. This feature has not changed for many years; that is, the growth rate of each industry has been proportional to each others.

2.05 The employment by industry also indicate the feature peculiar to an industrial structure in Fiji. Table 2-4 shows the number of paid employment by industry. The average growth rate of the paid employment from 1971 through 1978 was 3.8% per annum. The highest rate was recorded by the industrial sector of community, social and personal and it was followed by the

Table 2-2 GDP by Industrial Origin at Factor Cost
at Constant 1968 Prices
(Million Fiji Dollars) 1972-1978

INDUSTRIAL GROUP	1972	1973	1974	1975	1976	1977	1978(p)
Agriculture, Forestry & Fishing	37.9	40.3	38.9	39.1	40.6	43.7	45.2
Mining & Quarrying	2.3	2.2	1.9	1.9	1.8	1.4	0.8
Manufacturing	18.5	19.1	19.8	19.9	21.6	23.6	24.4
Electricity, Gas and Water	2.6	2.9	3.0	3.2	3.6	3.7	3.8
Building and Construction	9.7	11.3	9.9	8.7	8.3	9.0	9.4
Distribution (incl. tourism)	38.3	44.2	45.1	42.5	42.5	44.9	45.8
Transport & Communication	12.6	14.5	15.7	16.5	16.9	17.3	17.9
Finance & Insurance	23.8	27.6	29.8	32.0	32.9	33.4	34.1
Government Services	18.1	21.6	24.0	24.9	25.6	25.6	37.5
Other Services	8.0	9.7	10.2	10.5	10.7	10.9	
Less Imputed Bank Service Charges	-1.8	-1.8	-1.7	-2.4	-2.4	-2.4	-2.5
T O T A L	170.0	191.6	196.6	196.8	202.1	211.1	216.4
% Change over previous year	+7.9%	+12.7%	+2.6%	+0.1%	+2.7%	+4.4%	+2.5%

(p) Provisional

Table 2-3 GDP AND PROPORTION BY INDUSTRIAL ORIGIN

Industrial Sector	1972	1973	1974	1975	1976	1977	1978
Primary	37.9 (22.3)	40.3 (21.0)	38.9 (19.8)	39.1 (19.9)	40.6 (20.1)	43.7 (20.7)	45.2 (20.9)
Secondary	20.8 (12.2)	21.3 (11.1)	21.7 (11.0)	21.8 (11.1)	23.4 (11.6)	25.0 (11.8)	25.2 (11.6)
Tertiary	111.3 (65.5)	130.0 (67.8)	136.0 (69.2)	135.9 (69.1)	138.1 (68.3)	142.4 (67.5)	146.0 (67.5)
TOTAL	170.0 (100.0)	191.6 (100.0)	196.6 (100.0)	196.8 (100.0)	202.1 (100.0)	211.1 (100.0)	216.4 (100.0)

upper: Million Fiji Dollars

lower: %

Table 2-4 Paid Employment: Estimate Numbers of Wage and Salary Earners by Industry as at End of June

	1971	1972	1973	1974	1975	1976	1977	1978
AGRICULTURE, FOREST AND FISHING								
Wages	2,936	2,362	2,528	2,836	3,089	2,729	2,791	2,672
Salaries	956	418	915	1,065	1,231	1,057	1,161	455
Total	3,892	2,780	3,443	3,901	4,320	3,786	3,952	3,127
MINING AND QUARRYING								
Wages	1,695	1,547	1,569	1,783	1,642	1,349	1,566	597
Salaries	158	198	179	180	255	201	275	212
Total	1,853	1,745	1,748	1,963	1,897	1,550	1,841	809
MANUFACTURING								
Wages	8,681	8,413	8,598	10,118	10,971	10,162	9,800	11,492
Salaries	1,430	1,415	1,518	1,722	1,789	1,282	1,453	1,604
Total	10,100	9,828	10,116	11,840	12,760	11,444	11,253	13,096
ELECTRICITY,GAS AND WATER								
Wages	1,087	1,251	1,525	1,467	1,348	1,501	1,563	1,428
Salaries	144	190	202	192	184	264	316	206
Total	1,231	1,441	1,727	1,659	1,532	1,765	1,879	1,634
CONSTRUCTION								
Wages	7,834	7,961	9,111	7,979	8,044	7,171	7,575	7,389
Salaries	454	278	343	312	405	501	554	585
Total	8,288	8,239	9,454	8,291	8,449	7,672	8,129	7,974
WHOLESALE & RETAIL TRADES & RESTAURANTS AND HOTELS								
Wages	6,852	7,300	7,005	7,236	7,767	8,564	8,780	8,628
Salaries	2,638	2,588	2,663	2,778	2,613	3,137	3,337	3,209
Total	9,490	9,888	9,668	10,014	10,317	11,701	12,117	11,837
TRANSPORT, STORAGE COMMUNICATION								
Wages	2,697	2,979	2,928	3,815	4,059	4,081	3,974	3,926
Salaries	2,033	2,246	1,981	2,365	2,364	2,693	3,222	3,041
Total	4,730	5,225	4,909	6,180	6,423	6,774	7,196	6,967
FINANCE, INSURANCE,REAL ESTATE & BUSINESS SERVICES								
Wages	477	620	1,092	1,233	1,206	1,223	1,353	1,142
Salaries	1,250	1,406	1,509	2,108	2,286	2,474	2,816	2,898
Total	1,727	2,026	2,601	3,341	3,492	3,697	4,169	4,040
COMMUNITY, SOCIAL AND PERSONAL								
Wages	5,423	5,641	5,556	6,167	6,796	6,534	6,128	7,662
Salaries	10,234	11,586	12,254	13,642	13,988	15,251	15,719	17,333
Total	15,657	17,227	17,810	19,809	20,784	21,785	21,847	24,995
TOTAL								
Wages	37,682	38,074	39,912	42,634	44,862	43,314	43,530	44,270
Salaries	19,306	20,325	21,564	24,364	25,114	26,860	28,853	29,543
Total	56,988	58,399	61,476	66,998	69,976	70,174	72,383	73,819

industrial sectors of manufacturing, and wholesale & retail trades & restaurant and hotels. The structural feature indicated by the distribution of employment is different from that of GDP.

Table 2-5 is derived from Table 2-4, and shows the structural feature of the three industrial sectors. The distribution pattern is the same as GDP; viz., tertiary industry has the highest value (76.9% in 1978), followed by secondary industry (18.8%) and primary industry (4.2%).

This feature has not changed for many years; that is, the growth rate of employment of each industry has remained proportional to each others.

Table 2-5 NUMBER OF PAID EMPLOYEE

Industry Group	1971	1972	1973	1974	1975	1976	1977	1978
Primary	3,892 (6.8)	2,780 (4.8)	3,443 (5.6)	3,901 (5.8)	4,320 (6.2)	3,786 (5.4)	3,952 (5.5)	3,127 (4.2)
Secondary	11,973 (21.0)	11,573 (19.8)	11,864 (19.3)	13,803 (20.6)	14,657 (20.9)	12,994 (18.5)	13,094 (18.1)	13,905 (18.8)
Tertiary	41,123 (72.2)	44,046 (75.4)	46,169 (75.1)	49,294 (73.6)	50,999 (72.9)	53,394 (76.1)	55,337 (76.5)	56,787 (76.9)
Total	56,988 (100.0)	58,399 (100.0)	61,476 (100.0)	66,998 (100.0)	69,976 (100.0)	70,174 (100.0)	72,383 (100.0)	73,819 (100.0)

upper: paid employment (number)
lower: %

2.4 The South Pacific Sub-Region 1/

2.06 Papua New Guinea

Papua New Guinea (PNG) is the largest developing country in the South Pacific sub-region and had a population of 2,908,000 in 1977; the annual rate of population growth is about 3%. The GNP at market prices was US$1,270 million in 1976. The main activity is agriculture; the principal cash crops are copra, coffee, cocoa, palm oil and rubber. The size of the secondary industry sector in relation to the total economy was small --- only 11% in 1975-6. The contribution of the industrial sector to GDP was 7.5% in 1967-8. Table 2-6 shows GDP growth of PNG.

Table 2-6 GDP Growth Rate (%)

1974	1975	1976	1977
3.8	1.0	1.6	5.5

The breakdown of the labour force is shown in Table 2-7; agriculture & fishery is more than a half of the total.

Table 2-7 Labour Force by Sector (%)

Agriculture & Fishing	52.5
Commerce & Services	10.6
Manufacturing & Mining	7.2

1/ The main source of the statistics and information is "Industrial Development Profile of the Island Developing Countries of the South Pacific Region", UNIDO, Feb., 1980.

As seen in Table 2-8, the biggest industry sector in the secondary industry is Saw & Plywood Mills in employees number and Motor Vehicle Repair in establishments number. In Boat Building & Repair sector, there are 27 establishments and 404 employees.

Table 2-8 Establishments and Employment of Secondary Industry by Industrial Sector, Excluding Electricity Generation 1975-76

Industry	Establishments Number	Employees Number
Metals and Machinery		
General engineering	70	1,495
Motor vehicle repair	152	2,690
Motor body building	14	175
Aircraft repair	11	495
Boat building & repair	27	404
Electrical reparis	37	473
Sub total	355	6,603
Food, Drink & Tobacco		
Bakeries	36	1,028
Breweries, soft drinks	26	1,280
Tobacco & cigarettes	3	666
Tea processing	5	259
Coffee processing	31	519
Cocoa processing	8	282
Other food manufacture	28	475
Sub total	137	4,509
Sawmills & Joineries		
Saw & Plywood mills	68	3,078
Joineries	46	939
Sub total	114	4,017
Other Manufacturing		
Cement goods	15	276
Paints & varnishes	3	69
Chemical and oils	8	406
Canvas & rope goods	3	24
Clothing	15	303
Furniture	8	84
Printing & paper products	36	981
Plastics & fibre glass	4	47
Other industries	32	515
Sub total	124	2,705
Total	730	17,834

Major merchandise imports and exports of PNG (1976) are shown in Table 2-9.

Table 2-9 Major Merchandise Imports and Exports of Papua New Guinea, 1976

Imports	Value in '000 US$
Meat fresh etc.	8,519
Meat, canned etc.	7,253
Rice	14,461
Motor spirit, etc.	14,622
Gas, diesel & other fuel oil	28,757
Medicine & pharmaceutical products	2,917
Base metals	9,901
Manufactures of metal	13,668
Passenger cars	6,498
Buses, trucks, lorries	15,496
Clothing	10,173
Textile yarn, fabrics, etc.	8,443
Total	140,708
Exports	
Coffee beans	45,873
Cocoa beans	31,119
Tea	4,322
Copra	12,638
Crude rubber	2,882
Wood & lumber	10,828
Copper ore & concentrates	216,686
Palm oil	7,188
Coconut oil	7,954
Plywood sheets	3,076
Total	342,566

2.07 Solomon Islands

The Solomon Islands lie on a scattered archipelago across a south easterly direction from Bougainville to Santa Cruz. The total population was estimated as 214,000 in 1978. The GNP at market prices is shown in Table 2-10.

Table 2-10 GNP

	1965	1970	1975	1976	1977
GNP ($SI 000)	20,357	28,555	49,402	58,982	70,092
Annual Growth (%)		7.00	11.59	19.35	18.88

The labour force is small, but steadily grew from 13,690 in 1970 to an estimated 16,800 in 1977. The breakdown by sector is shown in Table 2-11

Social Services and Agriculture are the biggest in employment number; 3.020 and 2,950 respectively in 1977. Manufacturing is 1,430 in employment number and its proportion is 8.5% in the same year. Major imports and exports are shown in Table 2-12

2.08 Samoa

Samoa is an independent state, a member of the British Commonwealth, and had a population of 154,000 in 1977. Agriculture is the principal economic activity of the island, accounting for about 50% of its GNP. The industrial sector of the country accounts for 10% of its GDP and 5% of its employnent. Employment by sector is shown in Table 2-13.

The total merchandise exports in 1977 were US$12 million and imports were US$34 million. Table 2-14 and 2-15 show exports and imports of Samoa.

2.09 New Caledonia

The population of New Caledonia (NC) was estimated at 134,000 in 1977. The total GNP of NC was approximately US$550 million in 1974. The economy of NC is dominated by nickel production.

The only agricultural exports from NC are coffee and copra,

Table 2-11 Employment by Industry (1971-77)

	1971		1973		1976		1977(est.)	
	No.	%	No.	%	No.	%	No.	%
Agriculture	2379	16.8	2041	14.7	2900	17.7	2950	17.6
Forestry	1214	8.6	882	6.4	1015	6.2	1020	6.1
Fishing	30	0.2	194	1.4	625	3.8	710	4.2
Sub total	3623	25.6	3117	22.5	4540	27.7	4680	27.9
Construction	1582	11.2	1620	11.7	1450	8.8	1460	8.7
Mining	4	-	103	0.7	40	0.2	40	0.2
Manufacturing	658	4.7	934	6.7	1380	8.4	1430	8.5
Utilities	171	1.2	132	1.0	170	1.0	180	1.1
Commerce	1023	7.2	1358	9.8	1740	10.6	1800	10.7
Transport & Communication	1142	8.1	1132	8.2	1350	8.2	1400	8.3
Financial Services	174	1.2	119	0.9	130	0.8	130	0.8
Public Administration	929	6.6	1052	7.6	1710	10.4	1780	10.6
Social Services	2426	17.2	2816	20.3	3000	18.3	3020	18.0
Domestic & Other Services	2412	17.0	1484	10.6	900	5.6	880	5.2
Grand total	14144	100.0	13867	100.0	16410	100.0	16800	100.0

Table 2-12 Key Categories of Imports and exports ($ 000)

	1972-74	'75	'76	'77
Imports				
Fish all kinds	649	159	13	
Food, oils and fats	296	260	213	
Rice	1600	770	903	981
Meat	1506	450	603	
Sugar	936	484	406	
Fuel oils	3343	2158	2688	
Cement	346	253	133	
Timber & timber products	510	214	288	
Ships & boats	510	586	577	
Beer, exports tobacco	2141	870	1006	
Footwear & clothing	1094	603	448	
Others	26760	14958	13804	
Total	40297	21771	21088	25753
Exports				
Fish	8976	2459	7160	7895
Copra	13650	4661	3634	7988
Rice	23	-	-	-
Meat	-	-	-	-
Sugar	-	-	-	-
Fuel oils	-	-	-	-
Cement	-	-	-	-
Timber (logs)	10781	3064	6062	7725
Ships & boats	20	-	-	-
Tobacco (manufactured)	122	53	78	117
Footwear & clothing	-	-	-	-
Others	3410	1585	3014	5889
Total	36992	11822	19948	29614

Table 2-13 Employment by Sector

(1,000 persons, %)

	1966		1971		1976	
	n	Share	n	Share	n	Share
Agriculture	26.1	73.9	25.4	67.4	23.4	61.1
Village	(24.0)	(68.0)	(22.9)	(60.7)	(20.7)	(54.1)
Others	(2.1)	(5.9)	(2.6)	(6.7)	(2.7)	(7.0)
Manufacturing and construction	1.4	4.0	2.4	6.5	2.5	6.7
Commerce	1.8	5.1	2.6	7.0	2.7	7.1
Transport and communication	0.8	2.3	1.2	3.3	2.1	5.4
Services	5.2	14.7	6.1	15.8	7.3	19.2
Others	-	-	-	-	0.2	0.5
Total	35.3	100.0	37.7	100.0	38.2	100.0

Table 2-14 Merchandise Exports

(WS$ '000)

	1976	1977	1978 (est.)
Copra	1,894	4,871	3,370
Cocoa	2,229	6,043	2,600
Bananas	145	52	n.a.
Timber	64	201	n.a.
Taro	363	360	n.a.
Manufactured and/or processed goods	526	501	3,230
Others	128		
Total	5,349	12,028	9,200

Table 2-15 Composition of Imports

(WS$ '000)

	1974	1975	1977
Food, beverages and tobacco	6,130	7,956	10,589
fish	978	751	700
meat	1,193	1,648	2,802
cereals	1,162	1,914	1,961
Raw materials	107	217	961
Fuels, lubricants, etc.	529	1,913	2,903
Chemicals	1,094	1,128	1,439
Machinery and transport equipment	2,696	3,160	7,446
Others	5,353	6,787	8,917
Total	15,910	23,160	32,254

whose quantity is very small. Labour force of NC is shown in Table 2-16

Table 2-16 Labour Force by Industry

(person, %)

	n	Percentage
Agriculture	13,564	29.05
Mining	2,110	4.52
Manufacturing	5,469	11.71
Construction	4,475	9.58
Water, electric	547	1.17
Transportation, telecomm.	2,632	5.64
Commerce, bank, real estate	6,458	13.83
Services	11,338	24.28
Others	96	0.21
Total	46,689	100.00

Exports and imports of NC are as shown in Table 2-17 and 2-18, respectively.

Table 2-17 Exports of New Caledonia
(CFP million)

	1971	1973	1975	1976
Nickel ore	8,557	3,578	4,827	6,492
Nickel metal	11,474	11,434	19,461	18,888
Coffee	21	28	23	30
Copra	-	6	-	6
Others	126	709	1,181	1,272
Total	20,178	15,755	25,492	26,688

Table 2-18 Imports of New Caledonia
(Francs million)

	1971	1973	1975	1976
Foodstuffs	3,530	4,288	5,139	5,172
Textiles	1,437	1,403	1,400	1,116
Coal, petrol	2,251	1,904	5,822	6,043
Raw mats.& ind. products	6,108	4,656	6,159	5,033
Mach., transp.	8,983	4,474	6,877	5,490
Others	1,221	1,023	1,652	1,325
Total	23,630	17,748	27,049	24,179

The nickel metal always ranks first in exports with 70.8% of the total in 1976.

2.10 New Hebrides

New Hebrides (NH) is a condominium or territory administrated jointly by Britain and France. The population was estimated 100,000 in 1977. The total GNP of NH was estimated at US$40 million in 1974. The labour force is about 40,000 persons, 80% of whom are engaged in agriculture. Primary production consists of copra, frozen fish and beef. There are small meat canneries and fish freezing works. Other manufacturing activities are production of soft drinks, printing, building materials and boat-making. Exports and imports are shown in Table 2-19 and 2-20 respectively.

Table 2-19 Exports of the New Hebrides
(NH francs million)

	1973	1974	1975	1976
Copra	354	1,517	338	521
Cocoa	50	50	41	65
Meat (chilled/canned)	74	57	63	86
Coffee	-	2	n.a.	n.a.
Fish, frozen	889	637	258	514
Manganese	33	64	68	78
Timber	78	12	2	5
Boats	6	7	n.a.	n.a.
Others	16	36	45	46
Total	1,499	2,371	788	1,285

Table 2-20 Imports of the New Hebrides
(NH francs million)

	1973	1974	1975
Food, live animal	516	831	480
Beverages, tobacco	173	229	141
Mineral fuel	153	344	279
Chemicals	126	177	121
Manufactured goods	529	809	447
Machinery, transp.	462	678	644
Others	253	351	264
Total	2,448	3,796	2,754

Of total exports, copra and frozen fish are 80.5%.

2.11 The Kingdom of Tonga

The Kingdom of Tonga (KT) is an independent island country, a member of the British Commonwealth. Its population was 90,000 in 1977. The GNP of KT was estimated at US$30 million in 1974. The estimated total labour force is about 15,000 persons. The manufacturing employment in KT has been put at around 1,000 persons. The sole economic contribution of the others lies in subsistence agriculture. As for external trade, Table 2-21 shows exports and imports from 1970 to 76.

Table 2-21 Overseas Trade, Tonga
(T$ million)

	1970	1973	1975	1976
Imports	5.5	8.0	13.0	11.7
Exports	2.7	3.2	4.4	3.3

Imports always exceed exports and the deficit has been increasing.

2.12 The Republic of Kiribati

The total population of the Republic of Kiribati (RK) was 54,000 in 1977. Its labour force was 17,576 persons in 1973. The GNP was put at US$40 million in 1974. Primary production consists of coconuts, fruits for local consumption, forestry, fisheries and livestock. The only exported agricultural produce is copra. The local manufacturing industry is confined to small operations such as handicrafts, the salting of fish, biscuit and soft drink plants, and the building of small boats. Table 2-22 shows exports and imports of RK from 1969 to 1976.

Table 2-22 Exports and Imports of Kiribati ($ million)

	1971	1974	1975	1976
Exports	8.7	23.73	27.68	18.15
Imports	4.7	7.55	9.29	10.06

The balance is always deficit.

2.13 Americam Samoa

American Samoa (AS) is an unincorporated territory of the U.S.A. The population was 31,000 in 1977. The total GDP was put at US$30 million in 1974. The largest single employer in AS is the government which employs about half of the labour force. The economic base of AS is not copra, but fishing industry. The manufacturing industry of AS consists of fish canning, milk processing and ice-cream production. ble 2-23 and 2-24 show AS's exports and imports.

Table 2-23 Exports of American Samoa
($ '000)

	1974-75	1975-76	1976-77
Watches, clocks	4,706	4,273	2,542
Sharks fins	263	105	75
Fish, fresh	242	18	264
Fish meal	138	72	322
Meat, canned	-	-	58
Pet food	3,481	2,339	2,414
Jewellery	88	426	767
Tuna, canned	73,600	48,684	58,244
Clothing	469	-	-
Total	82,934	55,898	64,893

Table 2-24 Imports of American Samoa
($ '000)

	1974	1975	1976
Beer	484	585	627
Electric goods	1,273	1,305	1,608
Gasoline, motor	1,845	1,699	2,703
Machinery	722	588	936
Meat, preserved	487	764	1,181
Meat, fresh	624	694	1,178
Motor vehicles & parts	1,901	2,028	1,513
Diesel fuel	7,446	9,456	8,778
Poultry, fresh	989	882	973
Watches, clocks	2,334	1,796	1,798
Total	46,549	49,894	50,696

The canned tuna ranks first in exports with the share of 89.8% of the total exports in 1976-77.

2-14 Tuvalu

The population of Tuvalu was 5,887 in 1973, 7,000 in 1975 and 8,000 in 1977. Primary production includes copra and subsistence production of coconuts. As regards manufacturing, there are only a few small business units engaged in baking, furniture-making and building. The only exports consists of copra, the production of which was at the maximum of 566 tonnes in 1974 and at the minimum of only 60 tonnes in 1976.

3. SHIPBUILDING INDUSTRY IN FIJI

3.1 General

3.01 Fiji is the only country which has shipbuilding industry in South Pacific Region except for Australia, New Zealand, Papua New Guinea and American Samoa. As for steel ships, there are four major enterprises which engage in snipbuilding and shiprepair business, including the Government Shipyard. The Government Shipyard principally builds steel ships whereas, Carpenters Industrial, one of the private enterprises, mainly repairs ships and has built a few ships. Bish Ltd., another private enterprise, specializes in shiprepair business.

3.02 Table 3-1 shows the structural feature of the Fiji industry (mainly that of manufacturing) from a vew point of gross output in 1977. Total gross output of manufacturing industry was F$261 million. The top industry was sugar and coconut oil whose output was F$115 million in 1977 and the proportion was 44.2% in the manufacturing industry. The second is beer and tobacco, producing F$22 million. Shipbuilding and shiprepair is the twelfth industry, producing F$4.8 million. Its output share was 1.8% in 1977.

3.2 Present Conditions of Shipbuilding Industry in Fiji

3.03 The shipbuilding industry in Fiji is devided into two groups; the Government Shipyard and private enterprises.

Table 3-1 Gross Output of Industry 1977

(Producer's Value $000)

ISIC	GROUP	NO OF RESPONDING ESTABLISHMENTS	LOCAL SALES	EXPORTS	OWN CAPITAL CONSTRUCTION	INDUSTRIAL SERVICE TO OTHERS	GOODS NOT MANUFACTURED BY ENTERPRISE					WORK-IN-PROGRESS		STOCKS OF FINISHED GOODS		MISCELLANEOUS INCOME (a)	INTEREST RECEIVED *	GROSS OUTPUT
							SALES	PURCHASES	STOCKS BEGINNING	STOCKS END	GROSS MARGIN	BEGINNING	END	BEGINNING	END			
2	MINING & QUARRYING																	
23	Mining	15	-	5,536	-	-	-	-	-	-	-	-	-	-	-	212	47	5,748
29	Quarrying	7	2,280	418	-	-	637	756	86	73	-132	2	-	43	31	10	-	2,588
	TOTAL	22	2,280	5,954	-	-	637	756	86	73	-132	2	-	43	31	222	47	8,310
3	MANUFACTURING																	
3111	Butchering and Meat Packing	17	7,260	76	2	-	165	158	58	49	- 2	125	90	197	201	54	4	7,359
3115) 3118)	Sugar and Coconut Oil	5	6,359	105,012	-	11	54	48	251	590	345	-	33	3,308	5,979	978	551	115,409
3116	Rice Milling	5	15,030	153	379	3	3,744	3,428	16	21	321	-	-	452	581	154	5	16,169
3117	Bakery Products	13	4,453	502	1	5	213	185	5	8	31	17	11	161	135	14	2	4,974
3133) 3140)	Beer and Tobacco	2	22,011	-	-	-	-	-	-	-	-	33	37	472	487	61	-	22,091
3134 3112)	Non-Alcoholic Drinks	12	1,990	-	-	-	170	135	17	12	30	3	18	41	23	30	4	2,047
3113) 3114)	Dairy, Fruit & Fish	5	4,844	5,913	2	13	5,710	5,335	963	1,581	993	13	11	724	780	268	223	12,087
3119) 3121) 3122)	Miscellaneous Food Products	22	7,693	317	-	-	390	352	2	2	38	173	128	72	172	5	30	8,108
3220	Textiles and Clothes	59	2,648	38	-	-	22	15	17	26	16	27	31	243	254	46	14	2,763
3240	Footwear	6	398	-	-	-	123	102	67	77	31	2	3	20	20	34	1	464
3311	Sawmilling	27	8,367	1,612	28	1	-	-	-	-	-	210	226	785	1,138	94	3	10,471
3319	Curios and Artifacts	13	207	124	-	1	339	258	50	57	88	17	28	94	134	14	5	485
3320	Furniture and Upholstering	54	4,699	-	3	37	2,532	1,934	6	5	597	104	270	530	775	28	15	5,775
3418) 3420)	Printing and Publishing	28	7,667	177	-	-	126	108	52	61	27	70	66	110	173	80	2	8,010
3521	Paint	5	2,504	73	-	-	1,901	1,294	315	233	525	16	21	59	132	30	6	3,210
3525	Soap	6	4,597	138	-	-	-	-	-	-	-	47	46	410	445	12	10	4,781
3550	Retreading and Flip-Flops	4	1,125	1	-	-	560	468	166	201	127	2	4	23	34	7	-	1,273
3560	Plastics	5	2,792	98	-	-	85	76	21	28	16	-	2	176	166	152	2	3,050
3698	Concrete Products	10	9,506	267	11	8	10	8	-	-	2	46	57	290	178	119	24	9,812
3812) 3818)	Structural Metal Products	24	9,080	404	22	132	233	200	31	94	95	644	896	780	672	108	18	9,985
3822	Agricultural Machinery	11	616	-	12	23	-	-	-	-	-	40	60	-	-	3	1	674
3828	Office Machines	8	187	-	-	11	2,511	1,293	1,019	1,030	1,229	1	3	13	10	248	4	1,674
3838	Electrical Equipment	12	1,889	9	39	3	75	86	21	104	72	15	169	31	40	3	5	2,178
3841	Boat & Ship Bldg & Repairing	5	4,193	232	4	135	37	27	335	314	-11	173	379	22	19	14	4	4,770
3843	Bus Building	5	2,069	-	-	1	502	393	382	547	274	80	65	62	87	77	64	2,431
3908	Miscellaneous Products	13	976	22	-	-	270	186	79	230	235	13	27	58	113	13	1	1,315
	TOTAL	376	133,160	115,168	503	384	19,772	16,089	3,873	5,270	5,079	1,871	2,681	9,133	12,748	2,646	998	261,365
4	ELECTRICITY, GAS AND WATER	5	17,914	-	2,010	169	90	179	88	145	-32	111	337	19	38	450	114	20,756
	TOTAL 2, 3 & 4	403	153,354	121,122	2,513	553	20,499	17,024	4,047	5,488	4,915	1,984	3,018	9,195	12,817	3,318	1,159	290,431

NOTE: * Interest received is not included in last column totals.

(a) This amount includes rent and Government subsidies.

(1) The Government Shipyard

The Government Shipyard is under direct control of Marine Department, Ministry of Tourism, Transport and Civil Aviation. It builds small sized steel ships for business use such as cargo-passenger ship, RO-RO ships, tug boats, dredgers and so on. These ships are mostly 500G/T or under, 60 meters long and 12 meters wide. The Shipyard produces ships of various types in small quantities; from 2 to 5 ships per year, or from 200 to 500 tons in terms of steel processing.
In addition, the Shipyard builds and refits wooden boats of very small size (from 5 to 20 meters long), and also repairs ships which are 30 meters long or under.

(2) The Shiprepair Works of Private Corporations

3.04 There are three shipbuilding and repair works in Fiji which are owned by private capitals; that is, Bish, Ltd., Carpenters Industrial and Pacific Engineer, Ltd. These enterprises are very active in shiprepair business, using the slipways managed by the government. The slipways are:

No. 1	1,000 tons	x 1,
No. 2	500	x 1,
No. 3	200	x 1 and
No. 4	100	x 1.

The operation rate of the slipways No. 1, 2, and 3 is high; the pitches are 5 to 7 days per repair on the slipway. However, shiprepair service is in great demand and the government slipways cannot cope with the expanding demand. Carpenters have a plan

to construct a new slipway for shiprepair in their yard. In 1979, the total number of steel ships repaired in Fiji were estimated 600 in number, and about 300 ships among them were pulled up on the slipways and the rest of 400 ships were repaired while floating.

3.3 Development of Shipbuilding Related Industries

3.05 In order to become a viable economic enterprise, a shipbuilding industry must be supported by a network of well developed industries which are capable of providing for main engine, equipments, auxiliary parts and machineries, etc. indispensable for construction of a steel ship. However, in Fiji there hardly exists such shipbuilding related industries so that almost all the equipments, machines and parts have to be imported from abroad by spending scarce foreign reserves. For instance, the Government Shipyard heavily depends upon the supply of steel plates and sections which are given to the Fiji government as a grant in aid by foreign governments.

3.06 The present situation of development of shipbuilding related industries can be briefly described as follows:

(1) Main engines, auxiliary engines, dinamos, electric motors, pumps, meters and gauges for navigation, wireless apparatuses and so on are imported from abroad.

(2) Materials such as steel plates, section steel and welding rods are also imported. The price of steel plates per ton

is F$450 to 500, which is much higher than in developed countries and 30% to 40% higher than in Japan.

(3) Auxiliary materials such as oxygen and acetylene gases are produced in Fiji.

(4) Although Bish and Carpenters have casting and forging shops, it is beyond their capacity to manufacture large sized products of cast or forged steel such as stern-frames and rudder stocks.

(5) There hardly exists subcontracting factory of manufacturing hull blocks and various kind of out-fitting materials other than Bish and Carpenters.

(6) As for repairing work by lathe or of electrical equipment, the situation is the same.

3.4 Conditions of the Government Shipyard

(1) Facilities

3.07 The main facilities of the Government Shipyard are as follows;

1) Area of the site: approx. 10,000 m^2

2) Slipways for shipbuilding:

No. 1 length 60m x width 15m x 1

No. 2 60 x 15 x 1

3) Slipway for shiprepair:

No. 3 length 30m x width 15m x 1

4) Crane for slipways, No. 1 and 2:

Lifting capacity 35t x span 30m x 1

(goliath crane)

5) Building for combined use of fitting-out shop, machinery shop and plumbery shop

Length 40m x width 15m x 1, equipped with long lathes, drill presses, pipe benders, grinders and so on.

6) Boat building shop and Joinery shop

Length 40m x width 15m x 2, equipped with wood processing machines;

Mould loft

Length 40m x width 15m

7) Steel fabrication & sub-assembly shop

Length 50m x width 20m x 1, equipped with steel plate bending machines, shearing machines, bending rollers and so on.

8) Quay for mooring and out-fitting

Length 50m x depth approx. 4m x 1, without crane

9) Office building, drafting room, warehouses and so on.

3.08 The following are to be pointed out as the problems identified during the field survey of the Study Team:

1) The flow of each processing tends to move at random and the work is not integrated; i.e., not only the arrangement

of each shop is improper, but also the capacity of each shop is unbalanced.

2) The capacities of slipways and out-fitting quay are not well balanced to each other which makes it difficult to synchronize the timing of hull assembling and out-fitting.

3) Some steel processing machines, tools and cranes are not properly selected for the required work and some of them are outdated.

4) Since the portable cables of welding machines, oxygen and acetylene gas are used, there are frequent losses in carriage and safety problem arises.

(2) Productivity

3.09 The productivity of the Government Shipyard is judged to be relatively low as calculated from the man hours actually spent on shipbuilding in recent years. It is almost impossible to precisely evaluate the productivity in quantitative terms since there have been no man-hour and cost data collected by the yard. However, an estimation of the productivity can be made on the basis of man-hour schedule of a 36.5 meter type landing craft which is under process of construction. The estimated productivity of yard is equivalent to the level of 1/3 to 1/4 of efficiency of a Japanese shipyard of the same scale. Table 3-2 shows a comparison of working man-hours of the Government Shipyard with the shipbuilding industry of advanced country.

Table 3-2 Comparison of Working Man-hour
(36.5m Type of Motor Landing Craft)

Process	Government Shipyard		Shipbuilding of advanced country (estimation)
Hull	74,900		20,000
Out-fitting	16,600		
Piping	6,550		
Electric	1,300		
Machinery	9,850		
Deck machine	3,100	64,200	25,000
Panneling	10,800		
Seat	1,100		
Painting	14,600		
Box	300		
Total	139,100		45,000

Productivity Estimate of Hull Construction

3.10 The weight of hull of the landing craft: Hw=100 tons

Steel processing hours per 1 ton: Hm-h=74,900/100

$\cong$750

Since Hm-h ranges from 150 to 250 hours (average 200 hours) in an advanced country for shipbuilding, the productivity ratio is estimated 3.75 (750/200); that is, the productivity of the Government Shipyard is approximately 1/4 that of an advanced country.

Productivity of Outfitting

3.11 It can be estimated that the productivity of the Government Shipyard is almost 1/3 of an advanced country. There are problems which can be pointed out as the probable causes of the low productivities of the Government Shipyard.

1) There are many defects and improper layout in the facilities as explained before.

2) Since a production control system is not yet established, there tends to be no control in production.

3) Morale of the employees tends to be lower as compared to private sector.

(3) Cost of Shipbuilding

3.12 As there exist no cost data available to us, it is difficult to explain the cost structure of the Government Shipyard in quantitative terms. However, it can be inferred that

the building cost tends to be very high compared with an advanced country. The reasons are as follows:

1) The physical productivity is approximately 1/3 as stated before.

2) The labor cost is as high as F$1.50 per hour in 1980, which is approximately 1/2 of Japan.

3) A cost control system is not well established.

4) There is no budgeting system for a shipbuilding.

5) Since almost all of the raw and processed materials are imported from abroad, direct cost is apt to be high.

4. DEMAND FORECAST OF SHIPBUILDING AND SHIPREPAIR

4.1 Demand for Shipbuilding

4.01 In order to forecast the demand for shipbuilding, three categories of vessels should be taken into consideration. They are vessels of ocean-going, inter-island and off-shore transportation. Vessels of ocean-going seatraffic are mostly over 10,000 tons and those of inter-island traffic are mostly over 500 tons. There is no production facilities in Fiji for such a size of ships. And it is difficult to expand the present facilities so to produce such vessels of big size, since it not only requires an enormous investment and advanced technology, but also there is no relative industries in Fiji. In this respect, the former two categories should be excluded from the consideration.

4.02 On the other hand, there is a fairy sizable demand of shipbuilding for type and size of vessels of off-shore transportation. These vessels are landing crafts, barges, pilot boats, general cargo ships under 500 tons, which are used for coastal shipping in Fiji.

4.03 The procedure of the demand forecast of shipbuilding (cargo ships) is as follows:

(1) To calculate the elasticity of cargo movement for GDP (Gross Domestic Product),

(2) To obtain a regression equation in which year explains GDP,

(3) To forecast GDP in 1990 through the regression equation,

(4) To calculate cargo movement in 1990 through elasticity for GDP,

(5) To calculate net demand for shipbuilding by multiplying exising fleet tonnage and average annual growth rate of cargo movement,

(6) To add scrapped tonnage as compensation demand for shipbuilding by multiplying existing fleet tonnage and average scrap rate, and

(7) To obtain actual demand for shipbuilding, assuming ratio of second-hand ships for total registered ships will be constant.

4.04 Table 4-1 shows the cargo movement of coastal shipping in Fiji through Suva Port, which can be regarded as the majority part of the whole movement in Fiji.

Table 4-1 Cargo Movement through Suva
(Coastal Shipping)

1974	71,439 tons
75	106,354
76	74,718
77	73,652
78	93,047

Table 4-2 is the result of GDP of Fiji from 1972 to 78.

Table 4-2 Gross Domestic Product
(at constant 1968 prices)

1972	170.0 million F$
73	191.6
74	196.6
75	196.8
76	202.1
77	211.1
78	216.4

The elasticity of the cargo movement for GDP is 1.183 (for 4 years).

The regression equation of GDP is:

$$G = -96496+12742.5 \log Y \quad (r=0.935)$$

G: GDP (in million F$)

Y: Year

By using the said elasticity and the regression equation, the forecast of cargo movement in 1990 will be calculated as 209,432 tons; that is, the average annual growth rate of cargo movement is 6.99%. Supposing that the efficiency of a ship is constant, the said annual growth rate of cargo movement (6.99%) will be applied to the existing fleet tonnage. The tonnage of cargo ships (incl. passenger/cargo ships) is 14,251 GRT in 1980. Hence, the demand for shipbuilding, approximately 1,000 GRT. Since the average scrap rate from 1976 to 1979 is 5.6% per year, 5.6% of the existing tonnage (approx. 800GRT) will be scrapped in a year. The sum of these two figures (1,000 and 800 GRT) indicate the tonnage of newly required fleet. Among newly

registered fleet, approximately 43% were second-hand; that is, 43% of 1,800 GRT will be second-hand vessels.
Hence, approximately 1,000 GRT as forecasted demand for ship-building.

4.05 The following procedure was applied to forecast the demand for passenger boats.

(1) To obtain a regression equation in which arrival visitors for pleasure to Fiji explain tonnage of passenger boats,

(2) To forecast arrival visitors to Fiji in 1990 by applying average annual growth rate of itself from 1975 to 1979,

(3) To calculate required passenger boats in 1990 by using the said regression equation,

(4) To calculate average annual growth of tonnage of passenger boats, and

(5) To obtain demand forecast by adding required tonnage and scrapped tonnage.

4.06 Since the existing tonnage of passenger boats for past years could not be obtained, they were estimated through:

- the present tonnage
- the growth of tonnage for 1975 - 1979
- the average annual scrap rate

Table 4-3 shows estimated existing tonnage of passenger boats.

Table 4-3 Existing Passenger Boats

1975	8,518 GRT
76	9,078
77	8,868
78	10,051
79	10,636

Table 4-4 indicates the actual growth of arrival visitors to Fiji for pleasure.

Table 4-4 Visitors arrival (for pleasure)

1975	124,319
76	133,280
77	137,893
78	145,039
79	148,309

The regression equation is:

$$B = -2271+0.8494\ N \quad (r=0.920)$$

B: tonnage of existing passenger boats
N: visitors arrival to Fiji for pleasure

Since the annual growth rate of arrival visitors is 4.51%, the arrival passengers in 1990 will be 241,000. The required tonnage of passenger boats can be calculated as 18,190 GRT in 1990; that is, 600 GRT are required to be added as net demand every year. The demand for shipbuilding is calculated as 1,300 GRT through the scrap rate of 5.6%.

Assuming the ratio of second-hand ships as 43%, the result of demand forecasting will be approximately 700 GRT.

4.2 Demand for Shiprepair

4.07 There are four slipways for shiprepair in Fiji, as mentioned before. They are

1. A repair berth of 1,000 tonnage,
2. " 500 " ,
3. " 200 " , and
4. " 100 " .

The utilisation of each slipway is shown in Table 4-5. The table says that the utilisation measured by days in use out of 365 days is mostly from 80 to 90%, which means that the slipways are used almost everyday except Sundays; that is, the utilisation is over 100% for working days.

4.08 It is judged that demand for shiprepair services is great/or at least promising in Fiji.

(1) Fiji is located in strategic position in South Pacific.

(2) There are a lot of second-hand vessels which require repairs more frequently than new vessels.

(3) The four slipways are operated up to full capacity. It is obvious that Fiji is lacking shiprepair facilities.

Table 4-5 SLIPWAY UTILISATION FOR YEARS 1976 - 1979

1000 Ton Slipway Cradle

Item	Description	1976	1977	1978	1979
(a)	No. of vessels taken	67	65	60	72
(b)	Days in use out of 365 days	299	321	243	334
(c)	Utilisation (%)	81.69%	87.90%	66.57%	91.51%
(d)	Average no. of days per vessel	4.5	4.9	4.05	4.64
(e)	Total tonnage of vessels taken	16,466.32 Tons	18,790.15 Tons	21,682.10 Tons	23,766.20 Tons

500 Ton Slipway Cradle

Item	Description	1976	1977	1978	1979
(a)	No. of vessels taken	64	74	78	18
(b)	Days in use out of 365 days	320	300	278	328
(c)	Utilisation (%)	87.40%	82.19%	76.16%	89.86%
(d)	Average no. of days per vessel	5.00	4.05	3.56	4.21
(e)	Total tonnage of vessels taken	9,112.60 Tons	10,280.23 Tons	12,423.46 Tons	12,811.25 Tons

200 Ton Slipway Cradle

Item	Description	1976	1977	1978	1979
(a)	No. of vessels taken	66	55	70	87
(b)	Days in use out of 365 days	296	269	312	304
(c)	Utilisation (%)	80.87%	73.69%	85.47%	83.29%
(d)	Average no. of days per vessel	4.5	4.89	4.45	3.49
(e)	Total tonnage of vessels taken	4,025.90 Tons	4,005.87 Tons	4,032.62 Tons	4.422.99 Tons

100 Ton Slipway Cradle

Item	Description	1976	1977	1978	1979
(a)	No. of vessels taken	44	62	64	68
(b)	Days in use out of 365 days	314	331	318	281
(c)	Utilisation (%)	85.00%	90.68%	87.12%	76.99%
(d)	Average no. of days per vessel	7.2	5.34	4.97	4.13
(e)	Total tonnage of vessels taken	1,700.31 Tons	2,568.66 Tons	3,066.96 Tons	2,657.77 Tons

4.09 Generally speaking, frequency of shiprepair per one vessel is 1.23 a year on average. This figure depends on composition of ship age; that is, frequency of shiprepair of younger vessels is less than 1.23 and that of old vessels is more than 1.23.
Since there are a lot of old (second-hand) vessels in Fiji, the frequency may be more than 1.23.

4.10 Demand for shiprepair can be calculated by multiplying the frequency and the number of vessels. The number of vessels registered in Fiji is approximately 220. All of them can be considered as to do repair in Fiji.
The number of foreign vessels arriving at Fijian ports is 530 a year on average. Supposing that 10% of them are under 1,000 tons, and that 1/2 of them do repair in Fiji, 27 vessels should be taken into consideration of shiprepair. Demand for shiprepair will be at least 304 vessels ((220+27) x 1.23) per year.

4.11 Table 4-5 indicates that the four slipways are managing 250 vessels a year, which means that there is potential demand for shiprepair of approximately 50 vessels per year. As the number of vessels of Fiji and foreign vessels arriving at Fijian ports will increase year by year, the demand for shiprepair will also increase.

5. MODERNIZATION PROGRAM RECOMMENDED TO THE SHIPYARD

5.1 Strategy for Modernization of the Shipyard

5.01 In order to formulate a plan as to how the Shipyard can be modernized, both demand forecasted for shipbuilding and repair and the state-of-art of the shipbuilding of the Government Shipyard should be taken into consideration. As stated in Chapter 4, the forecasted demand for shipbuilding in Fiji may not be so big as expected. On the other hand it is viewed that there will be a great deal of demand for shiprepair.
The present state of the facilities of the Shipyard and its problems are described in Chapter 3.

5.02 Considering these conditions, we recommend to modernize the Shipyard according to the following guideline;

(1) Shipbuilding

- To aim at building 5 to 6 ships a year mainly ordered by the government for the succeeding few years,
- To improve productivity by installing some new processing machines and tools, and also by rearranging the production line,
- To establish production and cost planning and control systems.

(2) Shiprepair

- To gradually enter into shiprepair business where there is big demand,

- To reconstruct the two slipways so that they can be used for shiprepair, too,
- To take it into consideration to equip the Shipyard with a floating dock as a long-range plan, after the modernization measures have got into effective operation.

(3) Management System

- To improve the organization so that its operations can be effectively planned, managed and controlled; viz., establishment of production planning and control system, and budget planning and cost control system,
- To dispatch staff and engineers abroad for training to upgrade the level of their technical skill and know-how,
- To accept some experts from abroad for on-the-job training, particulary in the fields of production & cost planning and control, design and marine engineering.

5.2 Reorganization Plan of the Government Shipyard

(1) Establishment of Annual Production Planning System

5.03 In order to operate the Government Shipyard as an economically viable enterprise, it is essential that a network of planning systems will be established which comprises the following;

- Demand estimate
- Production planning

- Material and personnel planning
- Budget planning, etc.

In the following, some of the important planning systems are briefly explained.

5.04 Annual Production Plan for Shipbuilding: Table 5-1 shows an annual production plan recommended for the Government Shipyard which should be used as a guideline for the future reorganization plan of the facilities for shipbuilding. The principal dimensions of each type of the ships cited in Table 5-1 are also shown in Table 5-2.
Assuming that the annual production plan requires 1,000 tons of steel processing, it is advised that the man-hours required for the total work of the Government Shipyard should be lessened first by 30% as a result of the reorganization plan and by 50% after 3 years. These are to be considered as the realistic targets of increase of the physical productivity. The improvement of productivity by 50% must be regarded as the upper limit for any reorganization plan of the Government Shipyard. The standard and annual utilization pattern of the two slipways is also indicated in Figure 5-1.

5.05 Entering into Shiprepair Business: The demand for shipbuilding may fluctuate from year to year, and it might be difficult for the yard to secure a constant demand. In order to avoid lowering rate of operation, the Shipyard should gradually enter into a field of shiprepair business primarily because there is big demand as explained in the previous chapter.

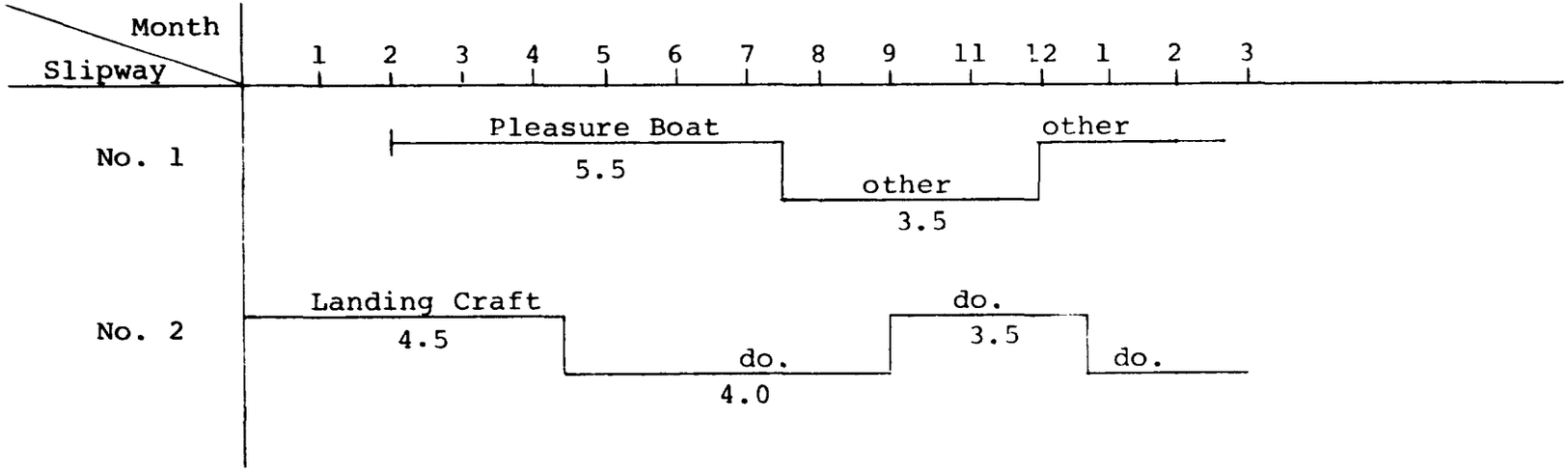
Table 5-1 Production Plan

Type	Number	Weight of Hull		Present Man-Hour		Man-Hour Just After Re-formation		Man-Hour 3 Years After Reformation	
		Per Ship (ton)	Total (ton)	Per Ship ('000 hours)	Total ('000 hours)	Per Ship ('000 hours)	Total ('000 hours)	Per Ship ('000 hours)	Total ('000 hours)
Pleasure boat	1	350	350	300	300	200	200	150	150
Landing craft	3	120	360	140	420	100	300	70	210
Others	2	100	200	100	200	70	140	50	100
Total	6		910		920		640		460

Table 5-2 Principal Dimensions
(meter)

Type	L_{0a}	L_{pp}	B_m	D_m
Pleasure boat	52	45	12	4
Landing craft	37	37	8	3
Tug	23	22	7	4

Figure 5-1 Standard Operation Plan of Slipways



The Shipyard can utilize the slipways to be used for ship-repair by a slight reconstruction.[1/] In case that there is no demand for shipbuilding at all, the slipways can be used for shiprepair thus ensuring the maximum utilization of the facilities. The Shipyard can repair 60 to 70 ships under 500 GT per year, and it can also repair some 100 ships if three slipways including the old one are used.

(2) Problems to be Considered for Reorganization Plan

5.06 The Government Shipyard has a lot of problems, managerial or technical, to be solved in order that it may become a really competitive enterprise in the future. It should be considered not realistic way to reorganize it so intensively or quickly because of many constraints; e.g., limited availability of capital funds, relatively lower level of technical and managerial skill, etc. Considering the conditions and the circumstances under which the Government Shipyard must operate, it is proposed that the reorganization plan will be formulated in accordance with the following principles.

1) The change of lay-out should not be done but some which are related to hull processing.

2) An installation of new equipments should not be done which requires a large investment.

3) The best efforts should be made to use old machines as long as possible, if usable.

1/ See Annex 12

4) The Shipyard should utilize sub-contractors as much as possible, especially Bish and Carpenters and should not duplicate the investment.

5.07 It is recommended that the following changes should be made with regard to work process/flow of the Government Shipyards as indicated in the physical layout plan A (see Annex 11):

1) Steel materials transported by trucks are carried in to A, storage yard for steel plate (approx. 150 m^2). (approx. 1,000 tons per year or 80 to 100 tons per month)

2) The hull processing in a shop are devided into 2 work flows A - B and C - D. The former is a steel plate process and the latter is a steel section process. The production line of A - B requires new installation of a 200 ton hydraulic press and a 3 ton x 10 meter over head crane (O.H.C.), and the production line of C - D requires a 100 ton hydraulic section bender and a 3 ton x 10 meter O.H.C. The floor should, if necessary, be covered by steel lattice and paved with cement.

3) The two work flows A - B and C - D, joint at E, where sub-blocks are assembled into a larger sub-blocks under 3 tons and they are carried out to F. The sub-blocks are assembled into a larger blocks under 10 tons. The area of E is approximately 200 m^2, F is 400 m^2. The floors are to be covered by steel lattice. F should be equipped with a 5 ton x 13 m goliath crane.

4) Sub-blocks assembled at F are moved by 10 ton mobile crane to G, and they are assembled to blocks under 30 tons. They are shifted to a slipway by 35 ton goliath crane, and assembled. G is located in the open space of 450 m^2 in front of the slipways. It should be covered by steel lattice and paved by cement.

5) The two slipways should be lengthened in the water so that the part under water becomes 60 m in length. They should be equipped with winch at the front part, as shown in the drawing.

6) A 3 ton/5 ton x 30 m/18 m Jib crane is required at the outfitting quay to mount heavy materials to increase the rate of operation of the slipways and to keep the work process of hull works and outfitting well synchronized.

7) The Fitting-out & Plumber shop requires changes in the layout of machines. Plate bender, plate bending roller, sheering machine and so on should be installed shifted from the hull shop. It should also be equipped with a new 3t x 15m O.H.C. (Over Head Crane).

8) Pipes for air, oxygen and acetylene supply and cables for electric welders and electric machines should be laid in the floor of the shops, B, D, E, F, G and at both sides of the slipways and the out-fitting quay.
Some outlets and joints are required at necessary spots.

9) As for electric welders, E and F requires 10 to 15 welders, G and the slipways require 25 to 35 welders, and the outfitting shop 5 to 10, totaling 40 to 60 welders.

10) The main office, drafting room and material warehouse should be located at places as indicated in the drawing in order to make the business efficient. The areas are 75 m^2, 75 m^2 and 120 m^2 respectively.

11) The main roads, paths and floors other than steel latticed ones should be paved with concrete.

(3) Cost Estimate of Investment for the Facilities

5.08 Rough estimate of the investment recommend on the facilities is given in Table 5-3. The cost estimate however does not include the costs entailed in civil work required.

Table 5-3 (1) shows all equipment, tools and machinery which are required for the whole reorganization plan. Table 5-3 (2) is prepared for separation of what are related to shiprepair from the whole reorganization plan. As for other equipment, tools and machinery needed for shiprepair, GSY is able to use those existing facilities for shipbuilding. Therefore, facilities which are proper to shiprepair are as listed in Table 5-3 (2).

Table 5-3 (1) Cost Estimation of Reorganization Plan

Item	Sub Item	Cost
a) Steel storage	200t Hyd. Press x 1 100t do. Section Bender x 1	F$170,000.00
Yard & Shops	3t O.H.C. x 2 wagon x 1	
Sub-Assembling Shops	5t goliath C. x 1 remodeling of building, steel lattice, foundation of machines	
b) Slipways & Assembling Shop	winch x 1 cradle x 30 reconstruction - in the earth - in the water	F$370,000.00
c) Crane at Out-fitting Quay	3t/5t x 30m/18m jib c. x 1 with foundation	F$160,000.00
d) Others	oxygen, acetylene pipes electric cables electric welders jet pump office building pavement and so on	F$290,000.00
e) Miscellaneous 1/		F$280,000.00
Total		F$1,270,000.00

1/ Installation Supervising Fee,
Packing Cost,
Transportation Cost & Insurance

Table 5-3 (2) Cost Estimation of Reorganization Plan for Shiprepair

Item	Cost	
Reconstruction of Slipway		F$370,000.00
reconstruction in the earth	F$42,700.00	
-do.- in the water	F$142,300.00	
winch x 1	F$96,100.00	
cradle x 30	F$88,900.00	
Others		F$46,700.00
jet pump (hydro, portable) x 1	F$12,500.00	
electric welder x 30	F$7,500.00	
electricity wiring	F$26,700.00	
Mescellaneous 1/		F$80,600.00
Total		F$497,300.00

1/ Installation Supervising Fee,
Packing Cost,
Transportation Cost & Insurance

(4) Production Planning Control and Management Organization

5.09 It is very important for any Shipyard to master the following control methods so as to attain the maximum operational efficiency:

(a) Process Control: To control daily schedule and man-hour of each stage in order to keep the building schedule and to lessen man-hour.

(b) Quality Control: To control accuracy of materials and parts in order to make better precision and efficiency.

(c) Cost Control: To control shipbuilding budget through comparing budget of man-hours and materials with actual data in order to minimize costs.

(d) Safety Control: To secure safety of workers and to minimize loss of materials.

5.10 In order to assure that the production planning and control measures would be effectively applied, the organizational set-up as depicted in Chart 5-1 is recommended to the government shipyard. The organizational position of the Government Shipyard within Marine Department is indicated in Annex 8.

5.11 The total number of the essential staff for the management is judged as 35 persons of good qualification. The total workers required for the yard are estimated 350, and a proportion of the administration staff remains 10%. Obviously the efficiency of the Shipyard depends on capability level of the management staff. The reason why control office and inspection office are under the direct supervision of the shipyard manager is to assure a singularity of the managerial power.

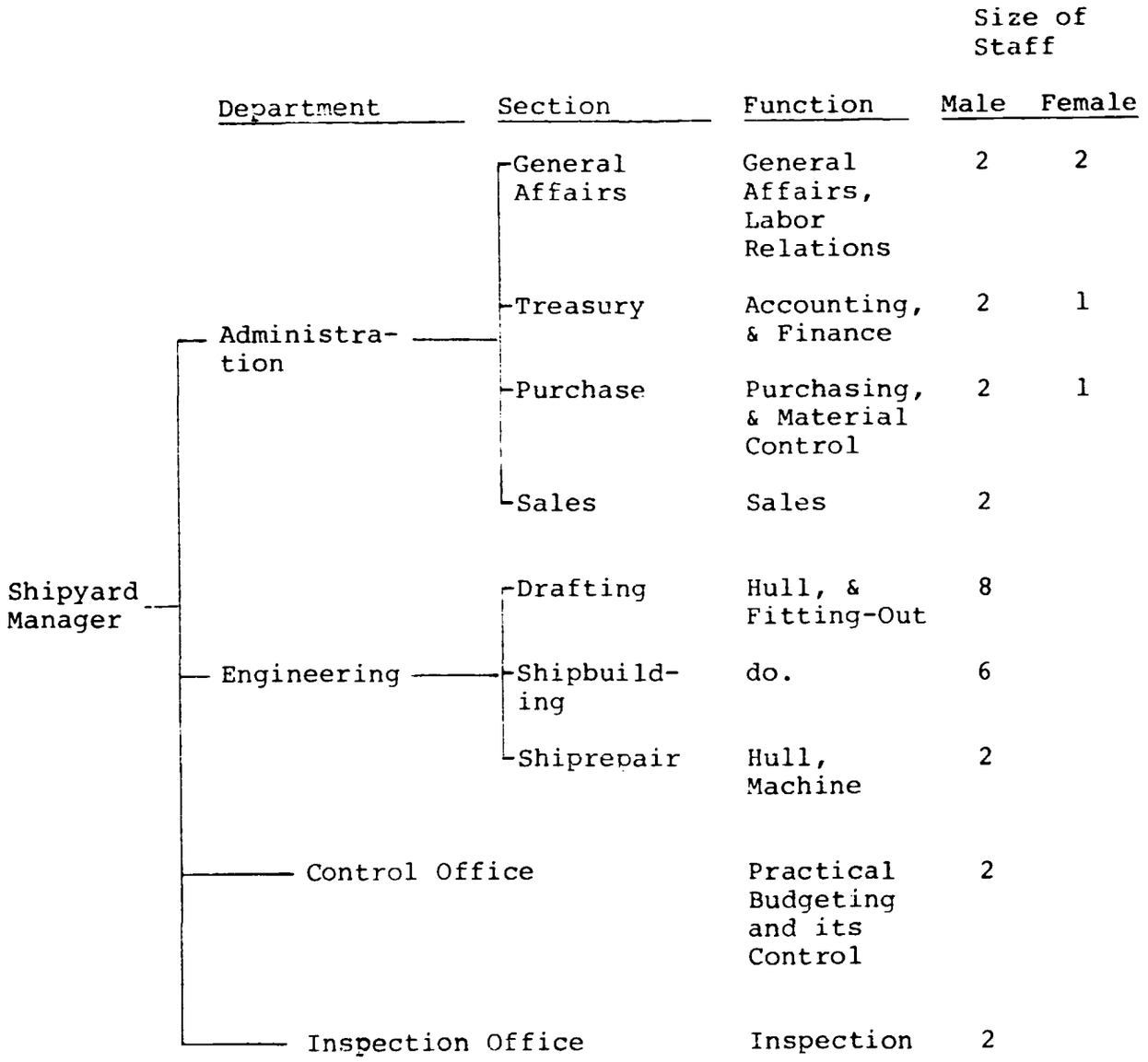
(5) Personnel Planning and Skill Training

5.12 The number of workers required for the shipyard can be calculated from the production plan explained previously.

(a) Direct Workers

5.13 The required number of the direct workers is estimated as in the following Chart:

Chart 5-1 Organization of the Shipyard



Department	Section	Function	Size of Staff Male	Female
Administration	General Affairs	General Affairs, Labor Relations	2	2
	Treasury	Accounting, & Finance	2	1
	Purchase	Purchasing, & Material Control	2	1
	Sales	Sales	2	
Engineering	Drafting	Hull, & Fitting-Out	8	
	Shipbuilding	do.	6	
	Shiprepair	Hull, Machine	2	
Control Office		Practical Budgeting and its Control	2	
Inspection Office		Inspection	2	
1	2		28	4

5.14 If the technical level of a worker in shipbuilding in an advanced country is assumed to be 1, the present level of the Government Shipyard is estimated 0.3. It is advised that the level should be raised upto 0.6. In order to realize it, a technical training of workers/staff is required in addition to the implementation of reorganization plan of the facilities and the management system. Skill training abroad should be first given to the workers of level of foreman selected from each kind of job for at least 6 months. These foremen can give practical on-the-job training to other workers of the Government Shipyard after their return to Fiji.

(b) Indirect Workers of Technical Staff

5.15 The Shipyard should recruit graduates of a university who majored in naval architecture, mechanics and electric engineering, or send some engineers for training abroad for 6 months or more to study management technology, in order to take the lead after returning to their country.

(c) On-the-Job Training by Technical Experts

5.16 It is recommended that the technical experts should be sent to the Government Shipyard for the on-the-job training of operational skill and know-hows at least for the period of 6 months to ensure that the workers and staff would acquire new skill and knowledge in concrete work situation. However, it must be cautioned that the man power training will be carried out with no disruption of the actual work process of the Shipyard.

Table 5-4 Improvement of man-hour

	Now	Just After Reorganization	3 Years After Reorganization
Annual Total Man-Hour	920,000hr	640,000hr	460,000hr
Necessary Workers (2,000hr/worker/year)	460	320	230
Surplus Workers (10%)	46	32	23
Total	506	352	253

(6) Reinforcement of Shiprepair Section

5.17 It is very important to reinforce the capabilities of shiprepair section at the earliest possible time for following reasons:

(a) Profitability of shiprepair is higher than shipbuilding. In Japan, profit ratio of shiprepair is 10 to 25%. It is believed that it is true in Fiji, too.

(b) There is a big demand for shiprepair in Fiji.

Although the two slipways can be used for both shipbuilding and shiprepair, it is impossible to use them for shiprepair while they are used for shipbuilding. In order to reinforce the shiprepair section, it is recommended that the Shipyard will be provided a floating dock of 2,000 ton lifting capacity 1/ in the future. The floating dock makes it possible to repair

1/ See Annex 9, "2000T FLOATING DRY DOCK ROUGH SPECIFICATION"

big sized ships. The construction cost of a 2,000 ton lifting capacity floating dock is estimated approximately F$3,600,000.00.

5.3 Other Materials

5.18 Ferro-Cement

Ferro-cement is a kind of compound material made of cement and steel rods or pipes. The idea was advocated by Pierre L. Nervi, an Italian naval engineer, in 1943. Ferro-cement has such merits as:

(1) low building cost,

(2) easiness in building work,

(3) low maintenance cost,

(4) long durable years,

and so on. However, it has such demerits, too, as:

(5) inapplicability to big sized ships,

(6) difficulty in out-fitting, and

(7) difficulty in quality control.

The most important merit is low building cost, which is 70-80% of a steel ship. It was a new and epoch-making material and was used much for boat building in post-war days. But it is not used much in advanced countries in shipbuilding, because of such new materials as FRP (Fiber-Reinforced Plastics). The demerits No. (6) and (7) are serious. Therefore, ferro-cement is not expected to be in fashion in the future; that is, it cannot be recommended to develop ferro-cement boat building in Fiji.

5.19 FRP

FRP is also invented in the 1940's. It has such merits as:

(1) lightness and strength,

(2) freedom in design,

(3) corrosion-free and long durable years,

(4) characteristics against electricity and electric wave,

(5) heat conductivity,

(6) transparency, and

(7) plentiful colors.

On the other hand, the demerits are as follows:

(8) high cost, and

(9) limit of size.

Although the limit of size is a demerit, some 50m long boats can be made of FRP. As for small sized ships, FRP is a superior material. It should be developed and used much, only if other conditions compensate the high cost.

5.20 It is recommendable that Fiji also brings up FRP boat building technology. However, the cost of FRP in Fiji is very high, because of import, and that of wood or plywood is very low, because of self-supply. The difference of the costs is so big that shortness of processing time of FRP cannot compensate the difference under existing circumstances. It must be better for GSY to reconsider the introduction of FRP in 6-8 years when the modernization and incorporation of the yard would be attained. GSY should concentrate on steel ships for the time being.

5.21 There is a wooden boat section in GSY. Although the section is not so big, there are a lot of workers who are engaged in wooden boat building and repair. In reality, however,

GSY should be specialized in steel ships and abstain from wooden ships, since the procedure and process control system of wooden boat building are quite different from those of steel ships, and there is no merit in the coexistence at all. But FRP will be a main material for small boats in the future also in Fiji. Therefore, it might be a good alternative for GSY to keep the wooden boat building section in the yard with intent to utilize the site for FRP workshop in the future and to hold clients for small boats.

The economical efficiency of FRP boat building depends on:

(1) cost of FRP,

(2) cost of other materials such as wood,

(3) labour cost, and

(4) processing hours required for wood and FRP boat building.

Taking these factors into consideration, it can be estimated that the break-even point of wood and FRP in Fiji will occur within a decade or so. It is important that GSY prepares for FRP boat building in half a decade, probing the changes of a state of things, although it is too early for GSY to do it at the present time.

6. FINANCIAL EVALUATION

6.01 There are some methods evaluating a project from financial view point. The DCF (Discount Cash Flow) method is, as one of the methods, used in many cases of investment decision making. The evaluation method which will be used in this study is a very simplified type of DCF method.

6.02 A profit and loss (P/L) statement and a fund management (F/M) statement are required to calculate a cash flow of the project. These statements are composed of following items:

P/L Sales, Direct and Indirect Cost, Depreciation, Interest, Tax, Profits,

F/M Depreciation, Investment in Equipment, Loan, Repayment

Followings are the procedure of the method:

(1) To calculate gross profit of each year (to subtract direct cost, indirect cost, depreciation and interest from sales)

(2) To calculate net profit of each year (to subtract tax from gross profit)

(3) To calculate the cash flow of each year (to add depreciation and loan to the net profit and to subtract investment and repayment from it)
Cash flow in plus sign means in-flow and that in minus sign means out-flow.

Table 6-1 P/L, F/M and Cash Flow

Item	Year	0	1	2	--	n
P/L	Sales	S_0	S_1	S_2		S_n
	Direct Cost	CD_0	CD_1	CD_2		CD_n
	Indirect Cost	CI_0	CI_1	CI_2		CI_n
	Depreciation	D_0	D_1	D_2	--	D_n
	Interest	I_0	I_1	I_2		I_n
	Tax	T_0	T_1	T_2		T_n
	Net Profit	P_0	P_1	P_2		P_n
F/M	Depreciation	D_0	D_1	D_2		D_n
	Investment	V_0	V_1	V_2		V_n
	Loan	L_0	L_1	L_2	--	L_n
	Repayment	R_0	R_1	R_2		R_n
	Cash Flow	C_0	C_1	C_2		C_n

$$P_i = S_i - CD_i - D_i - I_i - T_i$$

$$C_i = P_i + D_i - V_i + L_i - R_i$$

6.03 Some preliminary conditions are needed to complete the statements:

(1) The Shipyard is to be regarded as an independent enterprise (independent from other government organs),

(2) The fund procurement for the investment is to be done by the government (no loan),

(3) The investment is to be carried out within the first year,

(4) The depreciation of the present facilities has already finished,

(5) The inflation is to be out of consideration, and

(6) The duration of this project is to be fixed as 15 years. There is no standard figure of duration in case of shipbuilding and repair facilities. However, taking durable years of each equipment, the accuracy of the demand forecast into consideration, the duration of the project was fixed as mentioned.

6.04 As the demand for shipbuilding and repair fluctuate, the financial evaluation is made in three cases:

(1) Shipbuilding only,

(2) Shiprepair only, and

(3) 50% of each of the above.

6.05 The calculation of the DCF was made under the following conditions:

(1) Sales of Shipbuilding

The standard sales prices of ships mentioned in Chapter 5 are:

Pleasure Boat	F$1,430,000
Landing Craft	540,000
Others	360,000

According to the production plan, the Shipyard is supposed to build one pleasure boat, three landing craft and two other ships a year. The annual total sales will be F$3,770,000.

(2) Direct Cost

Generally speaking, the profit ratio of shipbuilding is 6%, although it fluctuates with the economic situation. As it is quite difficult to estimate the profit ratio of this Shipyard for every year, the 6% profit ratio was applied to this calculation. Therefore, the direct cost of shipbuilding a year is F$3,557,000.

(3) Investment in Equipment

The total cost of reorganization of the Shipyard is as stated in Chapter 5; that is, F$1,270,000.

(4) Depreciation

As the duration of the project is 15 years, the depreciation of each year is one fifteenth of the total amount of the investment; that is, F$85,000.

(5) Tax

Tax is calculated on the assumption that the tax rate is a half of the profit of the year.

(6) Sales of Shiprepair

The shiprepair is treated as an alternative of shipbuilding. In case that the Shipyard fully concentrates on shiprepair, it can take 136 (68x2) vessels a year. (The average utilisation of a slipway is 68 vessels per year. See Table 4-5.) According to shiprepairing enterprises as Carpenters Industrial, the sales price of shiprepair with standard survey is F$10,885 per vessel. Therefore, the annual sales of the Shipyard will be F$1,480,000.

(7) Direct Cost of Shiprepair

Generally speaking, the profit ratio of shiprepair is 20%. The situation is the same as the case of shipbuilding (See (2)), although the fluctuation is much smaller than shipbuilding. The direct cost of shiprepair per year will be F$1,233,000.

6.06 Table 6-2 is the result of calculation of P/L and F/M with cash flow for 3 cases.
Table 6-3 is the comparison of DCF Rate for 3 cases.
The DCF Rate of Case 1 is 8.1%, which is the smallest among the three, and that of Case 2 is 9.9%, which is the biggest.

The most feasible case is Case 3; that is, the DCF Rate of this project will be approximately 9% on average.
It means that this project (investment) is neither so lucrative, nor so disadvantageous.

6.07 If the Shipyard be operated as one of the government organs, the tax should be omitted from the calculation; that is, the profits should be doubled and the cash flows increase according to the amount of tax.
Table 6-4 is the comparison of DCF Rate for 3 cases without tax. The smallest rate is 14.6% and the biggest 17.8%.
The most feasible case is Case 3; that is, the DCF Rate of this project will be approximately 16% on average. It means that this project (investment) is quite lucrative.

Table 6-2 Cash Flow (in thousand F$)

Case 1 : Shipbuilding 100%

Item \ Year		0	1	2	---	15
P/L	Sales		3,770	3,770		3,770
	Cost		3,557	3,557		3,557
	Depreciation		85	85	---	85
	Tax		64	64		64
	Net Profit		64	64		64
F/M	Depreciation		85	85		85
	Investment	-1,270			---	
	Cash Flow	-1,270	149	149		149

Case 2 : Shiprepair 100%

Item \ Year		0	1	2	---	15
P/L	Sales		1,480	1,480		1,480
	Cost		1,233	1,233		1,233
	Depreciation		85	85	---	85
	Tax		81	81		81
	Net Profit		81	81		81
F/M	Depreciation		85	85		85
	Investment	-1,270			---	
	Cash Flow	-1,270	166	166		166

Case 3 : Shipbuilding 50%, Shiprepair 50%

Item	Year	0	1	2	---	15
P/L	Sales		2,625	2,625		2,625
	Cost		2,395	2,395		2,395
	Depreciation		85	85	---	85
	Tax		73	73		73
	Net Profit		72	72		72
F/M	Depreciation		85	85		85
	Investment	-1,270			---	
	Cash Flow	-1,270	157	157		157

Table 6-3 DCF Rate

Case 1	8.1 %
" 2	9.9
" 3	8.9

Table 6-4 DCF Rate (without tax)

Case 1	14.6 %
" 2	17.8
" 3	16.2

7. MANAGEMENT ORGANIZATION

7.1 Management

7.01 GSY is one of the sections of Marine Department, Ministry of Transport. There are some problems of management of GSY, derived from the situation mentioned above.

(1) The most important problem is that there is no proper accounting system of GSY.

(2) It is impossible to evaluate productivity of GSY, since GSY is one of the government organs and there is no accounting system.

(3) Since most orders are placed by the government, there is no competition at all with other enterprises.
These problems take place often in government sectors.

7.02 It is important that these problems be solved as soon as possible.

- To establish an accounting system of GSY's own,
- To control production through the accounting system,
- To analyse the process of production and to control it through the analysis,
- To make effort to receive orders from not only government sector but also private sector,
- To make effort to build ships competitively in price with second-hand ones,

- To make effort to repair ships competitively in price and delivery with other shiprepair enterprises such as Carpenters and Bish.

7.03 The best way to achieve these objectives is that GSY execute conscientiously the modernization program stated in Chapter 5. The main points of the program are:

(1) Investment in shipbuilding and shiprepair facilities,

(2) Changes in work process of production line,

(3) Substantiation of the organization,

(4) Establishment of production/management control, and

(5) Technical and skill training.

It will take at least 2 years for GSY to carry out the said modernization program, and at least one more year to attain to establishment and well-run installation of the new system. It is important that GSY grow up to be competitive with other private shipbuilding and repair enterprises, so that the industry becomes a major and essential industry in Fiji. For that purpose, GSY should become an independent enterprise from the government; that is, GSY should be incorporated into a private or semi-public enterprise. It will take 3-5 years for GSY to be incorporated. Therefore, it is 6-8 years after the beginning of the modernization program that shipbuilding and repair industry establishes an indefatigable position in Fiji's economy.

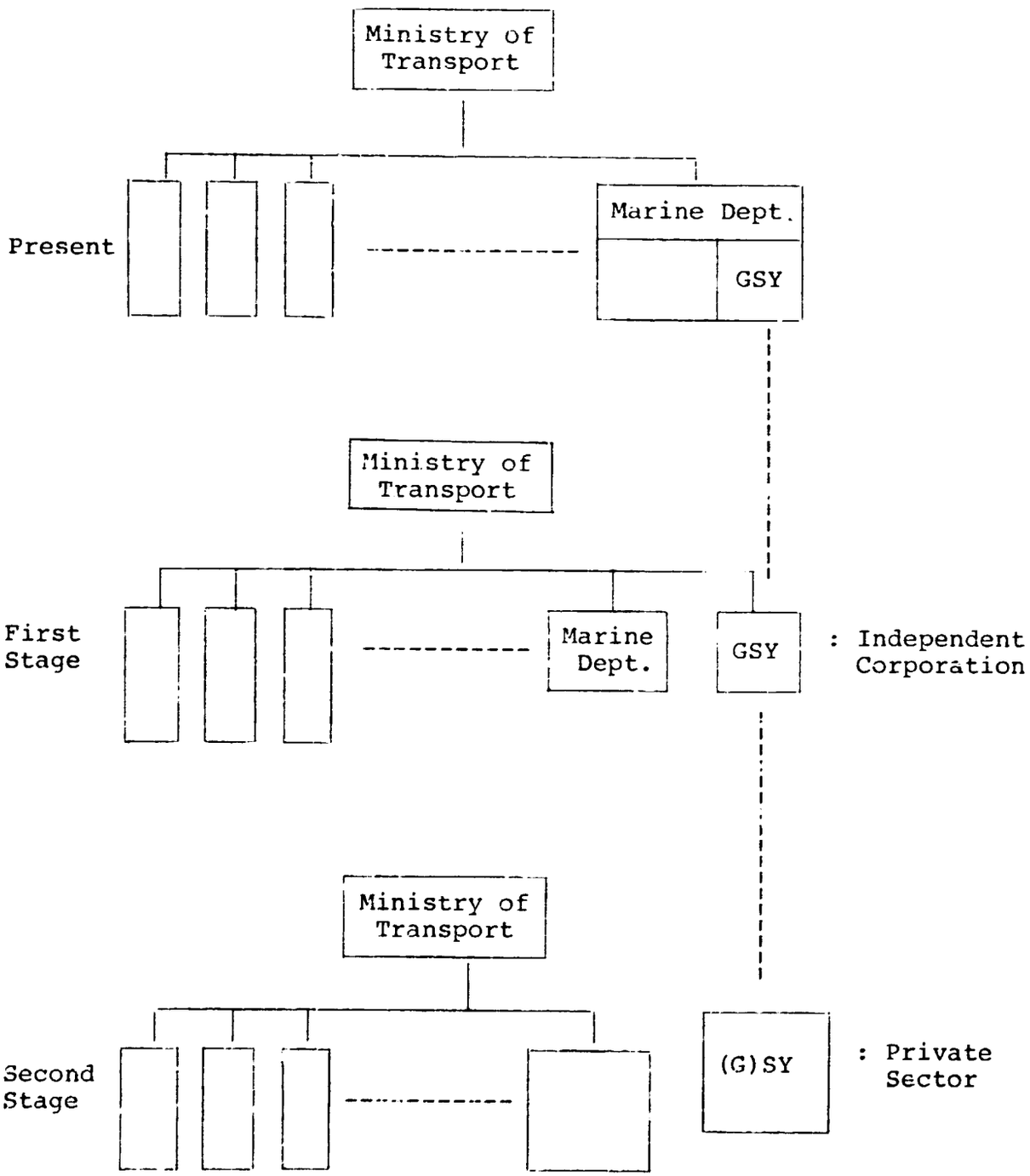
7.04 The feasible way for GSY is to be incorporated into a semi-public enterprise on the first stage, and into a private one on the second stage. What GSY should do on the first stage is to make effort to be able to compete with private enterprises. On the second stage, GSY should be transfered to private sector. On this stage, a joint venture with a private enterprise can be taken into consideration.

7.05 It is important and also possible that shipbuilding and shiprepair industry in Fiji be managed as private sector.

7.2 Joint Venture

7.06 Joint venture is a type of business which can be realized by two enterprises or more in case that a single enterprise is unable to provide all of labour force, technology, funds and so on. As for the labour force, GSY does not go short of it and it is possible for GSY to secure labour force as many as possible even if GSY were in need of it. As for technology, the level of GSY is not high enough and it is in need of some assistance of advanced country in shipbuilding. As for funds, GSY needs some funds for the modernization mentioned in Chapter 5. The funds can be offered by either the government of Fiji or other enterprises. Deliberating on the above said situation, it is possible to consider a joint venture with a certain enterprise.

Figure 7-1 Management Organization of GSY



7.07 In the South Pacific Sub-Region, Papua New Guinea (PNG) and American Samoa (AS) have shipbuilding and repair industry besides Fiji. The technical level of PNG and AS is the same as Fiji or lower. Therefore, there is no merit for Fiji to join them. As for funds, almost all of the countries in the sub-region are not rich (see Chapter 2) and it is impossible for Fiji to expect the funds from those countries.
In consequence, there hardly is possibility for Fiji to run a joint venture business with the other countries in the sub-region.

7.08 There are some shipbuilding and repair yards in Australia and New Zealand. Although both countries are specialized in ships of rather small size, the technical level is fairly high. Therefore, there is a merit for Fiji to join them. As for funds, the two countries are satisfactory for Fiji. Such countries as Japan, Korea, Taiwan and Singapore are advanced in shipbuilding and repair. They can produce and repair not only big sized ships but also small ones. Their technical level is very high and can be good parters for Fiji. As regards funds, they are also satisfactory. In this respect, there might be possibility for Fiji to run a joint venture business with these countries.

7.09 However, any joint venture cannot be realized without mutual merits. It is regrettable that there hardly exists merit for a partner country in the joint venture. The reason is that it is difficult for the partner country to expect big economic return from the joint venture, since the demand for

shipbuilding in Fiji is small and the labour cost is rather high, which means investment efficiency is not so high (see Cahpter 6). In consequence, there is no possibility of joint venture with other countries.

7.10 On the other hand, existing private shipbuilding and shiprepair companies can be taken into consideration as partners of the joint venture. The technical level of the companies is higher than that of GSY; especially those companies have high technology of electric, machining and shiprepair which originated from Australia or England.

In case that the Government of Fiji offers funds for the modernization of GSY, it would be a counter benefit for the partner. In other words, GSY can enjoy the technology of the partner and the partner can enjoy profit which would be somewhat greater than now. There are such shipbuilding and repair enterprises as Carptenters Industrial, Bish Ltd. and Pacific Engineering Ltd. These three are all suitable as the partner of the joint venture. Particularly, Carpenters Industrial has an intention to detach the shiprepair section and to sell it to the government. Therefore, the possibility of joint venture with Carpenters Industrial might be the highest.

8. CONCLUSIONS AND RECOMMENDATIONS

Following are the substances of our conclusions obtained through the study from Chapter 1 to 7.

- GSY should venture into shiprepair business step by step, and the government should invest in necessary equipments.
- GSY should be independent from the government sector as a private or semi-public enterprise.
- GSY should do education of middle-managements and engineers, in order to reinforce itself.
- GSY should establish an accounting system and production control system.

In order to attain the objectives of GSY mentioned above, the Fiji Government and the United Nations should assist GSY in each field. Followings are recommendations to the government and the United Nations.

Recommendations to the Government:

- To invest in some equipment mentioned in Chapter 5.
  Investment in slipways is required in order that GSY ventures into shiprepair business. Some other investment in steel storage, yard & shops, sub-assembling shops, crane at out-fitting quay and others is important to improve GSY's productivity. The total cost of the said investment is approximately F$984,400. (excluding facilities for shiprepair).

- To make GSY be incorporated into a private or semi-public enterprise.

  On the first stage, GSY should be incorporated into a semi-public enterprise

  On the second stage, it should be transfered to private sector.

Recommendations to the United Nations:

- To assist GSY in technical training of GSY staffs. (See Chapter 5)

  Overseas training of key staff of GSY for 6 months to one year is required, and the training cost is $40,000-$50,000/year per person.

  After the training mentioned above (that is, in the second year), GSY should invite consultants/ experts in production planning/management and engineering for shipbuilding and shiprepair from an advanced country in shipbuilding. The estimated cost of foreign consultants is $50,000-$80,000/year per person. (see Annex 10)

- To assist GSY in procurement for shiprepair

  UNIDO should provide GSY with some equipment, tools and machinery for shiprepair listed in Table 5-3 (2) excluding reconstruction of the slipway in the water, in the earth and electricity wiring. The facilities to be provided are winch (x 1), cradle (x 30), jet pump (x 1) and electric welder (x 30), the total amount of which is F$205,000.

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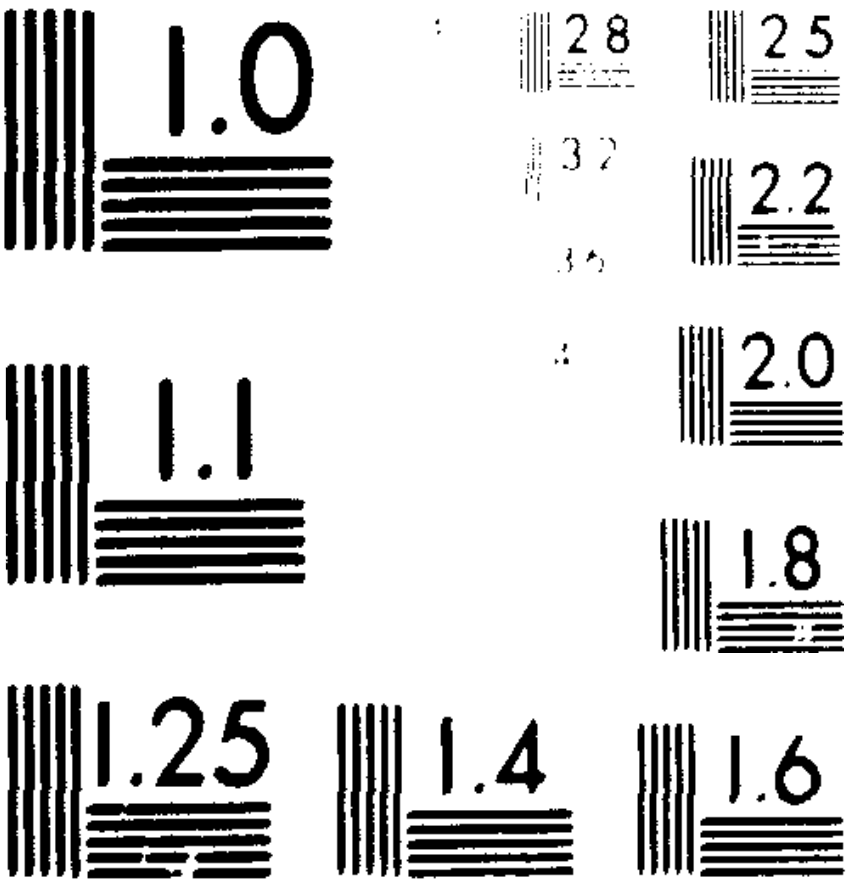

1.0
2.8
2.5
3.2
2.2
3.6
2.0
1.1
1.8
1.25
1.4
1.6

Terms of Reference

The Terms of Reference for the Study, extracted from the UNIDO Request for Proposal DP/FIJ/79/003/01/37, "Assistance to Shipbuilding Industry" dated February 21, 1980, are as follows:

1. Background Information

1.01 Shipbuilding and shiprepair facilities have been identified as a potential large industry in Fiji to serve the needs not only of the immediate islands in the Pacific but also from abroad. The growth in volume of traffic together with the increasing number of fishing activities and interests in Pacific is seen as a good indication for viable shipbuilding and shiprepair facilities. With the growing number of inter-island traders and fishing fleets, operating in the Pacific, it is felt that a demand for repair, berthing, shipping facilities would be in great demand in and around the Pacific.

The Government also hopes that some foreign interests could be attracted to join forces with the Government to set up such an industry.

1.02 The United Nations Industrial Development Organization has assisted the Fiji Government Shipyard for a period of eight years through the services of Mr. Arnie Sannergren a Naval Architect and Construction Manager hired under an OPAS contract.

FIJ/71/007 - During this period Mr. Sannergren designed and directed the construction of 24 ships all with metal hulls totalling 2000 tons.

1.03 The Government Shipyard is geared principally to serving the requirements of the Government and in very rare cases of the private sector within Fiji. It is the intention to examine the

prospects of converting this capacity into an international industry which could also meet demands from abroad.

1.04 Shipping is very vital to the Pacific and with the establishment of 200 miles exclusive economic zones, much of the attention is now turning to harvesting marine resources, the Government feels that the time is now opportune for a thorough investigation in the feasibility of setting up an appropriate industry to cater for these demands.

1.05 The Government is keen to have a feasibility study made by a reknown consulting firm in order to work out its policy towards development of viable shipbuilding and ship-repair in Fiji. The feasibility study should look at the suitable organizational and management structure together with the appropriate skilled manpower requirements. It should also identify the amount of working capital for the venture. It is understood that the existing Government shipyard should be the core of the proposed commercial organization and get a fair share of the orders. The project may promote co-operation among the developing countries in shipbuilding and ship-repair in the Pacific Region.

2. Objectives of the Project

2.01 Development objective: Fiji, being a maritime nation and with the growth of shipping and fishing industry in the Pacific, the Government feels that it should prepare itself for the current demands for shipbuilding and shiprepair facilities and services. Given the volume of sea traffic through the South Pacific and the absence of suitable servicing facilities in the Islands, the Government wants to explore this possibility together with developing its industrial capability.

2.02 Immediate objective: This project is aimed at examining the setting up of suitable shipbuilding and shiprepair facilities to be run on strictly commercial lines.
The project is expected to produce a feasibility study report on the possibility of setting up the Government shipyard as a viable commercial undertaking. Market forecasts, financing requiremerts, personnel requirements and training inputs should be included in the report.

3. Scope of Contracting Service for the Consultants

3.01 The objective of the study is to prepare a feasibility study on the shipbuilding industry in Fiji which must include;

(1) Examination of the present management and economic conditions of the Government shipyard, evaluation of the technical standards, and assessment of the potentiality of establishing a viable commercial shipyard serving Fiji and neighbouring countries.

(2) Market study of the possibilities of getting orders from the countries in the Pacific Region and comparative study of Sydney, Auckland, Port Moresby in Papua New Guinea, Apia in Samoa, Honiara in the Solomon Islands, Tarawa in Kiribati and Tuvalu.

(3) Examination and recommendation of the possibility of joint ventures with existing shipyards in Fiji or in the Pacific Region.

3.02 The feasibility study report must include the following topics:

(1) State of the present shipbuilding facilities and equipment, design methods, skilled manpower, organization and management;

(2) Market estimates for the region and the country;

(3) Investigation of revenues, problems of supply and demand and other financial matters;

(4) Review of the production technology, equipment, material used and boatbuilding programme with recommendations to improve the present state;

(5) Recommendations on industrial co-operation and possible joint ventures;

(6) Recommendations on the training for local staff and labour force;

(7) General scheme and time schedule for the modernization of the yard;

(8) Findings and recommendations to the Government on further actions as a follow-up of the study report with possible co-operation of UNIDO.

ITEMS OF THE FEASIBILITY STUDY ON THE SHIPBUILDING INDUSTRY IN FIJI

1. Economic and Social Background

   1-1 Economic Background in Fiji
   1-2 Social Background in Fiji

2. Evaluation of the Present Shipbuilding Facilities

   2-1 Equipments
   2-2 Engineering Level
   2-3 Skill Level
   2-4 Shipbuilding and Shiprepair Capacity
   2-5 Problems

3. Demand Forecasting of Shipbuilding and Shiprepair

   3-1 Existing Tonnage by Ship Type and Size
   3-2 Actual Results of Shiprepair by Ship Age
   3-3 Volume of Seaborne Trade (State-of-Art and Forecast)
   3-4 Demand Forecasting of Shipbuilding and Shiprepair

4. Construction Plan of the Shipbuilding Yard

   4-1 Scale of the Yard
   4-2 Necessary Building Materials
   4-3 Yearly Plan of the Construction of the Yard
   4-4 Cost Estimation of the Construction

5. Technique, Skill and Equipments

   5-1 Necessary Technique and Skill
   5-2 Necessary Equipments
   5-3 How to Modernize the Present Facilities
   5-4 Necessary Labor

6. Education

6-1 Required Educational Level
6-2 Education Method
6-3 Yearly Plan of the Education

7. Financial Analysis

7-1 Cost Estimation (Capital and Operational)
7-2 Income Estimation
7-3 Financial Analysis by DCF

8. Type of the Enterprise

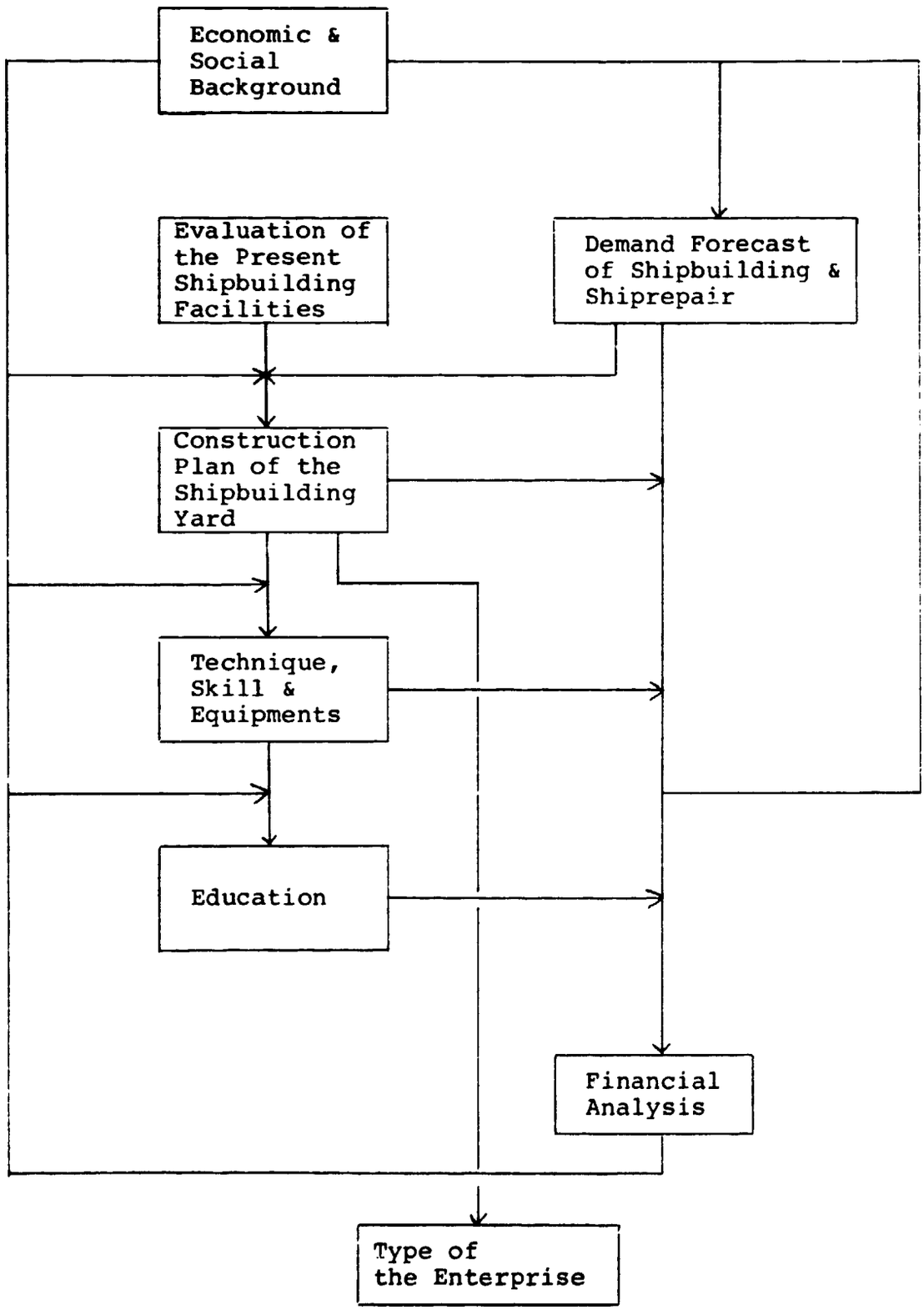
8-1 Alternative Types of the Enterprise
8-2 Possibility of Joint Venture

9. Recommendations to the Government and UNIDO

9-1 Role of the Fiji Government
9-2 Role of UNIDO

Annex 3.

Framework of Analysis



List of Principal Personnel Interviewed by Mission

Mr. R. D. Doods	Permanent Secretary for Tourisms & Transport, Ministry of Tourism, Transport & Civil Aviation
Res. Capt. M. M. Joy	Director Marine, Marine Department, Ministry of Tourism, Transport & Civil Aviation
Mr. Apenisa T. Naiguleru	Shipyard Manager, Shipyard, Fleet & Main Accounts Office, Ministry of Tourism, Transport & Civil Aviation
Mr. Sergio Dello Strologo	Industrial Development Advisor, Pacific Region and Papua New Guinea, United Nations Development Programme
Mr. Eiki Hirayama	Manager, Banno Oceania Limited
Mr. T. Sugimoto	First Secretary, Embassy of Japan, Suva, Fiji
Mr. H. Sperling	Regional Fisheries Coordinator, UNDP
Mr. T. Ochi	General Manager, Ika Corp. (Fiji National Fishing Corp)
Mr. John Franklin	Trade Marketing Officer, South Pacific Bureau for Economic Cooperation
Capt. Foster	Marine Department, Ministry of Tourism, Transport & Civil Aviation
Mr. John Samy	Director of Economic Planning, Central Planning Office
Mr. Peter Johnston	Central Planning Office
Mr. Naisoro	Central Planning Office
Mr. Low Heng Kee	Director General, Ports Authority of Fiji
Mr. Rod Huston	Director, Carpenters Industrial
Mr. T. W. Billett	Director, Billett, Wright Associates
Mr. R. L. Wright	Director, Billett, Wright Associates
Mr. Colin W. Wieff	Engineering Manager, Bish Limited

Mr. T. Pickering	Manager, Development Bank of Fiji
Mr. Ponsami Gounder	Director of Trade and Industries, Ministry of Commerce
Mr. Lodhia	Bureau of Statistics
Mr. Maurice C. Bing	Director, Seatrans (Fiji) Ltd.
Mr. Jamnadas Polra	Estimator/Purchasing Officer
Mrs. Sala Konatoba	Ministry of Tourism, Transport & Civil Aviation
Mr. Gotam Chandra	Finance Administration, Ministry of Finance
Mr. Max Allson	Director, Sofrana Unilines
Mr. Uttam Chandra	Deputy Secretary for Finance (Administration), Ministry of Finance
Mr. J. W. St. Julian	Pacific Regional Manager, Union Company
Mr. Narayan R. Singh	Director Administration, Ports Authority of Fiji
Mr. George Pickering	Deputy Managing Director, Fiji Development Bank
Mr. I. J. Hoskison	Director, Inchcape (Fiji) Ltd.
Capt. Fritz Falkner	Master Mariner, Manager Shipping Operations, Carpenters Shipping
Mr. Wallace R. Read	Officer-in-Charge, Solar Engineering Unit, Division of Mech. Engineering, Commonwealth Scientific & Industrial Research Organization (SCIRO)
Mr. Lyle N. Cupit	Managing Director, W. R. Carpenter (South Pacific) Ltd.

Required Data And Information

1. Economic & Social Data

* Growth of Population
* Employment by Industry
* Values of Sales, Productions or Shipments by Industry
* Wages by Age and Industry
* Trend of Gross Domestic Product
* Wholesale Prince and Price Index by Commodity
* Growth of Imports and Exports by Commodity and Country
* Number of Students by Classification
  --- Economics, Sociology, Engineering and Others ---
* Trend of Bank Rate of Interest
* Other Data of Fijian Economic Growth

2. Shipping Data

* Existing Tonnage by Ship Type and Size (Gross Tonnage and Dead Weight Tonnage)
* Seaborne Trade Volume by Commodity
    1) Coastal Shipping in Fiji
    2) Shipping in Southwestern Pacific
    3) External Trade
* Number and Tonnage of Newly Built Ships by Type and Size
* Number and Tonnage of Repaired and Scrapped Ships by Type, Size and Age
* Distances Between Main Ports
  --- in Fiji, in Southwestern Pacific and Others ---
* Facts on Seaborne Transportation
    --- Ship Speed by Type and Size
    --- Average Port Days
    --- Average Loadfactor (percentage in DWT)
    --- Average Active Days a Year

3. Others

* Corporation Tax System
* Laws and Regulation on Joint Venture
* Trend and Movement of Fishing Industry
* Laws and Regulation on Depreciation
* Prospect and Visions on Shipbuilding Industry of Fijian Government
* Price of Ships by Type and Size

A Summary Description of Final Report on the Project "Expansion and Improving the Ship and Boatbuilding in Fiji," Project FIJ/71/007 OPAS and Recommendations for the Re-organization of the Government Shipyard, by A Sannergren, UNIDO Ship and Boatbuilding Expert, Shipyard Manager for Government Shipyard, April 1978.

1.01 Mr. A. Sannergren, a Swedish ship and boatbuilder, had stationed in Fiji as a naval architect and construction manager hired under an OPAS contract of UNIDO for a period of eight years since October 1969. At the end of the contract Mr. Sannergren wrote a report on the "Expansion and Improving the Ship and Boatbuilding in Fiji" in April 1978 and submitted it to the Fiji government and UNIDO. Some of the important observations and recommendations contained in his report are summarized in the following.

1. Evaluation of Shipbuilding and Repair Conditions of the South Pacific Islands

1.02 Based upon the market survey conducted in the South Pacific Region in 1970-71, Mr. Sannergren has come to hold the following view:

(1) Seaborne trade and inter-islands traffic are large enough to justify that more shipbuilding and repair facilities should be built for all the island countries in the South Pacific.

(2) Concentrated efforts should be made in Fiji, for it is the largest, most industrialized, centrally located, and in possession of better facilities needed for the shipbuilding and repairs.

(3) Shipyards in New Zealand and Australia cannot compete with the Fiji's due to higher manufacturing costs and longer distance. At the same time Fiji with the facilities and technological level attained thus far can compete with

American Samoa, Gilbert Islands and Tonga where improvements efforts were made in recent years.

(4) The shipbuilding industry has improved a lot in Fiji. The machines equipments, technical know-hows and skilled work force have become available in Fiji. The government shipyard concentrates on construction of new vessels and maintaining the Government fleet, while the two private companies, i.e., Bish Ltd. and Carpenters Industrials, have expanded their ship repair business.

(5) The Government shipyard has attained the production capabilities enabling it to construct 24 vessels of different type with 200 gross tonnage during the past five years.

(6) With the improved facilities and a better marketing, amount of work in the region can be increased and the shipbuilding industry in Fiji can become a competitive industry in the South Pacific.

2. Review of the Development Efforts of the Government Shipyard

1.03 Mr. Sannergren briefly explains a process of how the Government shipyard has attained the present status:

(1) In 1971 F$250,000 investment budget was approved for the Government shipyard and the purchase of equipments has started. In January 1972 Mr. Sannergren took over the responsibility as a shipyard manager.

(2) The yard in 1972 employed about 150 workers and constructed one or two vessels per year for the Government or private companies.

(3) The vessels were all built in sheds without any lifting devices and with outdated methods. The following changes were made by Mr. Sannergren to improve the production capabilities of the Yard;

- The sheds were broken down and new gantry crane with 35 tons lifting capacity was installed.
- New arrangement was made for prefabrication workshops with modern gascutting machines and welding equipments.
- Offices of drawing, purchasing and storage were newly organized.
- Staff of drawing office and supervisory personnels were sent to training school.
- Drawing office became capable of designing different types of vessels up to a length of about 250 feet.
- The shipyard became more or less self supporting with the installment of equipments such as press brake, guillotine shears, electric overhead, mobil diesel crane, woodworking machines, machineshop tools etc.; many of them are gifts from foreign governments.

(4) Since the commencement of DPVII in 1976, steel ships of various types and size have been constructed by yard including landing crafts, tugs, general purpose vessels of goverment use, fishing vessels, barges, cutter suction dredge etc.

(5) The government shipyard employs now 325 workers, now the largest in the South Pacific except Australia. Recommendations were made by Mr. Sannergren as to how to improve the production capacity of the shipyard;

- The capacity should be expanded by employing 500 workers.
- Management systems should be reorganized.
- Workshops capacity needs to be expanded, particularly of fitters workshops.
- Dry docking capacity must be expanded.

3. Recommendations as to How to Re-organize the Government Shipyard

(1) To re-organize it as a commercial enterprise owned by the Government.

(2) To improve the drydocking facilities by extending 200 tons slipway to 500 tons.

(3) To increase the workshops, stores and office areas by taking over the P.W.D. mechanical workshops at Walu Bay.

(4) To extend the wharf facilities at Walu Bay.

(5) To engage more aggressively in market promotion in South Pacific Area.

(6) At later stage of development, a floating dock of 5000 tons lifting capacity should be acquired.

4. Recommended Changes in Shipyard Organization

(1) The present organizational arrangement of shipyard working under Marine Department of Ministry of Tourism, Transport, and Civil Aviation should be changed into something like a semi-government enterprise of the Ports Authority.

(2) The more efficient management system should be introduced including cost planning and management system, and modern accounting procedure.

(3) No recommendations were made to the change of the primary responsibilities of the government shipyard. It is now responsible for;

- Maintenance of Marine Department fleet
- Designing and construction of new vessels
- Operating and maintaining of government slipways
- Construction and maintenance of navigational aids such as beacons, bouyes, lighthouses, etc.

5. Brief Review of Cost Structure of the Government Shipyard

The following is the cost structure of the Government Shipyard reviewed by Mr. Sannergren in 1978:

(1) The average cost for operating and maintaining the Government shipyard is estimated F$ 700,000 per year which excludes the cost of the wages and materials.

(2) The maintenance cost of Marine Department fleet is estimated F$ 350,000 per year. Construction cost of new vessels ranges from F$ 800,000 to 1,000,000. Construction and maintenance cost of lighthouse is estimated F$ 80,000 and revenues from slipway fees are also F$ 80,000.

(3) It is estimated that in the case of the commercial shipbuilding an overhead cost is 40% of the total construction cost.

(4) It is calculated by Mr. Sannergren that the government shipyard can make a profit even if it is turned into a commercial enterprise ; F$ 122,000 profit by the shipyard employing 300 workers and F$ 390,000 profit with the employment of 500 workers.

6. Organizational Changes Recommended by Mr. Sannergren

(1) Management - A board of directors should be organized consisting of representatives of government and private sectors in order to plan and manage the shipyard from an overall view point of national economy. A managing director should be as a chief executive officer responsible for an overall management of the shipyard. A primary importance should be attached upon the planning and control of production and construction cost.

(2) Marketing - An aggressive marketing should be undertaken by a Marketing Director, a newly created position, in order to assure that ; a) the government shipyard capabilities will become widely known in the South Pacific Region ; 2) production planning will become closely coordinated with assessment of market demand, ; and 3) sufficient order will be placed for the Shipyard all the time.

(3) Drawing Office - To expand the capabilities of the drawing office, three new staff should be recruited ; one naval architect, one electric engineer, and one marine engineer.

(4) Purchasing Office - Internal rule and procedures of how to place requisition order needs to be established, and efforts of how to reduce the purchasing costs and material in stock should also be made as much as possible.

(5) Accounting Office - A new accounting section must be established to ensure that ; 1) a modern yearly budgeting system will be firmly established ; 2) cost control measures will be adopted for each operation of the shipyard ; i.e., shipbuilding, repairs, joinery, etc. and 3) quality of accounting clerks should be upgraded.

(6) Workshops - A measures should be taken to secure proper utilization of PWD workshop located adjacent to the government shipyard. Welding and gascutting equipments need to be extended. Modern equipments need to be installed for boatbuilding, joinery and woodworking section.

Present Conditions of the Government Shipyard

Introduction

1979 Annual Report on the Shipbuilding Section, Fiji Marine Department, was written by Mr. Apenisa Naigulevu, the Acting Shipyard Manager on April 30, 1980. In the Report present conditions of the shipyard are briefly described as in the following paragraphs.

Present Conditions of the Shipyard

(1) Number of staff and workers

	1979	1978
Staff	27	29
Employees	307	292
Apprentices	39	41
Total	373	362

(2) Shipbuilding

4 ships - Completed, and delivered during 1979
3 ships - Laid down, launched and completed during 1979
1 snip - Laid down and launched but for delivery in 1980
2 ships - Laid down for launching and delivery in 1980

These ships are mostly for the government offices such as Marine Department, Ministry of Transport, and the Fiji Navy etc. In addition, 9 punts were built in 1979.

(3) Utilization of Slipway

- The utilization of four slipways (1000, 500, 200, and 100 tons) was 85.41% as compared to 79% in 1978. Vessels using the slipways spent an average of 4.09 days on the

slip compared to 4.23 in 1978. The slip handled 305 vessels during the year and 272 in 1978 with a total gross tonnage of 43,657.81 in 1979 compared to 41,205.14 in 1978.

- A breakdown of the total vessels using government slipways is as follows: 114 local ships (37.4%), 78 ships of Fiji government fleet (25.6%), 56 local and overseas fishing vessels (18.4%), 30 overseas going vessels (9.8%) and 27 private yachts (8.8%).

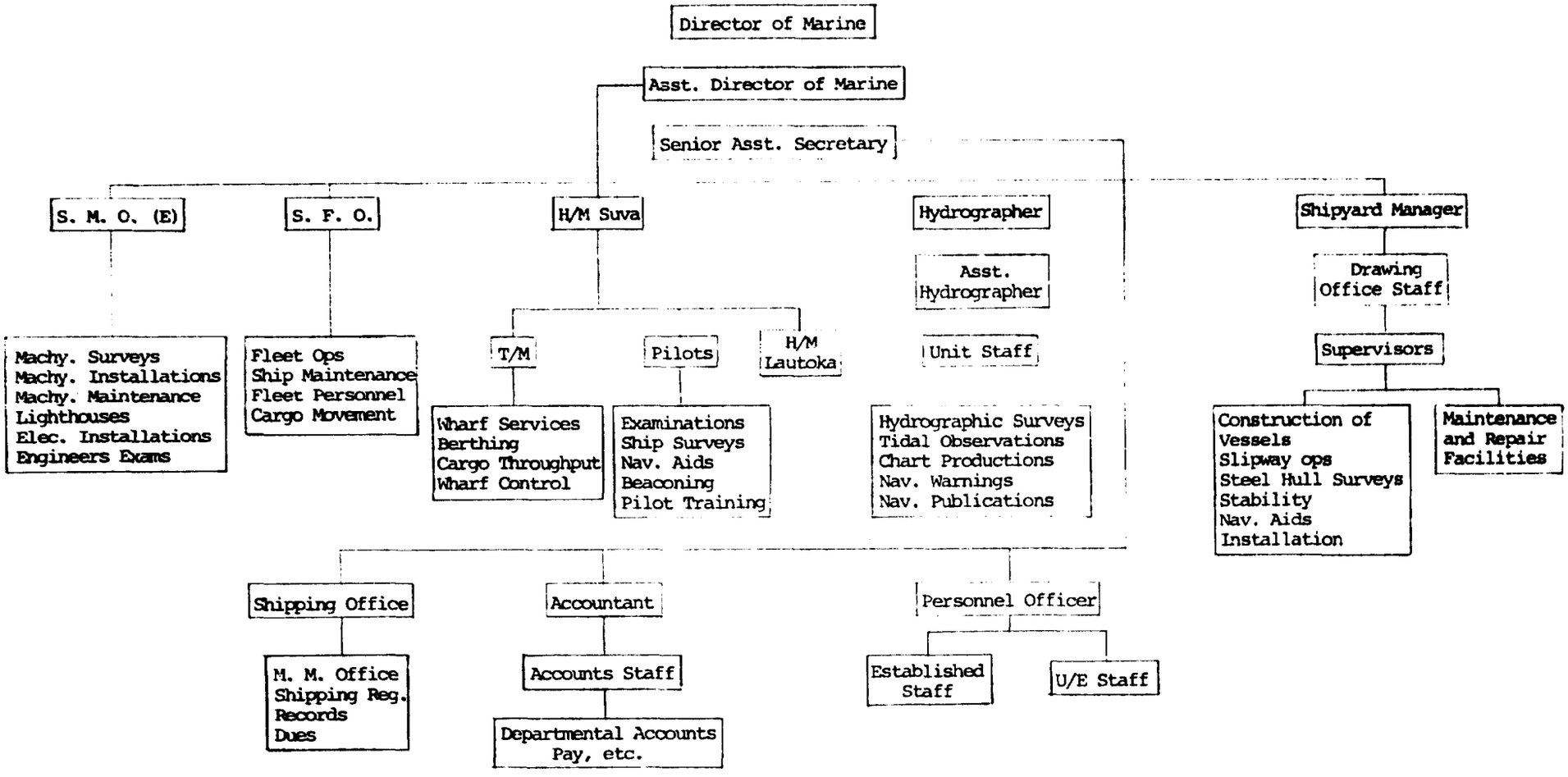
(4) Finance of the Shipyard

- The 1979 Appropriation Act provided F$ 1,530,000.00 to the government shipyard.

- The purchase of materials and equipments amounted to F$ 1,509,599.00 compared to 955,061.07 in 1978.

- The shipyard received 813 tons of steel plates and sections on the South Pacific Aid Scheme.

MARINE DEPARTMENT ORGANIZATION CHART



2000T (Lifting Capacity) FLOATING DRY DOCK

---ROUGH SPECIFICATION---

H1. GENERAL

It is the intent of these Particulars to describe and set forth the design, material, construction and equipment of a dock suitable for service craft.

Material, machinery, equipment, etc. to be of Japanese make unless specifically agreed and/or described in these Particulars.

H2. PRINCIPAL DIMENSIONS

Length over all	approx.	71.00 m
Length of Pontoon Deck		65.00 m
Breadth over all		26.00 m
Breadth between side walls		20.00 m
Depth		10.00 m
Maximum draft of Dock submerged		8.00 m
Minimum draft of Dock floated with maximum load	approx.	2.50 m

H3. LIFTING CAPACITY

It is including F.O. residual water ballast, store etc.
approx. 2000 t

H4. TANK CAPACITY

Fuel	approx.	60 m^3
Fresh water tank	approx.	75 m^3
Water ballast tank	approx.	6,020 m^3
Slop tank	approx.	50 m^3

H5. LIGHT WEIGHT

approx. 1,400 t

H6. COMPLEMENT

20 persons (workmen)

H7. PAINTING

Shell

Dock bottom	AC x 2, AF x 2
Boottop (outside and inside)	AC x 2, BT x 2
Topside (outside and inside)	AC x 2, TS x 2

Exposed deck

LZ x 2, DP x 1

Exposed superstructure

LZ x 2, CP x 2

Water ballast tank

TE(HB) x 1

Fresh water tank

EP x 2

Fuel oil tank

RIO x 1

Slop tank

TE(HB) x 1

(Abbreviation)
AC: Anti-corrosive paint
AF: Anti-fouling paint
PT: Boot-top paint
TS: Top side paint
LZ: Lead zinc primer
DP: Deck paint
CP: Coloured paint
EP: Epoxy paint
TE: Tar epoxy paint
HB: High built type
RIO: Rust inhibitive oil

H8. CATHODIC PROTECTION

Suitable number of zinc anode to be fitted outside of the shell below 2.5 W.L.

H9. MOORING GEAR

4-capstan with 1-chain drum and 1-capstan is fitted on the longitudinal edge of side walls.

They are served both as windlass and mooring winch.

Windlass capstan

4 x 5 t x 15 m/min electro-hydraulic type with 1-chain drum and 1-capstan end.

H10. ANCHOR AND CHAIN

4 x 1 t stockless anchors

4 x 30 mmø x 350 m anchor chains

H11. TRAVELLING CRANES

1 x 25 m x 10 t wind up speed 24 m/min, run speed 30 m/min

1 x 25 m x 3 t wind up speed 24 m/min, run speed 30 m/min

H12. WATER BALLAST HANDLING SYSTEM

Water ballast pump

2 x 1,000 m^3/h x 15 mT.H. electric vortex type

Valve control system

Main valves are remotely controlled from the conrol room.

Liquid level reading system

Pneumatic type level gauge

H13. FIRE EXTINGUISHING SYSTEM

Sea water piping line	1-line, hydrant x 3 (on each wall top deck)
Living part	Portable foam extinguisher
Engine room	Portable foam extinguisher and sea water

H14. VENTILATION AND AIR-CONDITIONING

Design conditions

Season	Location	Temperature	Relative himid
summer	inside	25°C	65%
	outside	50°C	100%
	sea water	35°C	
winter	inside	20°C	
	outside	0°C	

Design conditions to be applied as following space.

(a) Workmens messing and sleeping space

(b) Office

(c) Workshop

(d) Control room

Toilet and galley etc. Electric exhaust ventilation fan

Generator room Electric ventilation fan

H15. LIFE SAVING EQUIPMENT

Life raft 2 x 25 men

Life ring 10

Life jacket 50 (on side wall top deck)

H16. FLYING BRIDGE

A flying bridge is fitted between the side walls at one end of the deck.

H17. ACCOMMODATION

Accommodation is fitted all fully equipped and furnished.

(a) Galley, Mess, Toilet, Shower and Sleeping facilities for 20 workmen.

(b) Office x 1 Floor area - 20 m^2

(c) Workshop x 1 Floor area - 40 m^2

(d) Store x 4 Floor area - 27 m^2 x 2

Floor area - 36 m^2 x 2 Total 126 m^2

(e) Control room Floor area - 20 m^2

H18. SERVICES TO SHIP UNDER REPAIR

(a) Equipment of compressed air

Piping line --- 1-40A, 4-connection (on each side wall top deck) S.G.P.

(b) Secure gathering storage for oxygen and acetylene gas bottles.
oxygen - 20 acetylene - 10

Piping line --- 1-40A, 4-connection (on each side wall top deck), For both oxygen and acetylene gas S.G.P.

(c) High pressure fresh water --- refer to M3.

(d) Arrangement for water testing of ships tanks.

(e) Welding machine ---- 24 (on each side deck)
current rating 40-300 AMP.

(f) Equipment in workshop

(1) Vice x 2

(2) Lathe drilling machine x 1 swing on bed 290$^{\phi}$m/m

swing on return bed 145$^{\phi}$m/m

center hight 150m/m

length between centers 550m/m

(3) Shaper x 1, Gear shaper L x B x H, 1390 x 1510 x 1945m/m

1.5/2.2 KW (4/6 p) 3 t

(4) Milling machine x 1 travelling distance

right left, fore aft, up down

630 mm x 200 mm x 400 mm

working table dimension 1350 x 300mm

63-355 r.p.m. 3.7 KW 2.2 t

(5) Electric saw x 1

(6) Double head grinder x 1 100 V, 3.1 A, 200 W, 3000 r.p.m.

(7) 4"-Pipe bender machine x 1

(8) 1/2"-Brake press x 1

H19. KEEL AND SIDE BLOCK

Keel block ZZ

Side block 12 x z

Block is comprised of steel bases, hardwood baulds and softwood cappings.

M1. ELECTRIC GENERATING PLANT

Main diesel generator;

2 x 300 KW (375 KVA), 445 V, 60 Hz, 3 ø,
drip-proof, self-ventilated generator.
Diesel engine; DAIHATSU 6 DSb-18

Remarks; Approximately 120 percent of required total power at deballast, Two sets generators to be used at ship repairing service.

Aux. diesel generator; 1 x approx. 100 KW (125 KVA)

M2. AUXILIARY MACHINERY & ETC.

Starting air compressor; Diesel driven	1
Starting air reservoir	1
Cooling sea water pump	1
Sea water service pump	1
Fire & general service pump	1
Bilge pump	1

Fuel oil transfer pump	1
Fresh water service pump	2
Calorifier with circulating pump	1
Gen. engine room vent. fan	2

Heat exchangers and other auxiliaries to be provided in accordance with Builder's standard.

Piping system;	Sea water line	Galvanized steel pipe (SGP)
	Other line	Builder's standard

M3. WORKING SERVICE MACHINERY

Worjing air compressor; Motor driven 2 x approx. 8 m^3/min F.A. 7Kg/cm^2

Working air reservoir; 1 x 1,000 liter 7 Kg/cm^2

High pressure fresh water pump; Motor driven 2 x 5 m^3/h 85 Kg/cm^2

M4. CONTROL

Main diesel generators can be started and stopped from the control room.

Other machinery to be locally controlled.

E1. SYSTEM VOLTAGE

Power system:	AC 440 V 3ø 60 Hz 3-wire insulated.
Lighting system:	AC 110 V 3ø and 1ø60 Hz 3 and 2-wire insulated
Emergency system:	DC 24 V

E2. MOTORS

I.E.C. standard sized, class E and/or B insulated, squirrel-cage type induction motors, in general

E3. TRANSFORMERS

Drip-proof construction, class B insulated, natural-air cooled and dry type.

Two(2) three-phase bank, consisting of three(3) 10KVA, 440/110 V single-phase transformers: for general service.

E4. BATTERY

Two(2) sets of 200 AH, DC 24 V lead-acid type: for general and emergency service.

E5. CABLES

Cables throughout the vessel to be constructed in accordance with Japanese Industrial Standard (JIS).

E6. LIGHTING

Lighting fixtures, plugs and socket-outlets, switches etc., to be of Japanese make.

Engine room lighting	: Fluorescent lamp
Living quarter lighting	: Fluorescent lamp
Sanitary space lighting	: Incandescent lamp
Main deck lighting	: Incandescent and/or mercury arc lamp type floodlight

E7. INTERIOR COMMUNICATION SYSTEM

Direct telephone : 1 set

1 : 3 (flying bridge-engine room)
-mess room)
-passage)

E8. POWER ALTERNATION SYSTEM

The power supplied from the shore 50 KVA and the alternated voltage frequency are aupplied from the follcwing equipments.

System voltage

Shore supply : AC 208 V 3 ø 50 Hz--AC 220 V 3 ø 50Hz
3-wire insulate
--DC 220 V 2-wire insulate
--AC 440 V 3 ø 60Hz
3-wire insulate

Transformers

Constructions are same as item E3. TRANSFORMERS

One(1) three-phase bank, consisting of three(3) 20 KVA, 208/220 V single-phase transformers connected delta-delta.

Rectifier

The equipment is a static-rectifiring type.

Rectifiring capacity : 50 KW DC 220 V 1 ø

Converter

The equipment is a rotating or a static type. The converter changes the frequency from 50 Hz to 60 Hz.

Converter capacity : AC 208 V, 50 Hz/ AC 440 V, 60 Hz, 50 KVA,3 ø.

Annex 10.

Summary of UNIDO's Assistance in Training of GSY

UNIDO should assist GSY in inviting consultants/experts in production planning/management and engineering for shipbuilding and repair from an advanced country in shipbuilding.

Required experts are as follows:

(1) Production Control Expert : Designing, Process Control, Cost Control and Safety Control

(2) Hull Expert : Traced Drawing, Hull Blocking, Welding and Election

(3) Machinery Expert : Main Engine, Auxiliary Engine, Installation, Test Running and Treatment

(4) Electric Expert : Electric Motor, Generator, Wire Distribution, Lights, Wireless Telegraphy and Navigation Gauges

(5) Plumber : Piping for Engine, Other Piping and Pumping

These five experts, at least, are required for the training of the staffs of GSY. It is desirable that the duration of assistance of each expert be one year, and that these five experts be sent to GSY at the same time.