REPORT ON
FISHERIES DEVELOPMENT PROJECT
IN PAPUA AND NEW GUINEA

MARCH 1972

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

REPORT ON
FISHERIES DEVELOPMENT PROJECT
IN PAPUA AND NEW GUINEA

MARCH 1972

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

FOREWORD

Pursuant to the agreement reached by the governments of Australia and Japan at a conference on the Japan-Australia Fisheries Agreement signed on December 25, 1970, the Australian Government made a request for Japan's cooperation for a pre-investment basic survey for establishing a large scale fisheries products processing complex in Madang districts, Papua and New Guinea. Acceding to this request, the Japanese Government entrusted the Overseas Technical Cooperation Agency with the execution of the survey.

The Agency organized a survey team composed of nine members headed by Mr. Aiji Takashiba of Tuna Export Packers Association of Japan and dispatched it to Papua and New Guinea over a period of about 40 days from July 28, 1971. During the survey period, the team studied the feasibility of establishing the projected processing complex with its members grouped into two parties, one specialized in fisheries and stock survey and the other undertaking the survey of marketing situation, processing industry and financial aspect.

After return to Japan, the team directed its efforts to various reviews and studies based on the data collected during the survey, and compiled these data into 'Report on Survey for Fisheries Development Project in Papua and New Guinea' hereby presented to the Australian Government.

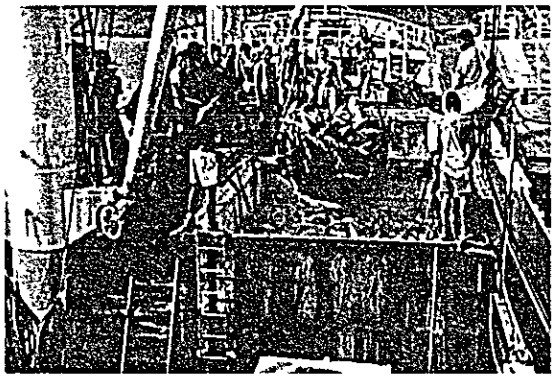
It will give me great pleasure if this report, which is an outcome of joint efforts of the Australian Government, Administration of Papua and New Guinea and Japanese Ministries concerned, proves of some use for future development of the Papua and New Guinea, particularly for the development of fisheries products processing industry and coastal fisheries of the territory and at once serves to enhance the amity and economic relations between Australia and Japan.

I take this opportunity to express my gratitude to the Australian Government, Administration of Papua and New Guinea and Japanese Embassy in Australia for valuable assistance extended to the team, to the Ministry of Foreign Affairs, Ministry of Agriculture and Forestry, Fishery Agency for the support given to the team, as well as to all the team members for their laborious services.

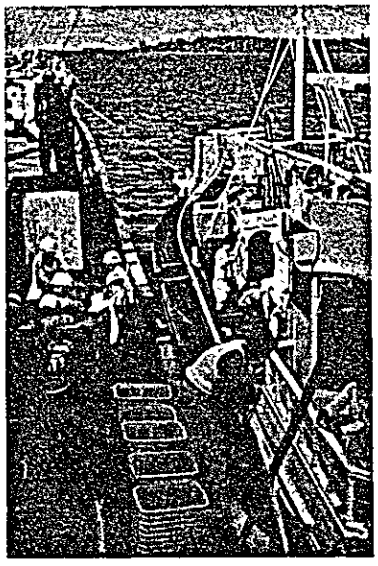
March 1972

Keiichi Tatsuke
Director General
Overseas Technical Cooperation Agency

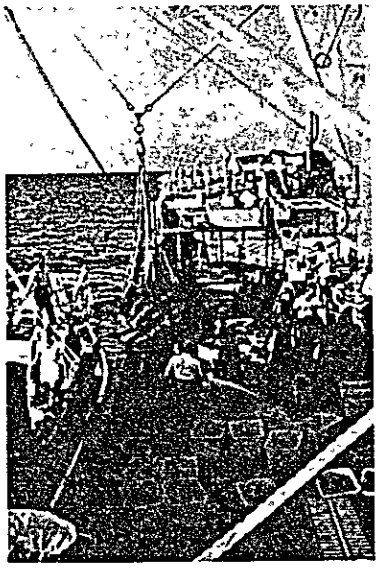
(1) Skipjack poll and line



Mother-ship



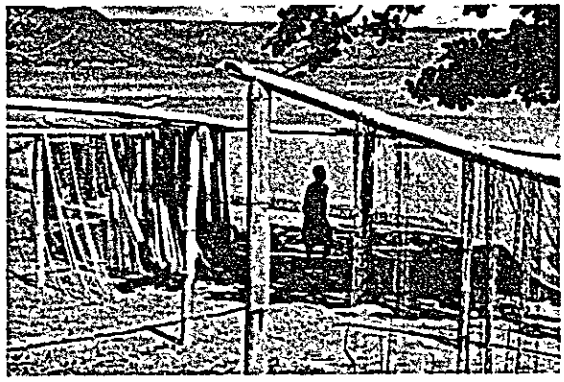
Catcher boat



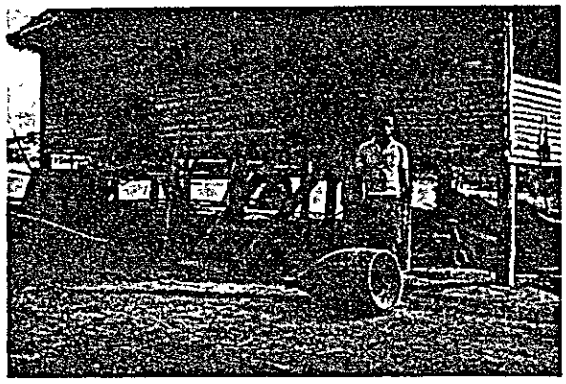
Landing of fish catch from
a catcher boat to mother-ship

(2) Fishery by local people

Indigenous fishermen and their canoe
(Madang)



Fishing gear and equipment
(Rabaul)



Fishing gear and equipment
(Sepik)

(3) Market of fishery product

1 Market

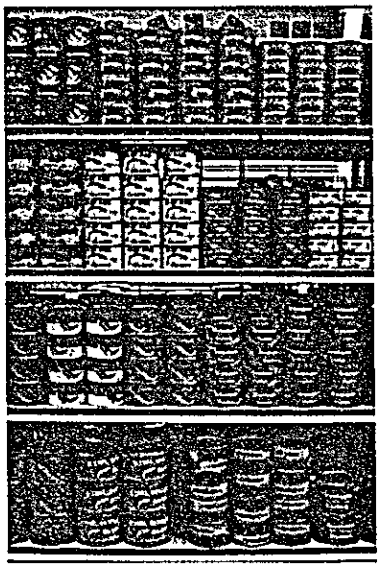
The market in Madang
(Smoked Tilapia)

The market in Madang

2 Super-market

11B

Canned goods counter

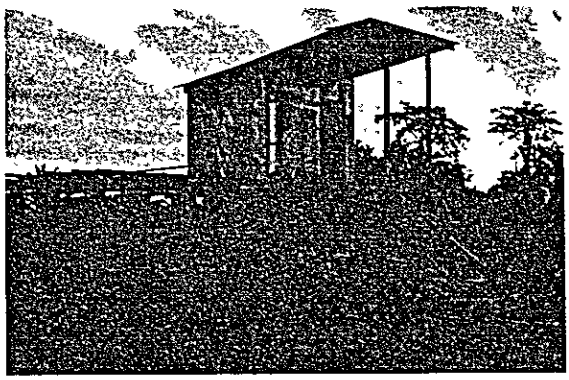


10B

3 Fresh fishes

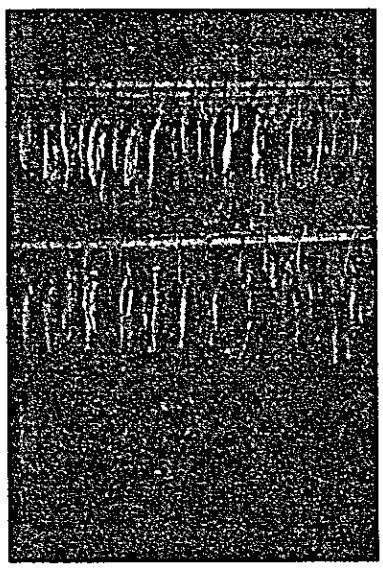
Marine fishes
(Fish-market in Madang)

4 Fishery processing



Smoke house
(In Sepik)

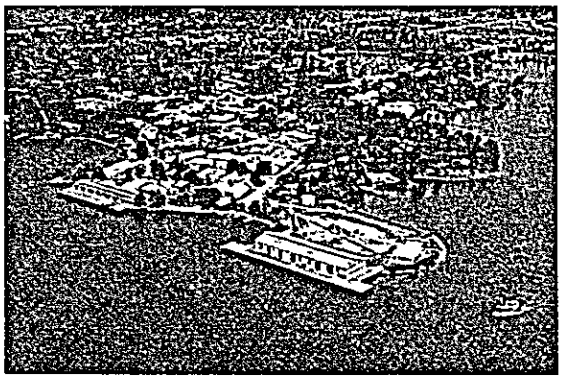
Fresh water fishes
(Tilapia)
(In Sepik)



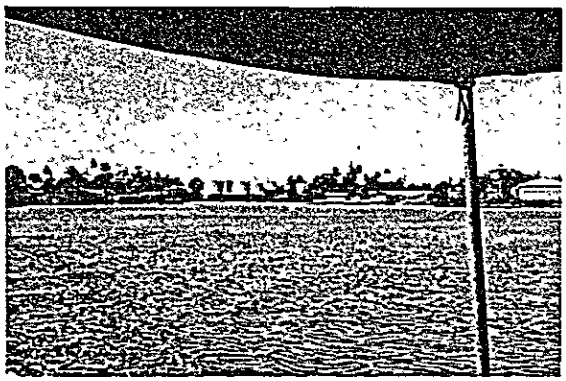
Inside of smoke house
(In Sepik)

(4) Madang

1 City area

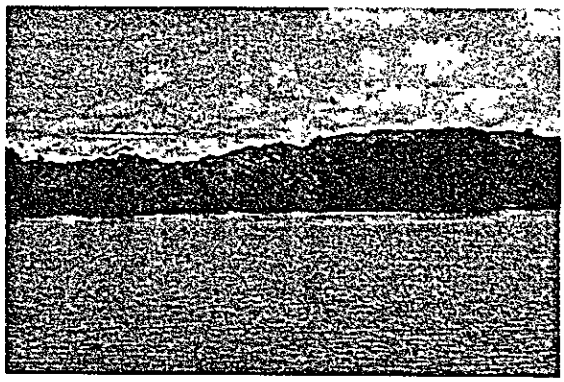


Landing pier & city area



Tank of oil supply

2 Proposed sites for selection



Nagada Bay

Mililat Bay

Sek Bay

CONTENTS

Page

Page

1. Introduction

(1) Background

At a conference held between the governments of Japan and Australia for the establishment of joint fisheries venture in Papua and New Guinea on the basis of the Japan-Australia Fisheries Agreement concluded on November 27, 1968, the Japanese government expressed its intention to extend its cooperation in the establishment of the said joint venture and agreed to have its intention to be officially recorded in the conference's minutes.

At about the same time, the Japanese government dispatched 'Shunyo-Maru', a fisheries research vessel having a gross tonnage of 186 tons and owned by the Far Sea Fishery Research Institute, to the sea area in the vicinity of Papua and New Guinea (hereafter referred to as 'P.N.G.') to investigate the available fisheries stock. In the subsequent two year period, surveys by Japanese government and Japan Fisheries Association were carried out both on land and on the sea to collect basic data required in studying the potentiality of the fisheries development.

As a result of these basic surveys which lasted for three years, the Japanese government reached the conclusion that skipjack fishery would be most suitable for the desired fisheries development, and encouraged the participation of Japanese private fishing establishments.

This has led to the skipjack pole and line fishery undertaken in 1970 by three Japanese establishments (of which two were Japanese-Australian joint ventures) on an experimental commercial basis in the Bismarck Sea of P. N. G. The experimental fishery proved quite successful, and all the three companies have formally decided on the establishment of a joint venture by the end of 1971.

Further, at another conference devoted to the discussion on the Japan-Australia Fisheries Agreement signed on December 25, 1970, the Japanese government expressed its intention to conduct a pre-investment basic survey for the planned establishment of large scale fisheries product processing industry in Madang district, P. N. G. In 1971, the Australian government made a request for the survey, and the Japanese government decided to dispatch a survey team to P. N. G. in July.

(2) Purpose of Survey

The survey was conducted as a feasibility studies on the establishment of a large scale fisheries product processing complex in Madang district for fisheries development in P. N. G., and was intended to be ensured by the compilation of collected data into a report.

(3) Outline of Survey

The survey was carried by the survey team organized by the Overseas Technical Cooperation Agency and comprising the following members over a period of about 40 days from July 28, 1971 in Australia and P. N. G.

Formation of Survey Team:

Assignment	Name	Position
Leader	Aiji Takashiba	Tuna Export Packers Association of Japan
Fisheries Economy	Masao Akai	Fisheries Administration Department, Fishery Agency
Fisheries Stock	Masaharu Igarashi	Shizuoka Prefectural Fishery Experimental Station
Fishing Operation	Kisaburo Honda	Fisheries Production Department, Fishery Agency
Marketing and Processing	Shunichi Hozumi	Ditto
Fisheries Credit	Masafumi Oda	The Agriculture, Forestry and Fisheries Financing Corporation
Fisheries Facilities	Katsumi Suzuki	Guidance Department, Federation of Japan Tuna Fisheries Cooperative Associations
Processing Facilities	Nobuharu Gejo	Akitsu Fisheries Co., Ltd.
Coordination	Yukihisa Sakurada	Development Survey Department, Overseas Technical Cooperation Agency

Prior to the survey, the team met the officials of the Australian Government and the Administration of the P. N. G. to obtain data and information on the economic development plan, fisheries policies and foreign capital inducement policies adopted for the territory as well as on a fisheries complex plan at Madang district. The team was then grouped into two parties, the fisheries survey party which comprised the leader and members in charge of stock, fishing operation, fisheries facilities and coordination, and the economic survey team which was composed of the members assigned to fisheries economy, marketing and processing, fisheries credit, and processing facilities. Besides Madang district, the fisheries survey party visited such other districts as Rabaul and Kavieng and the economic survey party covered districts like Lae, Wewak and Mt. Hagen to conduct a field survey on different items such as the existing state of fisheries, economic conditions and site conditions.

ITINERARY OF SURVEY TEAM

Date	Day	Time	Description
July 27	Tue	5:00 p.m.	Departure from Haneda by QF Flight 2 73
28	Wed	9:35 a.m.	Arrival at Sydney
		11:40 a.m.	Departure from Sydney
		12:30 p.m.	Arrival at Canberra
		3:30 p.m.	Courtesy call made on the Japanese Embassy, with explanation given on the duties of the survey team.
29	Thu	10:00 a.m. - 4:45 p.m.	Information provided on the condition of P. N. G. and answers given to questions raised by the team at the Ministry of External Territories
30	Fri	10:00 a.m. - 12:00 p.m.	Information provided and answers given to questions raised by the team at the Ministry of Primary Industries
		20:00 p.m.	Films introducing P. N. G. shown to the team
31	Sat		Consolidation of data obtained
Aug. 1	Sun	10:00 a.m. - 4:00 p.m.	Inspection tour by bus sponsored by the Australian Government
2	Mon	9:00 a.m..	Departure from Canberra
		9:55 a.m.	Arrival at Sydney
		1:00 p.m.	Information obtained from Japanese enterprises in Australia
3	Tue	7:50 a.m.	Departure from Sydney
		12:35 p.m.	Arrival at Port Moresby
			Intra-team discussion and arrangement concerning questions to be clarified
4	Wed	8:00 a.m. - 12:00 p.m.	Consultation and arrangement with the Administration of the P. N. G.
		1:30 p.m. - 6:00 p.m.	The team divided into A Party (Takashiba, Igarashi, Honda, Suzuki and Sakurada) and B Party (Akai, Hozumi, Gejo and Oda); data and information collected by each party from the organizations concerned.
5	Thu	8:00 a.m. - 5:00 p.m.	Collection of data and information by the two parties
6	Fri	8:00 a.m.	Collection of data and information by the two parties

Date	Day	Time	Description		
			A Party		B Party
Aug. 6	Fri	12:30 p.m.	Departure from Port Moresby	Collection of data and information from organizations concerned.	
		3:40 p.m.	Arrival at Rabaul		
		5:00 p.m.	Arrangements for survey itinerary with Kaigai Gyogyo K.K. and the Administration of the P. N. G.		
7	Sat	6:30 a.m.	Departure by a fishing boat to study the fisheries condition aboard the Kaigai Gyogyo K.K.'s mothership	12:30 p.m.	Departure from Port Moresby
				11:30 p.m.	Arrival at Lae
				2:00 p.m.	Arrangements for future survey itinerary; inspection of Namasu
		Night:	Inspection of the bait fish catching (until morning)		
8	Sun	9:00 a.m.	Departure from the mothership	9:00 a.m.	Survey of market and fishing port of Lae
		4:00 p.m.	Arrival at Rabaul	2:15 p.m.	Departure from Lae
				6:00 p.m.	Arrival at Wewak
9	Mon	9:00 a.m.	Courtesy call made on the District Commissioner of Rabaul	9:00 a.m.	Survey of market and fishing port of Wewak.
		1:30 p.m.	Survey of fishing boats and associated items in and around Rabaul Bay	2:00 p.m.	Departure from Wewak; survey of fishing villages in Sepik
10	Tue	7:15 a.m.	Departure from Rabaul	Morning:	Survey of fishing villages and rivers in Sepik
			Arrival at Kavieng	6:10 p.m.	Departure from Sepik and arrival at Wewak
		10.00 a.m.	Courtesy call made on the District Commissioner		
		1:30 p.m.	Departure for a study of fisheries condition aboard a mothership of Kyokuyo K.K.		
		5:00 p.m.	Return to Kavieng		
11	Wed	Morning	Consolidation of data obtained	9:00 a.m.	Survey of market
				Afternoon	Information provided by the District Commissioner and discussion held with him

Date	Day	Time	Description	
			A Party	B Party
Aug. 11	Wed	1:30 p.m. - 3:30 p.m.	Inspection of the construction work of the processing facilities of Kyokuyo K.K.	
		5:00 p.m.	Inspection of Kavieng Fishery Supply	
12	Thu	8:30 a.m. - 5:00 p.m.	Inspection of fishing establishments, agricultural experiment stations and plantations	8:15 a.m. Departure for Wewak 9:10 a.m. Arrival at Madang 1:10 p.m. Collection of data
13	Fri	7:10 a.m.	Departure from Kavieng	Morning Consolidation of data
		9:40 a.m.	Arrival at Madang; the two parties joined.	
		2:00 p.m.	Arrangements for further survey itinerary with the Australian Government and Hokoku Marine Products Co., Ltd.	
14	Sat	8:00 a.m.	Inspection of the Fisheries Training Centre	
		1:30 p.m.	Study of fisheries condition aboard a Hokoku's mothership	
		6:00 p.m.	Return to Madang of team members except Honda who remained on the mothership for further survey.	
15	Sun	8:00 a.m.	On-the-sea survey of the three proposed sites of processing facilities construction by a fishing boat	
		Afternoon	The team landed at Sek Bay for an on-land survey of site conditions.	
			C Party (Takashiba, Akai, Hozumi, Gejo, Oda and Sakurada)	D Party (Honda, Igarashi and Suzuki)
16	Mon	9:00 a.m. - 5:00 p.m.	Courtesy call made on the District Commissioner, and requests for supplementary data made at administrative organs concerned.	9:00 a.m. - 5:00 p.m. Marine survey by a fishing boat
17	Tue	8:00 a.m.	Departure from Madang	9:00 a.m. - 5:00 p.m. Marine survey by a fishing boat
		8:40 a.m.	Arrival at Mt. Hagen; arrangements for itinerary	

Date	Day	Time	Description	
			C Party	D Party
Aug. 17	Tue	1:00 p.m.	Observation of market and culture farms	
18	Wed	9:00 a.m. - 5:00 p.m.	Observation and study of actual condition of market and plantations	Aerial survey by Honda and Suzuki
19	Thu	7:00 a.m.	Departure from Hagen	Survey of rivers and lakes by Honda and Suzuki
		7:40 a.m.	Arrival at Madang	
		1:00 p.m.	Intra-team review and discussion of survey results for presentation of a preliminary report to the Administration of the P.N.G.	
20	Fri		Ditto	
21	Sat	10:30 a.m.	Departure from Madang	
		1:15 p.m.	Arrival at Port Moresby	
		3:00 p.m.	Arrangements for itinerary	
22	Sun		Data collection, and preparation of draft of the report	
23	Mon	1:30 p.m.	Preliminary survey results reported to the Administration of the P. N. G.	
24	Tue		Data collection, and receipt of supplementary data; preparations for return trip	
			E Party (Akai, Hozumi and Sakurada)	F Party (Takashiba, Igarashi, Honda, Gejo, Oda and Suzuki)
25	Wed	12:30 p.m.	Departure from Port Moresby	3:00 p.m. Departure from Port Moresby
		5:15 p.m.	Arrival at Sydney	9:25 p.m. Arrival at Hongkong
26	Thu	8:30 a.m.	Departure from Sydney	Departure from Hongkong and arrival at Tokyo
		9:15 a.m.	Arrival at Canberra	
			Arrangements for preliminary survey report and itinerary made at the Japanese Embassy	
27	Fri	9:30 a.m.	Preliminary survey results reported to the Ministry of External Territories.	
		Afternoon	Round-table talk	
28	Sat		Consolidation and arrangement of data	
29	Sun	10:30 a.m.	Departure for Eden for observation of a canning plant and oyster culture farms	

Date	Day	Time	Description
Aug. 30	Mon	6:00 p.m.	Arrival at Canberra
31	Tue	9:00 a.m.	Courtesy call made on the Japanese Embassy and the Ministry of External Territories
		12:45 p.m.	Departure from Canberra
		1:35 p.m.	Arrival at Sydney; talked with the representatives of the three Japanese enterprises in Australia.
Sep. 1	Wed	Morning	Market survey and observation of fishing boats
2	Thu	Morning	Departure from Sydney
		6:00 p.m.	Arrival at Hongkong
3	Fri		Departure from Hongkong and arrival at Tokyo

Acknowledgements

During the present survey, the team was much impressed by the strong hope exhibited by the Australian Government authorities such as the Ministry of External Territory, Ministry of Primary Industries and Administration of P.N.G. for realizing the projected processing complex.

The team was greatly indebted to the Australian Government and the Administration of P.N.G. for their unlimited assistance including the provision of data and information requested by the team, services offered for the team's trip to the proposed sites of the complex, arrangements for accommodation and transportation of team members, and provision of boats and aircraft for survey.

Throughout the survey period, the team was greatly assisted by the staffs of the Japanese Embassy who offered valuable advices and convenience for transportation, maintained close contact with the Australian Government, arranged for discussions with Australian officials, and undertook liaison with the Japanese Government for the team. The team wishes to express deep gratitude to the Ambassador, Minister and all the other staffs of the Japanese Embassy in Australia for all these kind arrangements and assistances.

The team further wishes to record its appreciation to the Ministry of Agriculture and Forestry, Fishery Agency, Ministry of Foreign Affairs and Overseas Technical Cooperation Agency for the untiring support given to the team.

2. Conclusion and Recommendations

(1) Conclusion

1) The field investigation conducted by the team covered Lae, Wewak and Madang districts of P. N. G. as well as Rabaul and Kavieng districts to select a suitable site for establishing the fisheries product processing complex. After inspecting the existing condition of fisheries and site conditions in these districts, the team reached the conclusion that Sek Harbour of Madang district is most suited for the planned complex.

2) The fisheries processing complex is to be provided with a canning plant using skipjack as raw material and related facilities. The optimum scale of these facilities is as follows.

Canning Plant	: 2 lines, daily production capacity - 1, 700 cases
Cold Storage Facility	: Cold storage capacity - 500 tons
Fish Meal Plant	: Daily capacity - 10 tons
Number of Employees	: 216

3) It is considered advisable that the complex be run on a commercial basis and that preparations be pushed forwarded for its commissioning in 1974.

In view of the lack of experience in the complex operation, marketing and other conditions, the rate of operation should be limited to one line of canning machinery in the initial stage, to be later increased one more line as these conditions come to be satisfied.

4) Constant supply of raw material is the prime factor in ensuring the smooth operation of the complex. Efforts must therefore be made for the research and development of skipjack fishery and bait fish fishery.

5) It is estimated that the complex operation will produce black figures in four year after completion of its facilities and will fully cover the deficit carried forward in seven years.

6) The internal rate of return attainable during the ten year period after the commissioning of this enterprise is calculated to be 15.6 per cent.

It is to be added that if the implementation of this project is accompanied by the enforcement of appropriate promotional measures by the Australian Government and the Administration of P.N.G. regarding the items pointed out the following (2) Recommendation, the materialization of the fisheries promotion project centering on the canning industry in Madang district will have an enormous potentiality.

(2) Recommendations

Establishment of fisheries product processing complex in Madang district for the enhancement of regional development calls for the assistance in various aspects by the Australian Government and the Administration of P. N. G. The team hopes that the assistance will be extended particularly for the successful implementation of the following recommendations.

1) Constant supply of material fish is the prime factor for the smooth operation of the canning plant. Therefore, the pole and line fishing efforts out of skipjack fisheries would not have to be pegged at the present level. However, it would be advisable to raise the above-mentioned fishing effort level by degrees while taking into consideration the conditions of skipjack stock. In addition, as seen at each nation's base in the South Pacific, it should be considered to get fish-landings by means of attracting foreign fishing boats.

2) Since the implementation of the project calls for a large capital investment and a substantial deficit is expected before the complex is put into full-scale operation, the Government is required to offer its positive support in public investment, provision of long-term and low-interest loans, and low-taxes and public charges.

3) Installation and operation of the complex facilities calls for the cooperation of the Administration in mediating for and securing the necessary land, constructing and consolidating the workers' dormitory, supplying electric power and water, and recommending suitable workers.

4) Cooperation of the Administration is also hoped to be extended to the domestic marketing of canned flake meat which is by-products in skipjack canning process.

Furthermore, recommendations on fishing developments are as stated in the following.

1) The bait fish fishery is conducted only in a limited area at present. It is hoped that new fishing grounds be developed and fishing and preservation methods suited for each ground be devised and put into practice.

2) It is recommended that indigenous-fishermen be provided with the training on skipjack and bait fish fisheries.

3) It is recommended that indigenous people be encouraged in conducting coastal and inland water fisheries suited for regional development, and that guidances and financial aids be provided for closer mutual solidarity of fishermen, rationalization of distribution system, development of utilization and processing of fishes, and market exploitation.

4) In order to investigate the fishing grounds and assess the stock of important fishes, the Administration of P. N. G. is urged to undertake ecological studies and surveys of marine and fishing conditions for skipjack, anchovy and tusilier in the coming few years, for coverage of larger numbers of fish species in future.

3. Fisheries Development in P.N.G. and Its Background

(1) Economic Development in P.N.G.

1) Existing State of Economic Growth

During the 10 year period subsequent to 1961, P.N.G. recorded a marked growth of economic activities, with the GNP reaching 329.7 million dollars. The growth was conspicuous in the monetary sector excluding domestic consumption and non-marketing production sector. The annual growth rate in this sector marked 18 % during the period from 1965/1966 to 1969/1970.

Economic Growth of P.N.G.

Fiscal Year (July 1 - June 30)	1961	1965	1969	1970 *
Value of Total Market Supply				
Monetary Sector (in A$ million)				
Wages and salaries	56.3	89.7	139.9	174.0
Income from primary products	25.6	37.6	59.2	68.5
Income of company	6.6	14.0	34.0	41.3
Surplus funds of public authority business	-	0.7	0.4	1.0
Other incomes	5.9	11.8	18.9	27.0
Income of monetary sector	94.4	153.8	252.4	311.8
Depreciation Allowance	4.6	6.9	16.1	17.9
Gross production value (factor cost)	99.0	160.7	268.5	329.7
Indirect taxes - subsidies	4.7	8.1	17.4	23.9
Gross production value (market price)	103.7	168.8	285.9	353.6
Import of and disbursement for commodities and services	67.2	110.9	187.6	264.3
Value of market supply by monetary sector	170.9	279.7	473.5	617.9
Income of subsistence sector	154.5	174.8	188.7	190.0
Total	325.4	454.5	662.2	807.9
Value of Total Market Disbursement				
Monetary Sector (in A$ million)				
Disbursement for consumption	72.1	101.8	161.6	187.6
Net disbursement	34.5	57.4	99.2	110.6
Gross value of domestic capital formation	30.8	65.2	120.2	209.0
Gross disbursement of monetary sector	137.4	224.4	381.0	507.2
Export of and income from commodities and services	33.5	55.3	92.5	110.7
Market disbursement of monetary sector	170.9	279.7	473.5	617.9
Subsistence Sector				
Disbursement for consumption	119.2	134.4	144.4	144.7
Individual and community investment	35.3	40.4	44.3	45.3
Disbursement of subsistence sector	154.5	174.8	188.7	190.0
Total	325.4	454.5	662.2	807.99

* Preliminary

In contrast with this, the subsistence sector remained stagnated with an annual growth rate of 0.5 % . Its share in the gross national product declined from 53 % in 1965/1966 to 30 % in 1969/1970.

Looking into import and export, the industrial development expanded the scale of foreign trade. Export from P.N.G. increased at an annual rate of 17 % and import also recorded an annual growth rate of 18 % backed up by the demand growth.

In 1960/1970, P.N.G.'s economy was further animated and the growth rate in the monetary sector over the preceding year rose to 25 % . Though this rapid development is ascribable to the capital investment in the copper mines of Bougainville and import of capital goods, but there also were other causes such as the rapid increase in the government expenditure and investment by individuals, firm export price of major products, continued industrial development, and increasing employment opportunities.

The estimated value of major industrial sectors excluding mining industry during the 1968/69 - 1969/70 period and the target value of production envisaged under the Five Year Economic Development Plan for 1968/69 to 1972/73 are as tabulated below.

Unit A$ million

	Estimated Value of Production		Planned Value of Production	
	1968/69	1969/70	1968/69	1969/70
Agriculture and Livestock Farming *				
Copra	21.0	20 1	20.3	21.2
Cocoa	14 1	16 6	11.1	12 2
Rubber	2.3	2.8	2 4	2 5
Black Tea	0 3	0.7	0 1	0.3
Coffee	16.4	19 5	15 3[a]	16 9[a]
Others *	0.8	0 8	1 0	1.0
Cattle	0.8	1 0	0 9	1 2
Total	55.7	61 5	51 1	55 1
Forestry	10.9	12.3	12.6	14 4
Manufacturing Industry				
Industries	21.3	24 5	20 2	22 7
Foodstuffs, beverages and tobacco	14.3	16.8	14.9	17 5
Sawn wood, fittings and fixtures	14.5	15.8	13 2	13 8
Others	13 1	14.7	16.3	18 6
Total	63.0	71 8	64.5	72 6
Total Value of Production	129.6	145.6	128.2	142.1

Note. * Fisheries inclusive

Manufacturing industry occupies the largest share in the total value of production. While the rapid development of manufacturing industry is contributing largely to the expansion and diversification of P.N.G.'s economy, equally large contribution is made by agriculture and animal husbandry. Estimated production value surpassed the planned value in the two fiscal years. Viewed sector-wise, however, estimated production value of agriculture exceeded the planned value but that of forestry and manufacturing industry fell short of the planned value.

By such remarkable growth of various industrial sectors, income from agricultural crops gained an increase of 20 % , wage level rose by 16 % , so that the income standard of the territory's inhabitants was elevated and individual disbursement for consumption increased by 19 % and yet the consumer price remained fairly stabilized. Further, the scale of foreign trade continued expanding, with export recording an annual growth rate of 20 % and import 40 %.

This animated economic condition called for the employment of skilled and semi-skilled labourers. Though the number of labourers being trained into skilled and semi-skilled labourers is rapidly increasing, the pressing demand for skilled and semi-skilled labour force is a problem faced by various industrial sectors at present.

2) Background and Measures for Development

i Political Development

The major role committed by Australian Government for P.N.G. under the Charter of the U.N. is to expedite the political, social, economic and educational development of the territory and open the way for the territory's self-government and ultimately for its full independence. In line with such fundamental policy, the greater part of political and economic responsibilities was already transferred to P.N.G. from Australian Government. Therefore, P.N.G. is now in the important stage of political and economic progress. To be more precise, Australian Government revised the P.N.G. Law in 1966, whereby the membership of the territory's Assembly was increased from 64 to 94 (of which 84 are elected members and 10 are official members. In 1968, the second general election was held and 84 assemblymen were elected from 69 open electoral districts and 15 local districts. The local electoral district embraces two or more open electoral districts, and the minimum educational level required of the candidates is that they should be junior high school graduates or have equal level of education.

The ordinances passed by the Assembly must be approved by the Administrator of P.N.G. and occasionally by the Governor-General of Australia, but the approval is not given though on very few occasions.

The major administrative organ of P.N.G. is the Administrator's Executive Council which is composed of the Administrator, three official members, seven Ministerial Members, and a number of assemblymen nominated by the Administrator. Nine assemblymen are also nominated to act as vice ministers. The Ministerial Members assume the highest responsibility for the Administrator's Executive Council. The majority of the authority of the Australian Ministry of External Territories was transferred to the said ministers and vice-ministers in 1970. These assemblymen are therefore making decisions on a wide range of government activities in P.N.G.

Recently, the P.N.G. Assembly agreed to a number of recommendations made by a sectional committee which mapped out the general time schedule for the territory's constitutional development for independence, and the Australian Government also accepted the recommendations. It is accordingly expected that the Australian Government will be demanded to prepare an overall plan for P.N.G.'s self-government during the term of office of the assemblymen who will be elected by the third general election in 1972. However, how the said plan will be implemented will depend on the views of political leaders elected by the 1972 general election and the public opinion after the election.

ii Government Finance

The government disbursement is controlled by the Administration of P.N.G., P.N.G. Statutory Authorities (such as electric committee), Australian Government offices and Statutory Authorities.

The 1971 budget of the Administration is as follows.

Unit: A$ million

Total expenditure	181
Resources	
Revenue	74
Loans (incl. World Bank Group)	31
Aid from Australia	76
Total	181

In addition, the following disbursements were made.

	Unit: A$ million
Total disbursement of Australian Government for 1970/71 -	253
Disbursement for public works (incl. A$ 30 million disbursement of the Administration)	43
Budgetary aid to P.N.G.	
Aid for ciruclation and small scale enterprises	33
Development aid for roads, ports and harbours, building construction, and other specific projects	37
Loans for special projects	16
	86

In 1970/71, Australia's economic aid to P.N.G. amounted to A$131 million.

Besides the aid from Australia, the following loans are advanced to P.N.G. by the World Bank,

	Unit: US$ million
Development of telecommunication	7
Agricultural development	6
Highway construction in highland areas	9
Hydro-power development	23

It is expected that loans will be advanced by the World Bank or special subsidy will be provided by Australian Government if the Administration finds it necessary to raise fund or conclude a special agreement for loans for the proposed fisheries products processing complex in Madang district.

iii Social Development

a. Education

Primary and junior high schools are run by the Administration and a number of missionary societies, and these schools were brought into a unified educational system in July 1970. The long-range objective of education in P.N.G. is to establish a comprehensive educational system covering the entire territory. When such system is established, elementary education will be given to all the people and higher education will be given to every capable student.

At present, P.N.G. has the following educational facilities which are all higher than junior high school. Expectation is placed on the activities of these facilities.

Facilities	Location
University of P.N.G.	Port Moresby
Higher Technical Training Centre	Lae
Papua Medical College	Port Moresby
Vudal Agricultural College	Keravat
Forestry School	Bulolo
Junior High School Teachers' Training College	Goroka

Indigenous people of P.N.G. have long been divided into many small tribes differing from each other in race, culture and language and severed from each other by topographical conditions such as steep mountains. It is said that more than 700 different languages are spoken in the territory. For diffusion of a common language, therefore, stress is placed on the education of English.

b. Public Health

Medical network covering the entire territory and embracing hospitals, village health centres, first-aid stations, mother and child health centres is formed by the Administration and missionary societies receiving financial aid, with services offered by indigenous medical staffs. In the aspect of medical treatment, however, the territory still resorts to higher class foreign medical practitioners and nursing staffs. The Department of Public Health therefore attaches importance to the development of preventive hygiene, medical training, and child and maternal health.

c. Housing

The Administration offers houses to its staffs and the Housing Committee is constructing houses for individuals in major cities. Houses constructed by the committee before June 30, 1970 numbered 397. It is hoped that the building houses for workers employed will start by private enterprises.

d. Employment

Unskilled labourers can be usually recruited sufficiently in P.N.G. However, enterprises employing them will be required to train them before putting them on the production line. The fundamental policy adopted by the Administration is that development of the territory should be so promoted that indigenous people will be given employment opportunity at any place, and that foreigners should be employed only for the work which requires relatively high skill and cannot be fulfilled by indigenous workers. In this connection, it deserves attention that a bill limiting the entry of foreign employees into P.N.G. in case indigenous workers are employed or likely to be employed was submitted to the Assembly. It may be added that the bill stipulates that the entry of foreign employees will be approved under specific circumstances if the enterprise in view agrees to undertake the training of indigenous replacement workers.

e. Investment Policy

In P.N.G. it is considered necessary to induce foreign capitals to accelerate investment and materialize greater economic growth. Both Australian Government

and the Administration adopt the policy for encouraging foreign investors to promote development projects. Though foreign investment is thus welcomed in P.N.G., the government considers it necessary to check if a foreign investment plan conforms to the plan and policy of the government and therefore reserves the right to give approval after such screening.

Capital input in P.N.G. by foreign investors is therefore considered to serve to -

a) promote the development and sound utilization of the territory's resources;

b) contribute to the territory's development by a sound and balanced approach conforming to the general economic development plan;

c) Provide fair opportunity for local enterprises and capitals to participate in specific projects including the development of natural resources;

d) offer employment and training opportunities for indigenous people

e) promote the processing industry of P.N.G.;

f) involve the enterprises in the provision of maximum common user facilities (such as roads, ports and harbours);

g) promote the territory's development for its economic independence;

h) provide external economic activities; and

i) accelerate export.

f. Participation of Indigenous People

In the territory's development scheme, importance is attached to the opportunity for indigenous people to share in the ownership and management. To put in more detail, if indigenous people or the Administration acting in behalf of them are not given a fair chance for participation in a development project, the government has the right to reexamine the agreement concluded between the Australian company and the foreign investor in view. The government will give special consideration to the present and future investment plan for the employment and training of indigenous workers.

g. Investment Company of P.N.G.

A bill for establishing an investment company in P.N.G. passed the Assembly. It is expected that the company will provide the means to acquire the share in the ownership and management of major projects financed by foreign capitals.

The company is also expected to upkeep the 'equity' it attains in enterprises for future transactions with indigenous people, and will at the same time study, for selection of projects in which it participates, the economic soundness and the degree of contribution to the territory's development of respective projects.

h. Incentives to Investment

The following incentive measures are taken in P.N.G. to promote foreign investment.

a) Free transfer of capital and profit

b) Application of low tax rates to corporations and individuals

c) Special measures for alleviating taxes on mining, timber and agricultural production

d) Special exemption from taxes for a certain fixed period for enterprises occupying themselves with pioneer projects.

e) Complete exemption from P.N.G.'s income tax for five years for pioneer work

f) Exemption from tax on dividends paid by companies earning profits from pioneer activity (tax exemption in Australia is applied to dividends paid from pioneer profit to those living in Australia).

g) Application of protective tariff where warranted

h) Provision of credit loans through P.N.G. Bank on reasonable conditions

i. Declaration of Guarantee of Development Fund

P.N.G.'s attitudes towards foreign investment is expressly manifested in the Declaration of Guarantee of Development Fund which was carried at the Assembly in 1966 and reconfirmed in 1968.

It is stated in the Declaration that 'foreign capitals shall be welcomed, and shall be free from the application of expropriation, restrictive trade regulations, unreasonable restriction on transfer to the country of investor, or any other discriminative measures'.

3) Development Scheme of P.N.G.

In 1968, the P.N.G. Assembly approved the Five Year Development Plan for 1968/69 to 1972/73. The fundamental objectives and aims incorporated in this plan are as follows.

1. Cultivation of coconuts, cocoa, rubber, tea, and oil palm in an area of 280 thousand acres

2. Attainment of annual increase rate of 50 % or more of resettlement of indigenous people for production of major crops

3. Threefold increase in the production and export of timber

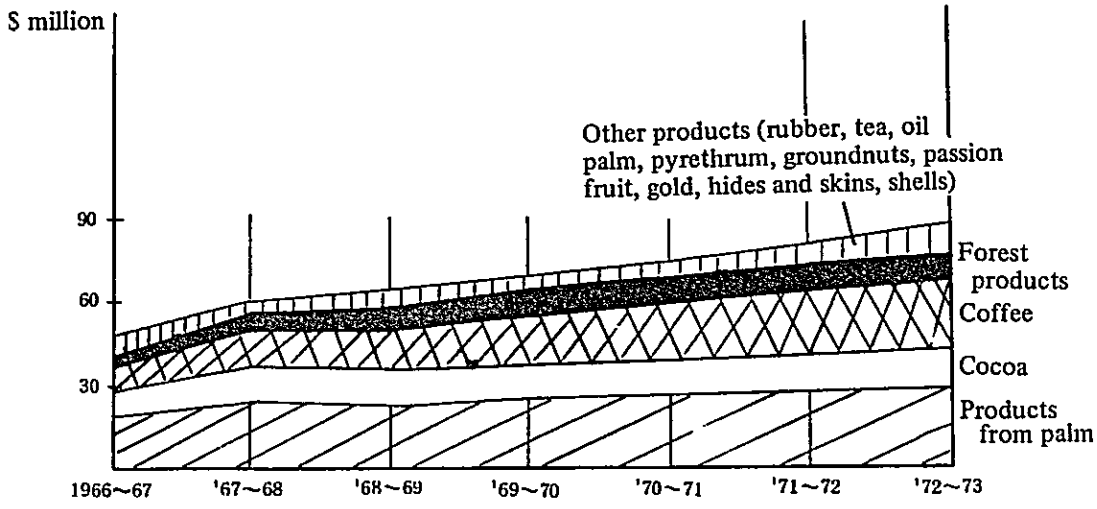
4. Twofold increase in the value of production of manufacturing industry

5. Twofold increase of junior high school graduates, and fivefold increase of graduates from colleges, teachers' training schools and higher technical training institutions

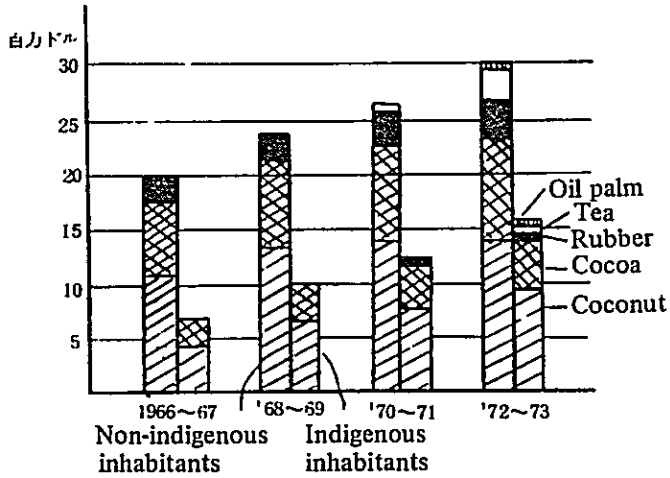
Thus, the Five Year Plan aims primarily at accelerating the economic expansion and participation of indigenous inhabitants in various development schemes.

Past achievements and future development plan in the aspects of export, production of major agricultural crops and resettlement for agricultural production are as illustrated below.

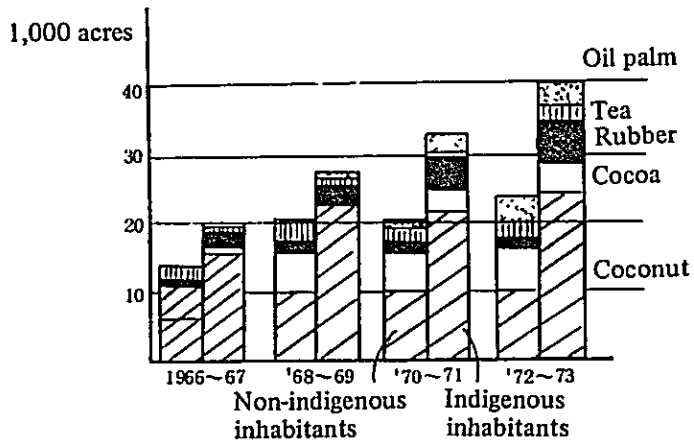
Export Plan



Agricultural Production Plan



New Resettlement Plan for Agricultural Production



Among a number of development plans mentioned above, the development plan mapped out for agriculture, animal husbandry and fisheries is designed chiefly for the increase and diversification of production, augmented participation of indigenous people in the production intended for marketing, provision of increased employment opportunities for indigenous people, and extension of sound and improved farming techniques for productivity improvement. Fisheries in the territory have made substantial progress in recent years but are still in the initial stage of development. Efforts are therefore directed towards attaining self-sufficiency of fisheries products and fostering small scale fisheries operating on a commercial basis.

A minor revision was effected in 1971 to the Five Year Plan due mostly to the development of copper mines of Bougainville which recently recorded a production surpassing the target value, but the fundamental objective of the plan remains the same. In reexamining the plan to effect the said minor change, due account was taken of the following.

1. Estimated GNP in the final year of the plan (1972/73) is about $800 million.

2. Production of manufacturing industry is estimated to grow at an annual rate of 16 % until 1972/73.

3. Production of vegetables, rice, cereals, pigs and poultry whose supply has so far depended on import is estimated to show a large increase.

4. Regular resettlement plan is to be enforced only for the development of oil palm, cocoa, coconut, tea and rubber, with efforts continuously exerted for overall agricultural development.

5. Falling, sawing and wood processing industries are to be developed in an integrated system, with prime efforts directed to the development of wood chip production and replanting work.

6. Receipts from export are estimated to be doubled in 1972/73 by the development of Bougainville's copper mines.

7. Maximum efforts are to be made to assign indigenous people to administrative, managerial and expert posts in both public and private sectors.

In addition above, intensified fisheries production was being planned to satisfy the demand which has so far resorted to import, and fisheries development for export through construction of large scale canning factories was also studied.

(2) Fisheries Stock in P.N.G. Waters

1) Fisheries Stock in P. N. G. Waters

A great variety of fish species living in the P. N. G. waters are listed in 'The Fish of New Guinea' published by the Administration of P. N. G. However, insofar as has been clarified by the survey of markets and landing places, species caught by fishing operations are limited to larger ones and small in number. Major fishes caught are Spanish mackerels, barracuda, trevallies, mullet, mackerel, skipjacks and tunas, rock cods, sea perches and emperor and trigger fishes.

The P. N. G. waters provide international fishing grounds where prawns, skipjack, and off-shore tunas are being caught. Skipjack fishery has been rapidly developing since 1970, and importance is attached to the stock of this fish for future development. The survey was therefore conducted with stress placed on this fish.

Fresh water fishes having commercial value are tilapia and shrimps. It is believed that tilapia is available in large quantities and there is room for its propagation by transplanting. At present, however, it is impossible to foresee the amount of fishcatch. The freshwater shrimp at Sepik grows to a large size and is suited for culture as its eggs can be artificially hatched. It is therefore hoped that studies will be made in future on these two species.

In addition to these fish resources, there are such export items as some marine shell-fishes, cultured pearl, prawns, and crocodile skin.

2) Stock of Skipjack

i Stock in the Pacific Ocean

The FAO statistics indicate that the world's total catch of skipjack is about 250 thousand tons. However, because of the error involved in the said statistics, fisheries experts estimate the catch at about 300 thousand tons.

Skipjack is distributed in all high temperature zones of the world and is being cauht chiefly by Japan and the United States. Sea areas already developed for skipjack fishery are the northwestern and eastern sea areas of the Pacific Ocean.

Distribution of young skipjack and fries, as pointed out in the data of the Far Sea Fisheries Research Institute of the Japanese Fishery Agency, is abundant in the sea area between lat. 20° S and lat. 20° N of the Pacific Ocean. Smaller types of skipjack measuring 40 to 50 cm in full length are known to be making large migration in the Northern Pacific, so that their distribution is extended up to L. 40° N. The migration in South Pacific, however, is not known yet.

The stock of skipjack in the Pacific Ocean is estimated to be considerably large from the fact that fries of skipjack are frequently contained in the stomack of large tunas, the catch in the existing fishing grounds is substantially large, and many thick schools of skipjack are observed by fishing boats.

Skipjack fishery in the western area of the Pacific is carried out mostly by Japanese fleets. During the February - September period, Japanese fishing boats carry out skipjack fishery by following the skipjack schools which migrate northward from South Pacific seas to Japanese seas, and in the remaining period of the year, they are engaged in fishing operation in the Micronesian fishing grounds where skipjack is constantly found. The catch of skipjack by these Japanese fishing boats is about 160 thousand tons in the migrating fishing grounds and about 40 thousand tons in the Micronesian fishing grounds. The smaller catch in the Micronesian seas is considered attributable to the difficulty which fishing boats encounters in obtaining sufficient bait fishes.

It is said that the fishing grounds of skipjack are generally found in areas where the current is agitated by such oceanographic configuration as is observed near land and islands, around the demarcation line between cold and warm currents, and near the convergence line of Japan Current and reefs.

ii Stock in P. N. G. Waters

Except for the full-scale fishing operation in the Bismarck Sea which was initiated inMarch 1970, no large scale skipjack fisheries have yet been conducted in other parts of the waters of P. N. G. including the Solomon Sea and the Coral Sea.

Characteristics of skipjack schools in the Bismarck Sea are as follows.

a. The weight ranges from 3.0 to 5.0 kg, and the schools are composed of fishes with an estimated age of two or three years.

b. Fish schools are denser near the coast, becoming thinner towards the offing.

c. Catch is subjected to a large fluctuation, with the daily catch per boat (40 - 50 tons) ranging from zero to 10 tons.

d. A large difference exists between different parts of the sea in the daily catch and full length.

iii Estimation of Stock of Skipjack

Estimation of a fishery stock is not possible without the data on amount of catch, size and weight of fishes, meteorological, sea and other conditions conductive to the formation of fishing grounds, follow-up survey of migrating fishes, etc. which are obtained by a survey conducted for a period of at least three years. The common practice is to utilize such data to calculate the production, survival rate, mortality rate, and rates of recruitment and dispersion in each fishing ground so as to estimate the fisheries stock and yearly catchable stock in a specific sea area in view. However, since this method is impracticable in the present case due to the absence of data, an estimate must be made by an expedient explained below.

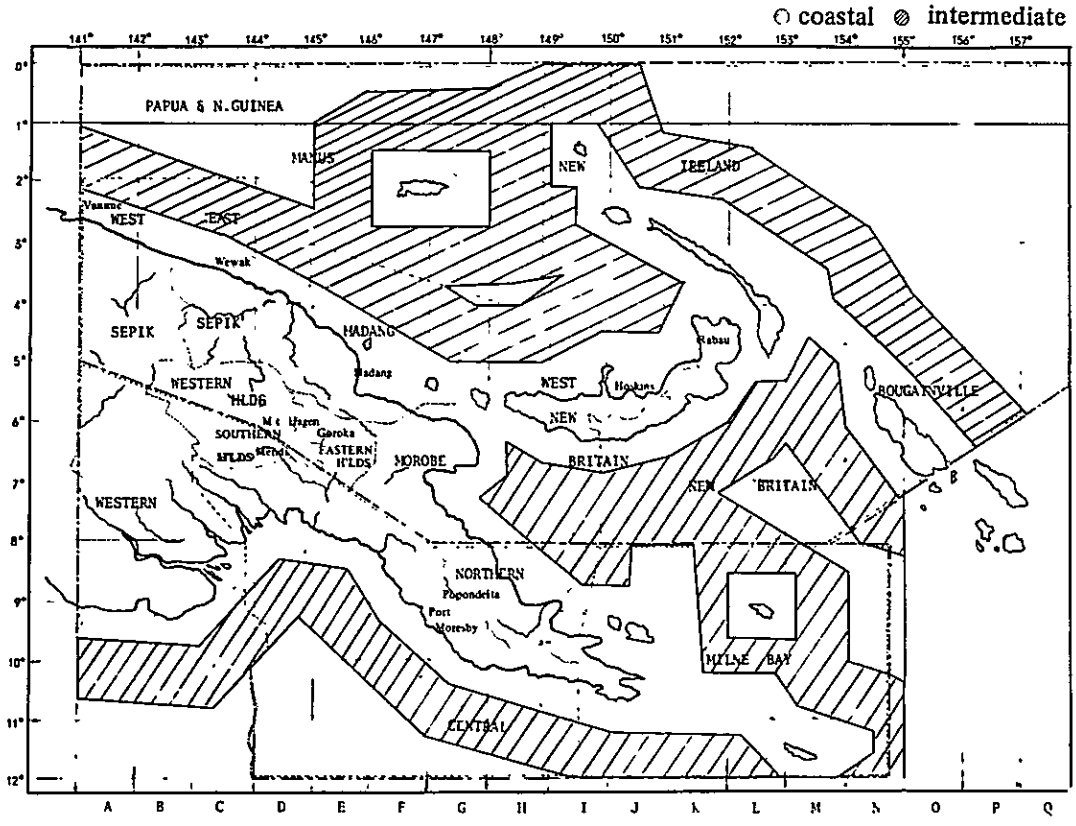
To be precise, the productivity (abundance) of the fishing grounds in the waters of P. N. G. is represented by that in a similar sea area (Micronesian Sea in this case), and the yearly catchable stock is estimated by multiplying the area of P. N. G. waters by the productivity of fishing grounds in Micronesian Sea. Application of this method, which is a very simple expedient and therefore involves errors, discloses the yearly catchable stock is 65,000 tons as tabulated below.

Item / Sea Area	Productivity of Micronesian Fishing Grounds* (tons)	Area of P. N. G. Waters (blocks)**	Yearly Catchable Stock in P. N. G. Waters (tons)
Coastal Area	944	40	37, 760
Intermediate Area	380	60	22, 800
Off-shore Area	99	47	4, 653
Total	-	-	65, 213

Notes: * Source - Shizuoka Prefectural Fisheries Experimental Station
** 1 block = long. 1^{0} x lat. 1^{0}

The catchable stock given in the above table is a very rough value which only serves to cope with the present lack of data and was calculated without any regard to the difference existing between the two sea areas in various factors relating to oceanography, meteorology, fish fauna and other aspects. It should therefore be corrected by future scientific studies.

Coastal, Intermediate, and Off-shore Areas of P. N. G.



3) Bait Fishes

Bait fishes used for skipjack fishery in P. N. G. waters are tusiliers and anchovies. Characteristics of these bait fishes are as described below.

Anchovy: Anchovies found in Japan live in shallow sea subjected to the inflow of fresh water while young, but as they grow larger, they migrate in coastal sea areas. When a year passes after hatching, they start spawning activity which takes place twice each year. Anchovies used as bait are young ones measuring about 10 cm in full length whcih are caught by purse seine net in coastal waters. In P. N. G. waters, anchovies are found abundantly in coastal waters and in smaller quantities around off-shore islands. The survey revealed that while smaller fishes live in shallow sea, large ones are observed in coastal and off-shore areas. Anchovies in this sea area are therefore considered similar in nature to those found in Japanese waters. Nothing definite is known about their spawning activity, but it is believed that they spawn at short intervals.

Sprat: This fish is distributed widely in P. N. G. waters and is found around off-shore islands where the salinity is higher than in the shallow sea in which anchovies live. Since this species is not suited for preservation, it serves as a good bait for fishing operations conducted for a limited time in high salinity waters.

Tusilier: This fish lives in high salinity waters, but young fishes belonging to this species live in shallow sea where they are caught and used as bait. Tusilier is highly evaluated as bait fish because it can be readily preserved and transported alive for one thing, and skipjack prefers it to any other kinds of fishes for another. Drawbacks about this bait fish are that despite its widespread distribution in P. N. G. waters, its catch is subject to seasonal fluctuation because young fishes alone are used as bait, and that no sizable catch can be guaranteed due to its nature to gather in reefy waters.

Hardyhead: This species is widely and abundantly found and is also suited for preservation. It therefore appears an ideal bait fish, but skipjack does not prey on it well.

As will be clear from the above description, constant supply of bait fishes calls for surveys and development of fishing grounds, improvement of fishing techniques, and development of preservation methods.

(3) Fisheries Development

1) General Condition of Fisheries Development in P. N. G.

i Existing State of Fisheries

Until quite recently, fisheries in P.N.G. were carried out to satisfy the local demand and the estimated annual catch was in the neighbourhood of 10 thousand tons. However, the annual catch increased to 16 thousand tons in the 1960's.

The P.N.G. waters are siad to be inhabited by more than 1,400 fish species. However, commercial fisheries are limited to the prawn trawling along the coast of Papua and the experimental skipjack pole and line fishing which commenced in 1970 in Bismarck Sea. Fisheries in the waters of P.N.G. therefore comprise, for the most part, the canoe fishing using traditional spear, angling, dragnet fishing, beach seine fishing and fixed net fishing. The canoe fishing is conducted by about three thousand fishing boats equipped with an outboard engine having an average horsepower of 20 HP and a large number of boats without engine.

The situation being such, the Administration of P.N.G. has established a fisheries training centre which is intended to assure coastal fishermen of increased catch and higher living standard and encourage commercial fisheries operators to introduce improved fishing gear and fishing techniques.

Since the centre was established to provide fisheries training at one place, it is located in Madang district on the northwestern coast of New Guinea. In this district, the effect of winds and waves can be averted and there is a large port.

Most of fisheries officers receiving training at this centre are from Vudal University and Agricultural Training Institute at Popondetta in the northern part of Papua. They have already completed the training course for extension of improved agriculture and are being given special training to acquire the qualifications for regional fisheries officer.

The carriculum at the centre includes maneuvering and control of fishing boats, fishing method and navigation training. The training is given within the safe Madang Port area in the initial stage, and later outside the port. The trainees also receive lectures on ship-building techniques using wooden materials, aluminum, steel and cement as well as on oil and diesel engines. Techniques on fishing gear are given importance in their training course. In addition to these, they are given information on fisheries products processing and marketing.

Trainees who have completed the training course are assigned to new posts at field stations or substations and serve under the guidance of experienced fisheries officers, and on certain occasions they work with the aid of one or two assistants.

English is used for the training at the centre. Most indigenous people, however, speak neither English nor pigeon English and usually resort to one or other of the 700 local dialects for their mutual communication. Further, they are imbue, with the traditional fishing practices inherited over many centuries in the past and refuse to take to the new method unless they are brought to be convinced of its advantage. The fisheries officers are therefore required to demonstrate the new method for the indigenous people so as to carry conviction to them.

As regards technical extension, credit loan is offered by the Development Bank and cold storages and marketing facilities are installed for indigenous fishermen, with endeavours also made for the improvement of their fishing boats and gear. For accelerating the diffusion of improved fishing techniques, daily extension service is given at different places in the coastal area and this is participated by fishermen employed in fishing villages on the daily basis and small scale commercial fisheries operators.

Besides the above-mentioned activities, investigations and studies are being carried out on the inland water fisheries. In inland areas, particularly in highland areas, fish culture centering on carps is conducted in culture ponds to supply the inhabitants with fisheries products.

There are two prawn fishing establishments operating with the capital participation of foreign enterprises, one Kuwait and the other Norwegian. The Kuwait-participated company has 30 fishing boats and the other 10 boats. It is reported that the prawn fishing conducted by these fishing boats in Papua bay is not successful.

ii Development of Marine Fisheries

Fish species which are widely distributed and caught in P. N. G. waters and which have a high commercial value are tunas, skipjacks, prawns, spanish mackerel, mackerels, groupers, perch, trevally and mullet.

Outlet of these fish species excepting tunas, skipjacks and prawns is found only within the territory, but the marine products have little local demand and their market price is generally high relative to other foodstuffs.

The desired fisheries development calls for the productivity improvement, increased fisheries production, consolidation of marketing situation, price reduction and increased demand for fishes. For this purpose, the following measures should be implemented in an active and progressive manner.

a) Survey of fishing grounds and stock of important fish species

b) Tests and experiments for the development of suitable fishing boats, fishing gear, fishing method and techniques

c) Extension of fishing gear and fishing method and techniques developed by tests and experiments

d) Researches for preserving marine products and processing them to the taste of customers

e) Modernization of fisheries by introducing joint fisheries and by organizing fishermen

f) Installation of facilities for preserving and processing marine products

g) Administrative and financial measures for the accelerated implementation of the above measures

iii Development of Inland Water Fisheries

The inland water fisheries carries a heavy weight in the fisheries of the territory. Major species of fresh water fishes caught in rivers, lakes and ponds are baramundi, tilapia, carp, cat-fish and eel. Of these fish species, tilapia available in the basin of the Sepik deserves attention as it promises an abundant unexploited stock. Introduction of four-armed scoop-nets and beach seine is expected to augment the fish catch and should therefore be studied together with the utilization and processing method of fishes.

2) Development of Skipjack Fishery

i Development of Skipjack Fishery and Problems

In view of the limited domestic demand for fisheries products, fisheries development in the territory should be promoted with stress placed on the increased catch of skipjack which has a high commercial value on the world market.

With this in view, the experimental skipjack pole and line fishing was commenced from March 1970 in Kavieng and from January 1971 in Rabaul, Manus and Madang districts. The experimental fishing so far conducted in these districts has exposed the following problems.

a) The catch per fishing boat per day obtained by the three private fishing establishments was as follows.

Kavieng: 2.7 - 6.4 M/T (average from March 1970 to April 1971 - 4.08 M/T)
Rabaul: 3.9 - 6.0 M/T (averageffrom January to May 1971 - 4.83 M/T)
Manus and Madang: 2.2 - 4.4 M/T (average from January to May 1971 - 3.85 M/T)

As will be clear from the above figures, the catch is subject to a large fluctuation.

b) The unstable supply of bait fishes makes it difficult to carry out the fishing operation on a stabilized basis.

c) Since the bait fishes must be caught by fishing boats, heavy work load imposed on the crew.

d) Extensive coverage of fishing grounds by the experimental fishery is made impossible because bait fishes do not live long in the hold.

Development of the skipjack fishery into a stabilized industry of the territory therefore calls for the surveys of stock as well as for the following research and development efforts.

a) Survey of unexploited sea area

b) Clarification of ecology, migration and fishing grounds of skipjack in the P. N. G. waters for the establishment of a stabilized and year-round fishery

c) Research and development of fishing gear, fishing method, and techniques for catching bait fishes

d) Research and development of preservation techniques of bait fishes in sea and in the hold

e) Division of bait fish fishery and skipjack fishery

The desired development also calls for the training of indigenous fishermen on the fishing method and for the establishment of indigenous skipjack fishery through their participation in the skipjack fishing and processing industry to be established in future.

The survey conducted in the Bismarck Sea revealed that the commercial skipjack fishery by purse seine will entail many difficulties because of the small size of skipjack schools, small vertical difference in sea water temperature, high sea water transparency, and existence of many reefs. Further, the high catchability coefficient incidental to the purse seine fishery is considered to give an adverse effect on the catchable stock of skipjack and invite undue competition between the fishing boats in skipjack fishing grounds. Introduction of this fishing method must be effected after clarifying the catchable stock and with suitable measures taken for the prevention of competition between fishing boats.

ii) Bait Fish Fishery

In the experimental fishery now being conducted by the three private fishing enterprises, the bait fishes for skipjack pole and line fishery are caught along the shore where the water depth is smaller than 40 m by the stick-held dip net fishing and drive-in net fishing. The catch of bait fishes which comprise anchovies and tusilier is subject to fluctuation and is not large enough to meet the demand of skipjack pole and line fishery. This unstable catch of bait fishes is the largest restrictive factor in the experimental fishery currently carried out.

Constant supply of bait fishes is thus the prime factor that determines the future development of skipjack fishery. Hence, the following researches and developments should be implemented as early as possible.

i) Development of new fishing grounds of bait fishes

ii) Improvement of stick-held dip net fishing method

iii) Research and development of advanced techniques to be introduced into purse seine fishing, haul net fishing and fixed net fishing

iv) Establishment of a fishery intended solely for bait fishes with the cooperation of indigenous fishermen

v) Research and development of techniques of preserving bait fishes both in sea and in the hold

iii) Number and Scale of Fishing Boats

Number of fishing boats engaged in the experimental skipjack fishery in P. N. G. waters on a commercial basis totals 17 as of August 1971 (8 in Rabaul, 4 in Kavieng and 5 in Madang). All these boats have a gross tonnage of about 40 tons, and are operating within a distance of 50 miles from the mothership (freezing carrier with a gross tonnage of 900 - 1,200 tons) to which the catch is carried each day.

The experimental fishery, which has been carried out only for a short time in the past, must be continued for at least three years to get a clear perspective of the payability of skipjack fishery since the migration of surface fishes is subject to a large annual fluctuation. At the present stage, the migration and fishing grounds of skipjack have not yet been brought to light, nor is the constant supply of bait fishes promised. Hence, there are too many in determinate factors to estimate the optimum number and scale of fishing boats. Conversely, however, both the period of operation and coverage of fishing ground will be extended and a larger and stabilized catch will be guaranteed if the constant supply of bait fishes is ensured and improved preservation techniques are introduced. When these improvements are

made, fishing boats will naturally be required to be sufficiently large and efficient and their optimum gross tonnage, as estimated from the experience gained in Japan, will be from 150 to 250 tons.

As things stand now, however, employment of large fishing boats is not expected to result in productivity improvement because the period of voyage and operation is restricted. The currently practised mothership-type fishery should therefore be continued for the experimental fishery in the skipjack fishing grounds and for stabilizing the supply of bait fishes.

Difficulties are entailed in estimating the optimum fishing effort (number and scale of fishing boats), but it does not seem imperative, by reason of the outcome of the experimental survey and the estimated catchable stock in P. N. G. waters, to hold the fishing effort at the present level. It is considered appropriate to intensify the fishing effort by degrees while directing efforts to the survey on catchable stock, development of unexploited sea areas, and clarification of operating conditions and trends in fish catch.

(4) Demand and Supply and Marketing of Marine Products in Papua and New Guinea

1) Demand and Supply

With the exception of the limited urban areas, the area under review is in a self-sufficient economy and conditions are still immature for the development of marketing mechanism of fresh and frozen marine products. Fisheries products are supplied either in fresh fishes which are caught by the inhabitants near the coasts and rivers for their own consumption or in canned fishes which are marketed to urban dwellers.

In 1969, 55 per cent of marine products consumed in the territory (in which raw fish landing accounted for about 37,000 tons) were imported canned fished amounting to about 9,000 tons. Import of these canned fishes has shown an increase of 50 per cent in the past five years and the greater part of them are canned mackerel in salt water imported from Japan. This indicates that the inhabitants in the territory have a strong liking for canned fisheries products.

As for the export of fisheries products from P. N. G., it is anticipated that a substantial amount of fishes and some frozen products including prawns will be exported as the annual frozen skipjack production of 15 thousand tons is planned by the experimental pole and line fishing which has recently been commenced by fishing companies established by joint capital investment of Japanese private fishing establishments and Australian concerns.

Demand and Supply of Fisheries Products in P.N.G.

Unit. ton

Item \ Year	1964/65	1969/69
Domestic Demand (in terms of raw fish weight)	18,566 (25,765)	26,079 (36,881)
Import		
Fresh and Frozen Fishes	81	142
Salted and Smoked Fishes	11	19
Canned Fishes (Canned Fishes in terms of raw fish weight)	5,999 (13,198)	9,002 (19,804)
Domestic productui	12,475	16,916
Overseas Demand	25	84
Export	25	84
Total	18,591	26,163
(Total in terms of raw fish weight)	(25,790)	(36,965)
Per Capita Supply	11.8 kg	17.0 kg

2) Marketing of Skipjack and Tuna

Skipjack and tuna caught in P. N. G. waters do not find their outlet in local districts because of the limited demand for fresh and frozen fishes and high price of canned fishes. It is therefore an imperative to find their outlet in overseas market. It is expected that frozen skipjack can be marketed without difficulties in large consuming countries like the United States and Japan where the demand is very strong, but canned skipjack will encounter severe competition with the products of other countries and will therefore be demanded to be reasonable in price and better in quality. Since the United States imposes strict quality control on imported canned fishes, stress must be placed on the production of canned skipjack in oil for the coming several years for export to European countries where the marketing is easier and demand is high.

Canned flake meat of skipjack, which is a by-product of the planned processing industry, would be considered salable on the world market. Its marketing in local districts, however, will encounter some difficulties since it is virtually absent on the local market and cans containing full size and chunk style mackerels are marketed in large quantities to the taste of indigenous inhabitants.

4. Project Plan

(1) Purpose of Project

The project aims at the accelerated economic development of P. N. G. through establishment of a fisheries product processing complex which serves to provide increased employment opportunities to indigenous people and contributes, at the same time, to increase foreign currency earnings through export and to augmented intra-territory supply of processed fisheries products.

(2) Project Organization

As the project is a commercial undertaking, its management should be organized on a commercial basis. Further, to ensure its smooth and efficient operation and administration, a total of three executive staffs besides the president should be assigned to administration, canning plant and cold storage, respectively.

(3) Outline of Project

1) Kind of Project

The project undertakes the production of canned fishes using skipjack caught in the P. N. G. Sea Area and other related works.

2) Site of Project Implementation

The project is to be implemented for the operation of a fisheries product processing complex to be established near Sek Harbour in Madang district, P.N.G.

3) Commissioning of Project

Construction and consolidation of the fisheries product processing complex planned under the project is to be initiated in 1972 for commissioning schedule for 1974.

4) Scale of Project

The fisheries product processing complex to be established under the project is to have the following facilities and capacities.

1 Canning Plant	:	Capacity - 2 lines (2 x 850 cases/day, each case containing 4 doz. of tuna No. 2 cans)
1 Cold Storage	:	Capacity - 500 tons
1 Fish Meal Plant	:	Capacity - 10 tons/day
1 Generating Facility	:	Capacity - 480 kW
Piers at 1 place	:	Metal and wooden fixed pier - 20 x 4 m Metal and wooden floating pier - 10 x 4 m
6 Cars	:	2 6-ton trucks 1 passenger car 1 microbus 2 forklifts

5) Construction and Consolidation of Facilities

In the initial year of the project, the canning plant, cold storage, fish meal plant, generating facility and cars are to be constructed, procured, and consolidated. The canning plant will be furnished with one line of canning machinery in the initial year and another line in the third year in consideration of the expected rate of its operation.

6) Operation

For the operation of the complex which is intended primarily for the production of canned fishes, foreign engineers will be employed to provide technical training to indigenous workers in the initial stage. During the three year period from the second year (year of commissioning) to the fourth year, efforts will be directed to the constant supply of fishes, improvement of technical level and marketing so as to increase the rate of operation by degrees for full-scale operation in the fifth year.

Item / Year	Production of Canned Fishes in Oil	Production of Canned Flake Meat	Total	Rate of Operation
	cases	cases	cases	%
2nd	65,000	13,000	78,000	15
3rd	130,000	26,000	156,000	31
4th	260,000	39,000	299,000	59
5th	422,000	66,000	508,000	100
↓	↓	↓	↓	↓

With the improvement of workers' technical level, the yield rate in the production of canned skipjack in oil, the main product of the complex, is expected to rise as tabulated below.

Item / Year	Material Requirement for 1 Case of Canned Skipjack in Oil	Yield Rate
	kg	%
2nd	23	42
3rd	21	46
4th	20	48
5th	20	48
6th	19	50
↓	↓	↓

7) Training of Workers

As will be described later, the canned skipjack which is the main product of the complex is expected to face competition with the similar products of the United States, Japan, Italy and France on the world market. This means that the marketing of the complex's products must be backed up by improving the canning techniques up to the international level. For this reason, three technical trainees for each of the five stages of production process (cooking, cleaning, packing, measuring and seaming and retorting will be selected from among the indigenous employees for overseas six-month training in 1973. These 15 trainees are to serve as the technical staffs of the complex.

For technical training of the indigenous workers, the complex will have eight foreign engineers during the four year period after commissioning. Number of these foreign engineers will be reduced to four in the fifth year and to zero in the seventh year as they are to be replaced by indigenous technical staffs from the fourth year.

8) Supply of Material Fishes

Survey of the skipjack pole and line fishery currently conducted in the P. N. G. waters disclosed that the sea and fishing conditions incurred an extreme fluctuation of catch. Operation of the projected canning plant, on the other hand, calls for the constant supply of skipjack to meet the planned daily production capacity. To attain a balance between the supply of skipjack and the plant operation, therefore, it is imperative to install a cold storage facility capable for storing a minimum required quantity of fishes.

The existing condition of fisheries carried out in the vicinity of Madang district where the plant is to be established does not promise the supply of the necessary quantities of skipjack. Therefore, in securing the skipjack, as seen at each base of Samoa etc., it should be considered to get fish landings by means of attracting foreign boats. Besides, raw material fish would have to be transported in Madang from other P. N. G. areas. In this case, raw material frozen skipjack would be loaded aboard a freezing carrier-boat and be transported from the fishing bases such as Rabaul and Kavieng or directly from fishing grounds.

To secure the constant supply of fishes of good quality, skipjack is to be purchased at a commercial price determined for each district on the basis of the world market price.

9) Products and Marketing

Canned skipjack is the main product obtainable by the skipjack processing. As by-products of skipjack canning, canned flake meat and fish meal are also obtainable. The canned skipjack must find its outlet on the world market since its price is high relative to other canned fishes and the local demand is rather limited. As for canned flake meat and fish meals, however, sales in P. N. G. is considered feasible if suitable arrangements are made for their marketing.

In the import of canned skipjack, the United States ranks top, followed by European countries. Considering the lack of experience in the production of canned skipjack, however, export to the United States would entail substantial difficulties because of the strict import inspection imposed by that country and the need for exporting the low-tax canned skipjack in salt water. It is therefore advisable to export canned skipjack in oil to European countries which are considered less strict on the import of canned products. Canned fishes in oil are an international commodity demanded to be superior in quality, and the canned skipjack produced at the complex would be handicapped as their brand name would be unfamiliar to overseas customers. Hence, their marketing must resort to trading firms having a well-established sales network.

(4) Raising of Fund

The project requires a total of 2,903,000 U.S. dollars of fund during the three year period from the commencement of its implementation. As broken down in the following table, the project requires an equipment fund of 1,562,000 U.S. dollars for the construction and consolidation of the complex, initial expenses of 178,000 U.S. dollars, and a working fund of 1,163,000 U.S. dollars.

These fund requirements are to be covered by capital investment (300,000 U.S. dollars), long-term loan (1,297,000 U.S. dollars) and short-term loan (1,306,000 U.S. dollars).

Breakdown of Fund Requirement

Unit: Thousnad dollars

Item / Year		1st	2nd	3rd	4th	Total
Equipment Fund	Canning Plant	597		197		794
	Cold Storage	399				399
	Fish Meal Plant	74				74
	Generator Facility	163				163
	Land	25				25
	Cars	54				54
	Piers	25				25
	Water Supply and Drainage Facilities	28				28
Initial Expenses	Initial Expenses	100				100
	Training Expenses of Workers	42				42
Reserve Fund		35		1		36
Working Fund		29	567	351	216	1,163
Total		1,571	567	549	216	2,903

Sources of Fund

Unit: Thousand dollars

Item / Year	1st	2nd	3rd	4th	Total
Capital	300				300
Long-term Loan	1,100		192		1,297
Short-term Loan	171	567	352	216	1,306
Total	1,571	567	549	216	2,903

Notes: 1. The capital is estimated to account for about 20 per cent of the equipment fund.

2. Fifty per cent of the capital is assumed to be paid by foreign enterprises, 20 per cent by banking institution in P.N.G., and 30 per cent by the enterprise.

3. The long-term loan is to cover the equipment fund, and is assumed to be advanced at a low interest rate of 3.5 per cent per annum.

4. The short-term loan is to cover the working fund and deficit, and is assumed to be advanced at a bank rate of 8 per cent per annum prevalent in P.N.G.

5. Conversion rate is assumed to be 1 U.S. dollar = 1.125 Australian dollar = 360 yen.

(5) Prospect of Income and Expenditure

Prospect of income and expenditure of the planned complex is based on the following conditions.

1) In the initial year of the project, construction and consolidation of the complex facilities will be undertaken. In the second and third years, the canning plant (one line only), cold storage facility and fish meal plant will be partly put in operation. In the third year, the canning plant will be equipped with another line (mechanical facilities only) for full scale canned fish production to be materialized with two production lines from the fourth year and onwards.

2) The yield rate of canned fish production will rise by degrees from the second to the sixth year with the improvement of the workers' technical level.

3) Consideration is given to raising the wages of workers according to the improvement of their technical level as well as to the trend of wage increase in Madang district.

4) Prices of export items and main raw materials are estimated to rise at an annual rate of 4 per cent from the trend of the international market prices, and those of other products and materials are estimated to rise at an annual rate of 2 per cent which is assumed to be applicable to the commodity price in P. N. G.

From the above conditions, it is estimated that deficit will be produced in the initial four years (1st to 4th), that profit before redemption will be created from the fifth year, and that the deficit carried forward will be fully covered in the eighth year.

Income and Expenditure (1st to 11th year)

Unit: U.S. Dollars

Item \ year	1	2	3	4	5	6	7	8	9	10	11
Income:											
Sales proceeds of canned fishes		855,617	1,777,678	3,645,236	6,439,878	6,691,819	6,953,647	7,226,394	7,510,439	7,804,308	8,111,867
Sales proceeds of fish meal		4,258	7,980	15,561	26,983	26,147	26,614	27,144	27,689	28,242	28,808
Total income		859,875	1,785,658	3,660,797	6,466,261	6,717,966	6,980,261	7,253,538	7,538,128	7,832,550	8,140,675
Expenditure including plant expenses:											
Canning plant		991,078	1,712,264	3,199,781	5,635,814	5,660,756	5,842,000	6,032,489	6,236,867	6,437,600	6,644,803
Cold storage		4,078	4,019	5,519	5,547	8,353	8,381	11,464	11,494	14,303	14,333
Fish meal plant		3,194	3,556	5,683	6,806	9,511	9,569	12,683	12,742	15,578	15,636
Generator facility		37,169	37,856	39,947	40,664	44,172	44,917	48,731	49,506	53,072	53,878
Personnel cost	40,000	160,347	174,192	267,225	249,225	270,494	248,842	269,131	276,781	284,433	298,083
Depreciation expenses		125,500	125,550	143,250	143,250	143,250	143,250	143,250	143,250	143,250	143,250
Total Expenditure	40,000	1,324,367	2,057,472	3,662,114	6,081,306	6,136,536	6,297,358	6,517,747	6,730,639	6,948,236	7,163,903
Gross profit	△40,000	△464,492	△271,814	△1,317	385,555	581,431	682,903	735,792	807,489	884,314	976,692
Operating cost	101,667	26,666	27,200	43,333	44,200	45,083	45,931	46,906	47,844	48,800	49,775
Operating profit	△141,667	△491,158	△299,014	△44,650	341,355	536,347	636,972	688,886	759,644	835,514	926,917
Interest on loans	24,917	79,756	116,231	147,581	163,594	139,928	110,706	69,611	28,514	10,403	3,403
Recurring profit	△166,504	△570,914	△415,224	△192,231	177,761	396,419	526,211	619,375	731,131	825,111	923,514
Total profit or loss	△166,684	△737,498	△1,152,742	△1,344,973	△1,067,212	△770,792	△244,581	374,695	1,021,519	1,682,125	2,419,999
Non-operating expenditure (income taxes)								84,306	164,506	185,650	207,792

Note: The personnel cost and depreciation expenses to be listed as part of the operating cost are included in the plant expenses because they are both small in amount.

(6) Amortization Conditions

Amortization is to be effected from the fifth year when profit before redemption can be expected to be produced.

Repayment Conditions of Long-term Loan (Equipment Fund)

Term : 10.5 years (term of deferment - 3.5 years)

Repayment Method : Principal payable equally over the entire term of repayment

Unit. US$1,000

Item \ Year		5th	6th	7th	8th	9th	10th	11th
Amount to be repaid	Long-term Loan	200	200	200	200	200	200	97
	Short-term Loan	139	278	278	575	278		
	Total	339	478	478	775	478	200	97
Source of Repayment Fund (Profit before Redemption)		321	540	669	763	874	968	1,067

Note. In the years when the fund is short (i.e., in the 5th and 8th years), surplus forwarded is to be appropriated for repayment.

(7) Economic Effect

Under the project plan, it is envisaged that the recurring profit will start recording black figures from the fourth year of the project commissioning, increasing gradually thereafter to record a profit of 923 thousand U.S. dollars in the tenth year.

As for the employment of indigenous workers, it is considered possible to employ 216 men from the seventh year when the complex will be put in full load operation.

Economic effect of the project is judged by the internal rate of return method. The internal rate of return of the project, as calculated on the basis of the investment and profit planned for each year, is 15.6 per cent.

In addition to the operating profit of the complex, the project is considered to bring about other benefits as listed below.

1) Accelerated development of P. N. G.

2) Provision of increased employment opportunities for indigenous people

3) Acquisition by indigenous people of techniques needed in secondary industries

4) Supply of animal protein food to indigenous people

5) Increased foreign currency earnings of P. N. G.

6) Increased revenues of National Treasury by tax collection

7) Promotion of related industries

ANNEX

ANNEX 1 PRODUCTION OF CANNED TUNA AND SKIPJACK

The production process of canned tuna and skipjack is as shown below. Raw tuna and skipjack are stored in respective raw fish storing bins depending on whether they are brought in the canning factory in fresh or frozen state, and then sent to the production line after removing unnecessary parts such as head, guts and fins.

1. Cooking (boiling) — After bleeding and washing, the raw fish is placed in the cooker.

2. Cleaning (finishing) — After the fish is carved into two portions, bones, skin and scales are removed, and the meat is divided into back meat and belly meat, and from them are removed dark meat, skin, small bones and bruised parts so as to obtain pure meat alone.

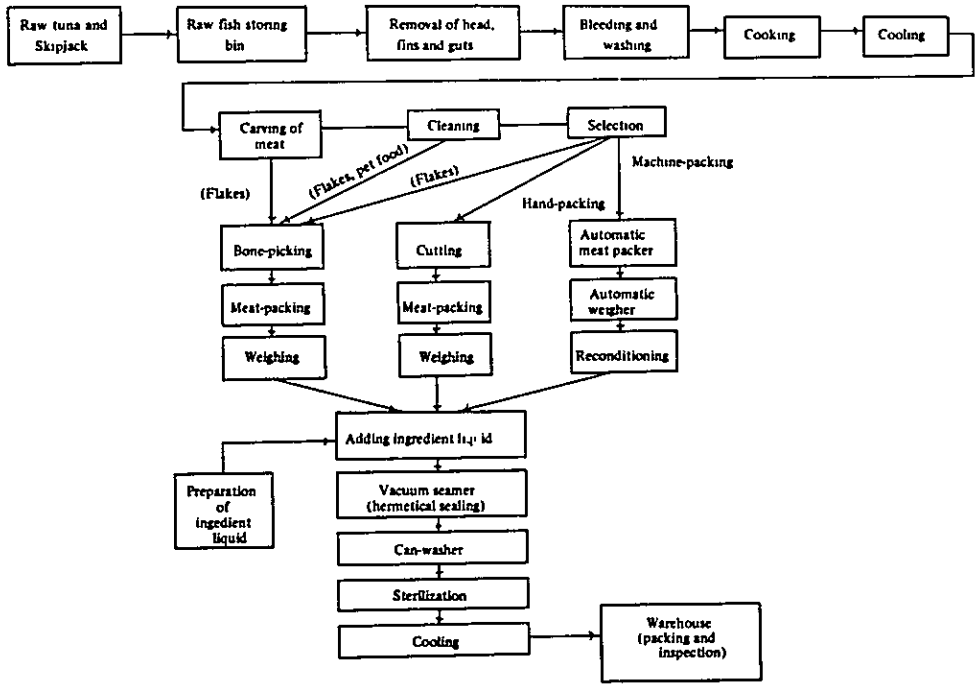
3. Hermetical sealing, and washing — Cans are hermetically sealed in a vacuum seamer in which a certain degree of vacuum is maintained. Grease, oil, salt and other foreign substances adhereing to the outside of cans are removed in a can-washer.

4. Sterilization — Sterilization under pressure is carried out in a retort (sterilizing oven).

5. Cooling — After sterilization, fresh water is poured into the retort for cooling. In case of institutional size cans (2-kilo tuna cans), cooling is conducted under pressure.

Unnecessary parts removed in the production process are processed into fish meal.

Schematic Flow-Sheet of Manufacture of Canned Tuna and Skipjack



ANNEX 2 PROSPECT OF DEMAND-SUPPLY SITUATION AND PRICE OF SKIPJACK AND TUNA

1. Prospect of Demand-Supply Situation of Skipjack and Tuna on World Market

(1) Demand and Supply Situation

Major consuming countries of skipjack and tuna are the United States, Japan and European countries to which more than 70 per cent of the world's total catch is supplied. In these countries, demand for skipjack and tuna has shown a steady upward trend by the elevation of the people's income level and population increase which are giving rise to increased consumption per capita and to the price rise.

According to the IOFC's data of fisheries development survey project, on the growth rate of demand for skipjack and tuna during the nine year period from 1960 to 1969 registered a high rate of 36 per cent in the United States, 29 per cent in Japan, and 72 per cent in European countries.

Supply of skipjack and tuna in the ten year period from 1960 to 1970 also increased by 40 per cent by the production increase brought about by the purse seine fishing of the United States and by the long-line fishing conducted by Formosa and Korea.

Consumption in Major Countries
(1960 & 1969)

Unit: Thousand tons

Year / Major Countries	1960 (A)	1969 (B)	B/A x 100
U.S.A.	339	461	36.0
Japan	311	404	29.9
E C	112	193	72.3
Total	762	1,058	38.8

Note: Figures indicate the consumption in major countries alone.

Source: IOFC/DEV/71/13 "International Trade-Tuna"

Supply of Tuna and Skipjack
(1960 & 1969)

Unit: Thousand tons

Year / Species	1960 (A)	1969 (B)	B/A x 100
Large Size Tuna	763	1,081	41.6
Small Size Tuna	301	409	35.9
Total	1,064	1,490	49.0

Note: Figures indicate the global total values.

Source: IOFC/DEV/71/13 "International Trade-Tuna"

(2) Future Prospect

The past upward trend observed in the demand for skipjack and tuna is expected to continue in future particularly because the people in advanced countries have a liking for these fishes and their processed products. Their supply, however, is not expected to pursue the same upward trend as observed in the past because the long-line fishing is limited to tunas in mid-waters and the purse seine fishing can be carried out only in those fishing grounds which are provided with spring layers. Increase in supply will be feasible only by the augmented production by pole and line fishing in unexploited fishing grounds. In the long run, therefore, the supply will gradually come to fall short of the demand.

2. Transition and Prospect of International Market Price of Skipjack

(1) Transition of Price

Japan is the largest exporting country of frozen and canned skipjack and tuna, and her export price of these products may safely be considered as the international market price. As will be clear from the following table showing the transition of Japan's export price over the past ten years, the price of frozen skipjack rose by 2.7 times, frozen yellowfin tuna by 2.6 times and canned skipjack in oil by 1.5 times.

In 1970, the export price of frozen albacore and yellowfin tuna rose by 47 per cent over 1969 due to the temporary shortage of supply, and the invited a 40 per cent price rise of frozen skipjack. In 1971, the export price of frozen skipjack is on a higher level than recorded in 1970.

Export Price of Raw and Processed Skipjack and Tuna in Japan (FOB)

Item / Year	Frozen Skipjack (US$/ton)	Frozen Yellowfin Tuna (US$/ton)	Canned Skipjack in Oil (US$/case)
1961	149	244	7.30
1962	188	313	7.10
1963	157	298	7.42
1964	143	301	7.10
1965	135	313	7.45
1966	257	449	8.02
1967	146	392	8.33
1968	144	367	7.94
1969	174	376	9.32
1970	330	554	10.63
1971 (Jan. -July)	408	635	11.07

Source: Customs Statistics, Japanese Government

Notes: 1. Unit weight of frozen fishes is metric ton, and the case of skipjack cans is a standard case containing 4 dozens of No. 2 tuna cans.

2. The price for 1971 is the average for January - July period.

(2) Future Prospect

The international market prices of frozen skipjack and canned skipjack in oil are estimated to rise at an annual rate of about 4 per cent in the forthcoming ten years for reasons given below.

1) By the application of equations of first degree established by the past trend, the price is estimated to rise at annual rates described below.

a) Frozen Skipjack — Annual increase rate of 4.9 — $Y = 113.35 + 18.01X$

b) Frozen Yellowfin Tuna — Annual increase rate of 4.7 — $Y = 228.44 + 31.44X$

c) Canned Skipjack in Oil — Annual increase rate of 3.6 — $Y = 6.41 + 0.39X$

2) Supply of skipjack and tuna is estimated to fall short of demand in the long run.

3) Increased production of canned lightmeat of skipjack is expected.

4) The large share of material cost in the production cost of canned skipjack and tuna usually causes the price rise of end products.

As for the price of canned skipjack flake meat and of fish meal as by-products of canning industry, an annual growth rate of 2 per cent, judging from the ordinary commodity prices, can be expected so far as the marketing in Papua and New Guinea is concerned.

ANNEX 3 SITE CONDITIONS

1. General Description of the P.N.G.

(1) Location

The P. N. G. is composed of the eastern half of New Guinea, Bismarck Is. and northern part of Solomon Is., and lies between the equater and lat. 12° S and between long. 141° and 160° E.

It faces the Bismarck Sea on the north, adjoins the Solomon Sea in the east, and faces the northern coast of Australia across the Coral Sea. It is in the tropics and situated at the eastern end of the Asia-Australian Monsoon Zone, and covers an area of 178,260 square miles (462,000 km^2).

(2) Topography

Topographically, New Guinea can be broadly divided into seven districts, i.e., the northern mountainous district, northern lowland district (basins of the Sepik, the Ramu and the Markham), central mountainous district, central plateau district, southern mountainous district, southern flat-land district, and swamp district.

Mountains rising to a height of 5,000 m stretch in the central mountainous district, and rivers are mostly short and have a rapid flow, allowing no boats to navigate upstream excepting the Sepik. Development of road network is deterred by this severe natural condition, and communication between major cities resorts to aeroplanes.

(3) Population

The 1966 census indicates that the population of the territory is as follows.

Indigenous inhabitants - 2,148,300

Non-indigenous inhabitants - 34,736

(4) Climate

Rainfall throughout the area distributes itself into two seasons, the wet and the dry, from November to April, the northwesterly wind blows, and from May to October, the southeasterly wind predominates.

Rainfall varies by the direction and altitude of mountain ranges. In general, however, islands, coastal areas and lowland areas have abundant rainfall throughout the year, whereas rainfall is abundant during the season of northwesterly wind in areas extending on the northern side of mountain ranges and during the season of southeasterly wind in areas lying on the southern side of mountain ranges.

(5) Industry

Excepting the production and marketing of primary products, the industrial activities in the territory resort heavily on import.

The greater part of indigenous people obtain foodstuffs and daily necessaries on their own, but demand for new products is also arising as a result of the livelihood improvement measures implemented by the Administration of the P. N. G.

Industrial activities and foreign trade are carried out predominantly by Australians, particularly by four large companies which cover a wide range of activities such as wholesale and retail business, operation of coffee, tea and copra plantations, management of hotels, wood industry, light industry and so on.

(6) Labour Force

According to the survey conducted in 1967, the estimated number of indigenous workers totals 140 thousand. A survey conducted on 101 thousand of these workers disclosed that 30 per cent are employed by the Administration and 70 per cent by private enterprises. Breakdown of workers employed by private concerns is as follows

Twenty-six per cent for copra and cacao plantations, 12 per cent for building and construction, 8 per cent for light industry, 6 per cent for commercial activities, 5 per cent for coffee business, 5 per cent for transportation and warehousing business, and 5 per cent for sanitation undertakings.

2. General Description of Madang District

(1) Location

Madang district lies between lat. 3° and 6° S and long. 144° and 147° E. Madang, the centre of the district, is situated in lat. 5°10' S and long. 145°50' E. The district is situated approximately at the centre of the coast facing the Bismarck Sea.

(2) Topography

A strip of flat land having a width of several miles extends along the coast. Transportation to the hinterland beyond this coastal belt area is impeded by the Adelbert range and the Finisterre Range.

The coastline from Madang Bay to Sek Bay presents a complex configuration, and many islands and reefs severs the coastal waters from the outer sea for about 10 miles to form a large arm of landbound sea. The bay thus formed provides excellent fishing grounds of coastal fisheries and is also being developed for catching bait fishes for skipjack fishery. The bay further furnishes berths having a depth of 30 - 50 m and capable of accommodating large vessels. Thus, the bay is favourably conditioned for development into a fishing base.

(3) Rivers

With mountain ranges extending close to the coastline, rivers are mostly small and do not provide sources of constant water supply. Hence, the supply of sufficient water required for the processing industry is one of the important problems. It may be said that the Gogol, which flows into the sea at a point south of Madang, is comparatively large and could probably serve as a water source.

(4) Soils

The coastal land area is composed of a thick layer of alluvial soil extending to the narrow beach which is formed by the deposit of large coral pieces.

(5) Climate

1) Wind

In the coastal land area, mild sea and land breeze blows in the morning and evening, with local moderate gales blowing on very rare occasions.

Climatological data recorded at the Meteorological Office located about 120 miles to the east-south-east of Madang is shown below by way of reference.

PAPUA AND NEW GUINEA: WEATHER AND CLIMATE

CLIMATOLOGICAL DATA· LAE (NEW GUINEA)

(Meteorological Office: Lat. 6°44' S., Long. 147°00' E., Height above M.S.L. 25 ft)

BAROMETER, WIND AND CLOUD

Month	Bar. corrected to 32° F. mn sea level and standard gravity from 9 a.m. and 3 p.m. readings (m bars)	Wind: Average miles per hour 9 a.m.	Wind: Average miles per hour 3 p.m.	Wind: Highest gust speed (mph)	Wind: Prevailing direction 9 a.m.	Wind: Prevailing direction 3 p.m.	Mean amount of clouds, 9 a.m., 3 p.m., 9 p.m.(a)
No. of years of observations	21	5	5	11		S	18
January	1,006.9	7.7	8.3	51	NW	SE	6.8
February	1,006.7	8.1	7.6	43	NW	SE	6.8
March	1,007.2	6.8	7.3	40	NW	SE	7.0
April	1,008.3	4.6	7.2	40	NW	SE	6.5
May	1,000.5	2.8	6.5	36	NW	SE	6 1
June	1,010.5	2.7	6.2	41	NW	SE	6.1
July	1,011.0	2.0	6.6	36	NW	SE	6.5
August	1,011.0	2.2	6.8	40	NW	SE	6.5
September	1,010.9	2.3	7.9	38	NW	SE	6.3
October	1.010.0	2 9	7.9	40	NW	SE	6.0
November	1,008.4	4.6	8.7	45	NW	SE	6.3
December	1,007.3	6.0	8.4	41	NW	SE	6.7
Year — Totals							
Year — Averages	1,000.0	4.4	7.5		NW	SE	6.5
Year — Extremes				51			

(a) Scale 0-8

2) Rainfall

Rainfall in Madang district is particularly large relative to other districts of the territory, and it often squalls even in the dry season. During the season of northwesterly wind, the damp air carried from the sea brings about lots of rain. The monthly mean rainfall as obtained from the data for 38 years up to 1964 is tabulated below.

Monthly Mean Rainfall in Madang

Unit: Inches
No. of years of observations: 38 years

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total
12.98	12.07	14.96	17.11	14.71	9. 0	7.41	5.04	5.91	10.16	14.77	14.59	139.91

The rain water is collected in the storage tank of each house and used as drinking water.

3) Atomospheric Temperature

The atmospheric temperature maintains a value of 22° - 24° C till 9:00 a.m. and 29° - 31° C till 3:00 p.m. throughout the year. The seasonal temperature difference is only about 1° C which is much smaller than the difference by different hours of the day. The average temperatures recorded during the 1951 - 1966 period are as follows.

Item / District	No. of Years of Observations	Highest Average Temperature	Lowest Average Temperature
Madang	6 years	86.4°F (Jan.) 85.2°F (July)	73.7°F (Jan.) 72.9°F (July)

4) Relative Humidity

The district has a high relative humidity which ranges from 79 to 80 per cent. Coupled by the year-round high temperature, this high humidity imposes a heavy physical burden on human being, and also necessitates corrosion preventive measures for machines and instruments.

It may be added that though squalls and thunders occur quite frequently, development of typhoons and local winds is very scarce.

(6) Marine Phenomena

1) Waves

The sea and land breezes are mild and do not cause high waves detrimental to navigation. Undulations of outer sea occasionally surge over the reefs on the periphery of the bay, but hardly incur any damages on the coastal land area because of the complex coastline.

2) Tide

The tide range at Madang Port is 3.5 ft (1.07 m).

3) Tidal Current and Coastal Current

No survey data are available on these currents. Surveys on these two subjects must therefore be implemented to obtain accurate information which is indispensable for the selection of fishing grounds and for the discharge of drain water from the canning plant.

4) Drift Sand

Effect of drift sand is negligible because the sand beach is small in width and the water depth becomes large at a short distance from the coastline.

The area extending from Madang Bay to Sek Bay is close to the fishing grounds and affords a safe navigation and anchorage for fishing boats. This area is particularly calm during the dry season. The team therefore considers it is advisable to construct the fishing base in the dry season.

(7) Inhabitants

The 1966 census indicates that the population by administrative districts is as shown in the following table.

Population in Madang City is composed of 1,304 Caucasians, 139 Asians, 159 Eurasians, and 8,273 indigenous inhabitants.

Area-wise, population in the entire Madang district is composed of 23,500 people living on islands, 69,714 in coastal area, and 37,879 in inland areas.

POPULATION, BY ADMINISTRATIVE DISTRICTS(a)
TERRITORY OF PAPUA AND NEW GUINEA, CENSUS, JUNE-JULY 1966

(Persons)

District(a)	Indigenous	Non-Indigenous	Total	Approximate area square miles	Persons per square mile
Western	61,424	436	61,860	40,000	1.55
Gulf	55,077	233	55,310	15,000	3.69
Central	134,693	11,638	146,331	12,000	12.19
Milne Bay	99,161	996	100,157	7,800	12.84
Northern	57,967	608	58,575	9,000	6.51
Southern Highlands	183,635	406	184.101	6,200	22.69
Total, Papua	591,959	14,377	606,336	90,000	6.74
Eastern Highlands	201,978	2,054	204,032	5,000	40.81
Chimbu	166,923	322	167,245	2,800	59.73
Western Highlands	289,452	1,690	291,142	9,200	31.64
West Sepik	99,141	466	99,607	19,700	5.06
East Sepik	156,406	1,525	157,931	10,500	15.04
Madang	149,986	2,061	152,047	10,800	14.08
Morobe	204,370	4,696	209,066	12,700	16.46
West New Britain	43,886	306	44,192	7,100	6.22
East New Britain	104,887	5,043	109,930	7,000	15.70
New	49,334	964	50,298	3,800	13.24
Bougainville	71,761	718	72,479	4,100	17.68
Manus	20,232	447	20,679	800	25.85
Total, New Guinea	1,558,358	20,292	1,578,650	93,500	16.88
Total, Papua and New Guinea	2,150,347	34,669	2,184,986	183,500	11.91

(a) For location of districts see map on plate 55.

(8) Industry

Agricultural production in Madang district during the one year period from 1969 to 1970 is reported to be as follows.

Copra	:	14,535 tons
Cocoa	:	2,187 tons
Coffee	:	117 tons
Groundnuts	:	50 tons
Rice	:	51 tons
Pepper and other products	:	-
Cattle	:	10,500 heads (of which 819 heads were slaughtered)
Pig	:	(of which 216 heads were slaughtered)
Poultry	:	Approx. 12,000

The open-air market in Madang City is opened on Tuesdays, Thursdays and Saturdays when 700 to 1,000 persons gather for transaction of vegetables, fruits and marine products. Dealings in fresh fishes, however, take place every day.

Number of major industrial establishments found in Madang City today are as listed below.

Aeroplane service	- 3	Bakery	- 1	Carpentry and finish carpentry	- 5
Commerce	- 4	Construction	- 4		
Machinery	- 10	Market management	- 1	Electric machinery	- 4
Photography	- 1	Plumbing	- 2	Petroleum	- 3
Printing	- 1	Retail business	- 34	Poultry farming	- 2
Marine transport	- 4	Port labour	- 3	Sanitation	- 1
Theatre	- 1	Tobacco manufacture	- 2	Sawmill	- 2
Food supply	- 6			Overland transport	- 2

These establishments employ 2,100 indigenous workers and 302 non-indigenous workers. Plantations are found at 70 places in Madang district and operated by 3,600 indigenous employees.

Further, P.N.G.'s first chip plant is about to be constructed to make use of the lumber resources available in the vicinity of Madang district, Agreement has already been reached by the Administration and the Japanese-New Guinea Timber Company (a subsidiary company of Honshu Paper Mfg. Co., Ltd.) regarding the conditions for the latter's production of chips, plywood and sawn wood. The total capital requirement for the construction of the chip plant, plywood plant, roads, wharf and dormitory building is estimated to amount to about 10 million dollars. The new company is expected to offer employment for 1,250 indigenous workers.

(9) Labour Situation

The labour situation during the July - December period of 1970 is such that against 382 applications for workers, there were 1,192 unskilled workers seeking employment and only 350 of them were employed. Job offers are just too deficient to absorb all the many indigenous people who are willing to work. A problem about these job seeking indigenous people is that they are mostly unskilled workers. Training of workers will therefore become an important condition for the smooth operation of fisheries product processing facilities.

Unskilled workers	:	A$7/week in the initial year A$7.25/week in the second year A$7.5/week in the third year
Semi-skilled workers	:	A$7.75 - 17.50/week
Skilled workers	:	A$17.00 - 23.00/week

(10) Transport Condition

Overland transportation in the district is possible only in the coastal land area since mountains stretch close to the coastline. Communication to other major cities and localities of the territory inevitably resorts to marine transport and aeroplane services.

There is an unpaved road extending along the coastline from Madang City, of which a 56 mile section allows for motorcar traffic. This road has a total extension of about 401 miles and is expected to be shortly connected with the 146 mile road which runs through Bogia district.

To connect the expressway linking Lae and the highlands with Madang, a new road is now under construction for completion in 1979. When this connection road is completed, overland transportation to densely populated areas will become possible.

Aeroplane service of the territory is well developed and serving as the major transport means, with 25 large and small airports established in Madang district alone. Madang Airport, in particular, is equipped with modern facilities which are utilized for regular flight services of TAA and ANSETT'. With the planned inauguration of international airline service, Madang Airport will become the gateway to outside world.

As for marine transportation, Madang Port has a large wharf located on the northern coast of the city. The wharf is equipped with various facilities for handling heavy and large-sized cargoes, and will therefore, be utilized for loading products and unloading materials and equipment in future.

(11) Fisheries in Madang District

1) General Condition

Fisheries currently conducted in Madang district is extremely small in scale and carried out by indigenous fishermen in coastal area and islands chiefly for the self-sustenance of food. It is estimated that the number of fishermen organized into a cooperative association is 50, non-organized part-time or full-time fishermen 600, and fishermen operating for the self-sustenance of food about 20,000. The fishermen organize a sort of executive meeting of fisheries products sales company through which their catches are sold on the market.

2) Fisheries Promotion Policy

The Administration of the Papua and New Guinea is pushing forward its fisheries promotion policy through the extension of various advanced fishing techniques among indigenous fishermen. Financial aid of the said office is provided for fishing activities conducted in the bay and in the sea waters within 30 miles from the coastline. Training and guidances on the fishing techniques and on the processing and distribution of fisheries products as before mentioned are offered to progressive and interested fishermen at a fisheries training centre established by the Administration. In an effort to accelerate the fisheries development in the district, construction and consolidation of cold storage facilities (capacity: 12,000 pounds), ice making facilities, fishing boat building yards, fishing gear repair shops, establishment of market survey system and fisheries credit system, etc. are being pushed forward by the Administration and part of these measures are already put into practice.

3) Consumption of Marine Products

Approximately 40 - 60 tons of marine products are marketed in Madang district in a year, and part of them are airborne to highlands. At present, demand surpasses supply and fishes are sold for 25 cents a pound.

The team was informed that there are some dealers that import limited quantities of frozen fishes from New Zealand.

Most of the indigenous people are not yet acquainted with fishing operation. Full-time fisheries in Madang district are therefore carried out solely by the fishermen from Sepik district.

(12) Facilities of Madang Port

1) Topography

Madang Port located on the northern coast of Madang City constitutes an excellent natural harbour encircled by land area and islands. Boats entering the port from outer sea pass through the Dallman Channel which is formed by Kranket Is. and Schering Peninsula. This channel has a length of about 1,000 m, a width of 500 m, and a depth of about 40 m along its central course, so that it allows free passage of large cargo boats.

2) Navigation Aids

A lighthouse having a visible distance of 15 nautical miles is constructed at Point Kalibobo which is at the entrance of the Dallman Channel. In addition, leading lights are equipped at Belli Is. By these navigation aids, boats are enable to safely enter or sail from the port even at night.

3) Mooring Wharfs

Boats entering the port are moored alongside the western and eastern wharfs in most cases. Specifications of these two wharfs are as given below.

Western Wharf: Water depth - 35 ft., length - 450 ft., width - 40 ft., area - 24,000 sq. ft.

Eastern Wharf: Water depth - 27 ft., length - 300 ft. (currently effective length - 280 ft.), width - 45 ft., area - 16,200 sq. ft.

4) Fuel Supply

Fuel oil is transported by tank lorries from oil stations in Madang City which are operated by Shell Oil, Caltex and Ampal.

5) Water Supply

Under the existing conditions, restriction is placed on the water supply to boats during the dry season when the shortage of water occurs.

6) Repairing Facilities

At present, there are two shipyards, one capable of grounding and repairing boats having a gross tonnage of up to 160 tons and the other up to 300 tons.

The government reserves the right to act in behalf of the local communities and demand private enterprises to offer their port facilities for public use.

(13) Electric Power Supply

At present, electric power is produced by relatively small generators and supplied by the Electric Power Committee, and additional installation of generators is being planned to cope with the potential power demand of town development and the chip industry. For this purpose, negotiations are now in progress for conclusion of a special agreement for financing. Insofar as

the electric power supply is concerned, the fundamental problem facing the fisheries is the estimation of power demand.

(14) Industrial Water

Feasibility of using surface water for industrial purpose involves many unsolved questions. Abundant groundwater can be obtained by drilling but it is not known whether groundwater is harmful to health or not. It is believed possible to supply abundant industrial water of good quality except in dry season of the year, but the cost of such industrial water supply should be included in the construction cost of the complex.

3. General Condition of Lae, Rabaul, Kavieng and Wewak Districts

Item	Lae	Rabaul	Kavieng	Wewak
1. Location	Located in the neighbourhood of Lat. 6°45' S and Long. 146°59' E. Constitutes the commercial port and city area at the innermost part of Huon Gulf on the east coast of New Guinea.	Located in the neighbourhood of Lat. 4°12' S and Long. 152°10' E. Constitutes the port and city area at the innermost part of Blanch Bay at the northern end of New Britain Is.	Located in the neighbourhood of Lat. 2°35' S and Long. 150°45' E. Constitutes the port area at the northern end of New Ireland Is.	Located in the neighbourhood of Lat. 3°33' S and 143°38' E. Constitute the port area on the north coast of New Guinea.
2. Topography	Situated at the estuary of the Markham emptying into Huon Gulf and surrounded by steep mountains of the Finsterre range and the Owen Stanley range.	Simpson Bay in the innermost part of Blanch Bay is bag-shaped with Vining mountain mass stretching close to the coastline. Flat area is found only along the coast. Many volcanoes cut the coastline. Reefs are developed along the coast and many sunk boats are found.	New Ireland Island is a long island with a width of about 7 nautical miles and has a mountain range stretching in the centre. Topography near Kavieng is relatively flat and featured by many islands. Water depth increases sharply and reefs are developed near the coast.	Situated on the north coast of New Guinea, with the Prince Alexander range stretching close to the coastline and the Sepik River flowing into the sea nearby. Offshore area is in the volcanic zone. Volcanic islands stretch as far as New Britain Is.

	Lae	Rabaul	Kavieng	Wewak
3. Climate	Wet season - May to October, southeasterly monsoon. Dry season - November to to April, northwesterly monsoon. Annual rainfall - 177". Annual highest temperature - 88.2°F. Annual lowest tem- - 71.5°F. Relative humidity - 73 - 90%.	Wet season - November to April, northwesterly monsoon. Dry season - May to October, southeasterly monsoon. Annual rainfall - 78". Annual highest temperature - 88.3°F. Annual lowest temperature - 73.7°F. Relative humidity - 75 - 81%.	Wet season - not clear. Dry season - not clear. Annual rainfall - 124". Both temperature and relative humidity are high.	Wet season - November to April, northern monsoon. Dry season - May to October, southeasterly monsoon. Annual rainfall - 82". Annual highest temperature - 86.8°F. Annual lowest temperature - 72.7°F. Relative humidity - unknown.
4. Marine Phenomena	Tidal range - 3.5'.	Tidal range - 1.8'. Generally calm with wind on the mornings and evenings.	Tidal range - unknown. Both wind and high waves are scarce.	Tidal range - unknown.
5. Population	Population of Morobe district by 1966 census: Indigenous - 204,370 Non-indigenous - 4,696	Population of East New Britain district by 1966 census: Indigenous - 104,887 Non-indigenous - 4,043	Population of New Ireland Island by 1966 census: Indigenous - 49,334 Non-indigenous - 964	Population of East Sepik district by 1966 census: Indigenous - 156,406 Non-indigenous - 1,525
6. Major Industries	Copra, cocoa and coffee, port activities, and commerce.	Copra and cocoa plantations, timber, port activities, and copra	Copra and cocoa plantations, timber, and port activities.	Copra, cocoa, groundnuts, rice, coffee, port activities and timber.

	Lae	Rabaul	Kavieng	Wewak
7. Fisheries	Small scale fisheries by indigenous fishermen.	Small scale fisheries by indigenous fishermen. Transaction of fresh and smoked fishes carried out in the city's market.	Small scale fisheries by indigenous fishermen. Frozen fishes are sold to the Procurement Office of Fisheries Office.	Small scale fisheries by indigenous fishermen.
8. Port	Moorage - 800' long. 40' wide and 30' deep. Fuel supply - both heavy and light oils supplied by tank lorry. Water supply - 30 tons per hour of water supply is available.	Moorage - 1. Bay Road wharf - 500' long, 50' wide and 35' deep. 2. Blanche wharf - 400' long, 40' wide and 28.5' deep. 3. Kamak wharf - 300' long, 60' wide and 31' deep. 4. Small ships wharf - 204' long, 22' wide and 11' deep. Fuel supply - Heavy oil supplied through oil pipes and light oil by tank lorry. Water supply - Limited.	Moorage - 330' long, 40' wide and 32.5' wide. Fuel supply - Both heavy and light oils supplied from tank lorry. Water supply - Not available.	Moorage - Capable of mooring 5,000 ton class boats, water depth ranges from 28 to 32'. Fuel supply - Feasible by the use of tank lorry. Water supply - Not available.

4. General Description of Proposed Sites of Fisheries Product Processing Complex

(1) Comparative Study of Three Sites in the Vicinity of Madang District

1) Existing State of the Three Sites

		Sek Bay	Miliat Bay	Nagada Bay
i	Configuration	Moorage is availble in a sea area of about 1,500 thousand m^2. There is a channel which allows free passage to and from the outer sea. Few shore-reefs are found along the coastline and fairway.	Navigation is not safe since the greater part of its approximately 1,000 m^2 area is covered with shore-reefs. Passage to and from the outer sea is possible only by a complicated channel of about 3 nautical miles which runs through shore-reefs.	Effective water area is small since the 500 thousand m^2 area of this bay is a narrow arm of sea lying between reefy coastlines. Passage to and from the outer sea by a 2 nautical mile channel is comparatively easy.
ii	Water	30 - 50 m in the central parts. Shore-reefs along the coastline have a small width and the water depth is large near the coast.	20 - 25 m in the central parts. Projections of coastal reefs present a complicated pattern. Measurement made at a innermost point of the bay about 100 m from the coastline showed a water depth of 9 m.	15 - 20 m in the central parts. Coastlines are covered with reefs. Water depth measurement conducted at a innermost point of the bay 10 m from the shore showed a value of 5 m.
iii	Hinterland	The Vitar Farm on the northern coast faces the outer sea on the east and covers a flat land area of more than 2,000 thousand m^2. With limited reefs found along the shore, the Farm area is suited for the estate construction.	The Miliat Farm on the northern coast has an ample extension of flat land area. The complexity of the shore makes it difficult to construct port facilities. The southern coast is composed of thickets and swamps, suggesting that a lengthy period will be required for development.	The area on the northern coast is an undeveloped swamp not suited for the construction of facilities. The Nagada Farm on the southern coast covers an extensive flat land area. Many houses are built in the coastal area.
iv	Road	An approximately 40 km long unpaved road capable of motorcar traffic leads out from the city area.	An approximately 20 km long unpaved road capable of motorcar traffic leads out from the city area.	An approximately 15 km long unpaved road capable of motorcar traffic leads out from the city area.
v	Water supply	There is a flowing water pond which can be used as a water source if the water quality is satisfactory. Utilization of rain water is essential.	There are no water sources likely to provide sufficient water. Utilization of rain water is essential.	There are no water sources likely to assure sufficient water supply. Utilization of rain water is essential.
vi	Land acquisition	Necessary land can be secured with ease since few houses are found on the coast.	Land acquisition entails difficulties because many houses are built along the coast.	Land acquisition entails difficulties because many houses are built along the coast.
vii	Sea water pollution by drain water	Pollution of the bay can be prevented by draining soiled water into the saline lake and the outer sea.	Pollution of sea water by the drain water discharge into the bay is conceivable.	It is conceivable that the drain water discharge into the bay would invite the pollution of sea water and exerts an adverse effect on Madang Port.

2) Facilities to be newly installed for the utilization of existing port facilities and for the construction of the fisheries product processing complex

		Sek Bay	Mililat Bay	Nagada Bay
i	Pier	The existing temporary pier should be replaced by a new one for fishing boats.	There are no piers at present. A new pier must be constructed for fishing boats.	A new pier should be constructed for fishing boats.
ii	Navigation aids	Light beacons must be installed towards the outer sea.	A good number of range lights must be installed on reefs and small islands. Light beacons must also be installed to indicate the bay mouth.	Light beacons indicating the bay mouth must be installed
iii	Supply facilities			
	a Fuel	A fuel tank and supply pipes should be newly installed.	Ditto	Ditto
	b. Water	Purification facilities and a water tank should be newly installed. A supply pipe line must be laid between the water tank and the pier.	A rain water storage tank and purification facilities should be newly installed. A supply pipe line and a clear water tank should be newly installed	Ditto
iv	Repairing facilities	The existing facilities of Madang Port are to be utilized.	Ditto	Ditto
v	Communication facilities	A fisheries radio station should be newly installed.	Ditto	Ditto
vi	Cargo handling facilities	Catches are to be carried by forklifts and conveyers. Heavy and large-sized cargoes are to be unloaded at Madang Port and carried by trucks.	Ditto	Ditto
vii	Transport facilities	Motorcars should be procured.	Ditto	Ditto
viii	Power source	A generator facility should be newly installed.	Ditto	Ditto
ix	Facilities for prevention of water pollution	A drain pipe of about 800 m should be newly laid.	Drain water purification facilities should be newly installed.	Ditto

(2) Advantages of Sek Bay over Other Sites

The coastal area of Sek Bay was selected as the site of the planned fisheries product processing complex as a result of the comparative study of various conditions of all the three sites. The comparison revealed that the selected site excels the other two in various aspects involving the moorage of boats, utilization of hinterland and road, supply of water, acquisition of land, disposal of drain water, construction cost, etc.

ANNEX 4 SPECIFICATIONS OF MAJOR FACILITIES

1. Canning Plant

Capacity: 850 cases of tuna 2/4 per day

(1) Plant Building - One-storied Slate Roofed Building of Steel Framed Structure (Partly Steel Framed Block Structure) with a Floor Space of 3,350 m2

	Floor Space
Plant	1,300 m^2
Warehouse	1,300 m^2
Boiler Room	100 m^2
Office Room	400 m^2
Ancillary Facilities (Bath Room, Warehouse and Dining Hall)	250 m^2

(2) Machinery

Boiler	1 unit, Model AS, 3,400 kg/h	
Water Softener	1 unit	
Cooker	4 units	
Cleaning Conveyor and Other Equipment	1 set comprising	1 unit for tuna, 1 unit for flake meat and chunks, and other ancillary equipment.
Seamer	1 set, Models 14M and 5M, complete with syrupper, vacuum pump and other ancillary equipment	
Retort	1 set comprising	3 units of retort and other ancillary equipment
Can Caser	1 unit	
Empty Can Conveyor and Other Equipment	1 unit of empty can conveyor and 15 units of other conveyors	
Ventilation Equipment	1 set	

(3) Drain Water Disposal Facilities — 1 set

2. Cold Storage Facilities

Storage Capacity: 500 tons

(1) **Cols Storage Building - Single-storied Slate Roofed Building of Reinforced Concrete Structure (Partly Steel Frame Structure) with a Floor Space of 840 m2**

	Floor Space
Cold Storage Rooms	360 m^2
Ante Room	60 m^2
Processing Room	240 m^2
Machine and Electric Room	120 m^2
Watching Room	60 m^2

(2) **Heat Insulation Facilities - Walls Covered with Foam Polyestyrene and Floors finished with tiles**

	Thickness of Heat Insulating Material
Cold Storage Rooms	175 mm
Ante Room	100 mm
Freezing Room	200 mm
Ice Making Room	200 mm
Ice Storage Room	100 mm

Note: Height of each room as measured on the inside is 4.5 m.

(3) **Refrigerating Machines**

Reciprocal Type Ammonia Compression Refrigerating Machine	2 units for cold storage with a motor having an output of 55 kW for constant operation and another for stand-by purpose
Cooling Water Pump and Other Equipment with a Motor Output of 100 kW for Forced Ventilation (Unit Cooling System)	

3. **Fish Meal Plant**

Material Processing Capacity: 10 tons;day

(1) **Plant Building - Single-storied Slate Roofed Building of Steel Framed Construction with a Floor Space of 170 m2**

(2) **Machinery**

Material Conveyor	1 unit
Cooker	1 unit
Screw Press	1 unit
Dryer	1 unit
Crusher Assembly	1 set

4. Generator Facility

Capacity" 480 kW ñ 160 kW x 3 generators

(1) Generator Building - Single-storied Slate Roofed Building of Steel Framed Construction with a Floor Space of 240 m^2

(2) Machinery

240 HP Diesel Engine	
Generator	3 units
Ancillary Facilities including 1 Automatic Control Device and Fuel Tanks	

5. Piers

(1) Fixed Pier

Length	20 m
Width	40 m
Water Depth (over a distance of 15 m from the pier end)	- 3 m or larger
Top Height	+ 2.5 m
Floor Slab (Bolted wooden slab)	80 m^2
I-Steel Stringers Arranged at an Interval of 3 m	2
I-Steel Cross Beams Arranged at Intervals of 5 m	5
Bearing Piles Driven at Intervals of 5 m	10
Bracings (Special angle steel)	28
Fenders (Bolted wooden fenders)	10
Mooring Posts	12
Working Lights	2

(2) Floating Pier

Length	10 m
Width	4 m
Freeboard	0.5 m
Floor Slab (Bolted wooden slab)	72.5 m^2
Anchor Chain	2
Mooring Posts	4

(3) Movable Bridge

Length	4 m
Width	4 m
Steel Beams	2
Bracings	2
Metal Joints	1 set
Bolted Wooden Floor Slab]	16 m^2
Steel Wheels	2

6. Cars

Forklifts	2
6-ton Truck	1
Microbus for 15 Passengers	1
6-passenger car	1

7. Tanks and Pipings

Fuel Tanks	4 tanks, each having a capacity of 22 tons
Fuel Pipe	30 m, 3" diameter
Water Supply Tanks	2 tanks, each having a capacity of 22 tons
Water Supply Pipe	100 m, 3" diameter

8. Navigation Aids

Light Beacons	1 set, each beacon having a visible distance of 10 miles

ANNEX 5 PROFIT AND LOSS STATEMENT AND FUND STATEMENT

1. Profit and Loss Statement

Unit Thousand Yen

Item \ Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Income											
Sales proceeds of canned fishes		308,022	639,964	1,312,285	2,318,356	2,409,055	2,503,313	2,601,502	2,703,758	2,809,551	2,920,272
Sales proceeds of fish meal		1,533	2,873	5,602	9,714	9,413	9,581	9,772	9,968	10,167	10,371
Total incom		309,555	648,837	1,317,887	2,328,070	2,418,468	2,512,894	2,611,274	2,713,726	2,819,718	2,930,643
Expenditures including plant expenses											
Canning plant		356,788	616,415	1,151,921	2,028,893	2,037,872	2,103,264	2,171,696	2,245,272	2,317,536	2,392,129
Cold storage		1,468	1,477	1,987	1,997	3,007	3,017	4,127	4,138	5,149	5,160
Fish meal plant		1,150	1,280	2,046	2,450	3,424	3,445	4,566	4,587	5,608	5,629
Generator facility		13,381	13,629	14,381	14,639	15,902	16,170	17,543	17,822	19,106	19,396
Personnel cost	14,400	58,805	62,709	96,456	89,721	97,374	89,583	96,887	99,641	102,316	105,150
Depreciation expenses		45,180	45,180	51,570	51,570	51,570	51,570	51,570	51,570	51,570	51,570
Total Expenditures	14,400	476,772	740,690	1,318,361	2,189,270	2,209,153	2,267,049	2,346,389	2,423,030	2,501,365	2,579,034
Gross profit	△14,400	△167,217	△97,853	△474	138,800	209,315	245,845	264,885	290,696	318,353	351,609
Operating cost	36,600	9,600	9,792	15,600	15,912	16,230	16,535	16,886	17,224	17,568	17,919
Operating profit	△51,000	△176,817	107,645	16,074	122,888	193,085	229,310	247,999	273,472	300,785	333,690
Interest on loans	8,970	28,712	41,843	53,129	58,894	50,374	39,854	25,060	10,265	3,745	1,225
Recurring profit	△59,970	△205,529	△149,488	△69,203	63,994	142,711	189,436	222,939	263,207	297,040	332,465
Total profit or loss	△59,970	△265,499	△414,987	△484,190	△420,196	△277,485	△88,049	134,890	367,747	605,565	871,196
Non-operating expenditures (income taxes)								30,350	59,222	66,834	74,805

Note The personnel cost and depreciation expenses to be listed as part of the operating cost are included in the plant expenses because they are both small in amount

2. Fund Statement

Unit Thousand Yen

Item \ Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Sources of Fund											
Capital	108,000										
Loan for equipment fund	396,000		71,000								
Balance	396,000	396,000	467,000	467,000	395,000	323,000	251,000	179,000	107,000	35,000	
Loan for working fund		44,130	26,400	57,770	87,060						
Balance		44,130	70,530	128,300	215,360	215,360	215,360	100,000			
Loan to cover deficit before redemption	61,500	160,000	100,000	20,000							
Balance	61,500	221,500	321,500	341,500	291,500	191,500	91,500				
Profit before redemption	△59,570	△160,349	△104,308	△17,633	△115,564	194,281	241,006	274,509	314,777	348,610	384,035
Total	502,470	43,781	93,092	60,137	202,624	194,281	241,006	274,509	314,777	348,610	384,035
Application of Fund											
Investment in equipment	491,500		71,000				17,550				
Working fund		44,130	26,400	57,770	87,060	7,340	500	7,920	7,700	7,870	7,800
Accumulated amount of applied working fund		44,130	70,530	128,300	215,360	222,700	223,200	231,170	238,870	246,740	254,540
(Amortization)											
Equipment fund					72,000	72,000	72,000	72,000	72,000	72,000	35,000
Working fund					50,000	100,000	100,000	206,860	100,000		
Income tax								30,350	59,222	66,834	74,805
Dividend										108,000	108,000
Total	491,500	44,130	97,400	57,770	209,060	179,340	190,050	317,130	238,922	254,704	225,605
Profit	10,970	△349	△4,308	2,367	△6,436	14,941	50,956	△42,621	75,855	93,906	158,430
Accumulated profit	10,970	10,621	6,313	8,680	2,244	17,185	68,141	25,520	101,375	195,281	353,712

Note The equipment fund for the seventh year is to be applied for the purchase of new cars, and is assumed to be obtained by subtracting the residual value after amortization

Reference:

(1) Method of Depreciation, etc.

a. Land (No amortization is considered)

b. Complex facilities

Depreciation of buildings and machinery is assumed to require a period of 10 years and that of transport facilities 5 years, with the residual value assumed to be 1/10 of the present value.

Facilities:

1st and 2nd years	- (463,000 thousand yen - 463,000 thousand yen x 1/10) x 1/10 = 41,670 thousand yen
3rd and subsequent years	- (71,000 thousand yen - 61,000 thousand yen x 1/10) x 1/10 + 41,670 thousand yen = 48,060 thousand yen
c. Transport facilities	- (19,500 thousand yen - 19,500 thousand yen x 1/10) x 1/5 = 3,510 thousand yen

d. Initial expenses and training expenses

These two expenses are included in the profit and loss account for the initial year without considering them as deferred items.

(2) Calculation of Interest on Loans

For the equipment fund, interest for one year was calculated since interest for six months was assumed to be paid in the year of advancement (and for three months for additional equipment installation) and interest for one year was assumed to be paid in all other years at the end of business term As for the working fund, interest for one year was calculated. For loans obtained to cover the deficit, however, interest for six months was calculated for the year of its advancement and for the last year of redemption.

(3) Miscellaneous income (interest on saving, etc.) was not calculated.

(4) It was assumed that all materials and commodities would be immune from taxes and that the transfer of deficit can be effected with no limit with respect to the payment of income taxes as in the case of primary industries. The rate of income tax is assumed to be 22.5 per cent.

ANNEX 6 DETAILS OF CALCULATIONS

1. Details of Calculation for Complex Facilities

(1) Details of Calculation for Facilities Cost

Item	Cost (thousand Yen)	Criteria
1) Canning Plant	295,000	
i Plant Building	124,500	3,050 m^2
Plant	52,000	Slate roofed steel framed structure; unit cost of 40 thousand yen x 1,300 m^2 = 52,000 thousand yen
Warehouse	52,000	- Ditto -
Boiler Room	3,000	Slate roofed steel framed structure, ventilated; unit cost of 30 thousand yen x 100 m^2 = 3,000 thousand yen
Office Room	5,000	Slate roofed steel framed structure; unit cost of 50 thousand yen x 100 m^2 = 5,000 thousand yen
Ancillary Rooms	12,500	Bath room, dining hall and locker room
ii Machinery	151,000	Canning lines (71,000 thousand yen x 2 lines = 142,000 thousand yen) and boiler (9,000 thousand yen) (Charges for erection, packing, design and supervision included)
iii Piping and Wiring Work	2,500	
iv Drain Water Disposal Facilities	4,500	Drain water disposal facilities - 1,500 thousand yen, Septic tanks of lavatories - 3,000 thousand yen
v Ventilation Facilities	3,500	
2) Cold Storage Facilities	143,600	
i Cold Storage Building		

	Cold Storage Rooms	100,000	Single-storied reinforced block structure; unit cost of 200 thousand yen x 500 tons = 100,000 thousand yen
	Processing Room	19,200	Single-storied reinforced block structure; unit cost of 80 thousand yen x 240 m^2 = 19,200 thousand yen
	Machine and Electric Room	9,600	Reinforced block structure; unit cost of 80 thousand yen x 120 m^2 = 1,600 thousand yen
	Office Room	4,800	Reinforced block structure; unit cost of 80 thousand yen x 60 m^2 = 4,800 thousand yen
ii	Charges for Design and Supervision	10,000	
3)	Fish Meal Plant	26,800	
i	Plant Building	6,800	Slate roofed steel framed structure; unit cost of 40 thousand yen x 170 m^2 = 6,800 thousnad yen
ii	Machinery	20,000	Material processing capacity of 10 t/day x unit cost of 2,000 thousand yen = 20,000 thousand yen (wiring and piping cost included)
4)	Generator Facilities	58,600	
i	Generator	36,000	Canning Plant - 100 kW Fish meal plant - 50 kW Cold storage rooms - 105 kW (Refrigerating machine - 55 kW) (Unit cooler and cooling water pump - 50 kW) Others - 50 kW Total - 305 kW 160 kW (240 HP) x 3 units = 480 kW (1 unit for stand-by purpose; 1 unit of automatic control device included)
ii	Construction of Ancillary Facilities	4,000	
iii	Fuel Tanks	4,000	

iv	Generator Building	9,600	Slate roofed steel framed structure; unit cost of 40 thousand yen x 240 m^2 = 9,600 thousand yen
v	Charges for Design and Supervision	5,000	
5)	Land	9,000	Unit acquisition cost of 20 yen x 100,000 m^2 = 2,000 thousand yen, and unit levelling cost (inclusive of the unit cost of access road) of 70 yen x 100,000 m^2 = 7,000 thousand yen
6)	Cars and Conveyor	19,500	6-ton trucks - 4,000 thousand yen x 2 trucks = 8,000 thousand yen, 1 passenger car - 1,000 thousand yen, forklifts = 1,500 thousand yen x 2 forklifts = 3,000 thousand yen 1 microbus - 1,500 thousand yen, and conveyor - 30,thousand yen x 200 m = 6,000 thousand yen
7)	Piers, etc.	9,000	Fixed pier - 7,980 thousand yen, Floating pier - 790 thousand yen, Movable bridge - 100 thousand yen, and Navigation aids 130 thousand yen
8)	Water Supply and Drainage Facilities	10,000	Cost of well excavation work and construction of a water distribution system to the complex facilities
Total:		562,500	

(2) **Layout of Major Facilities**

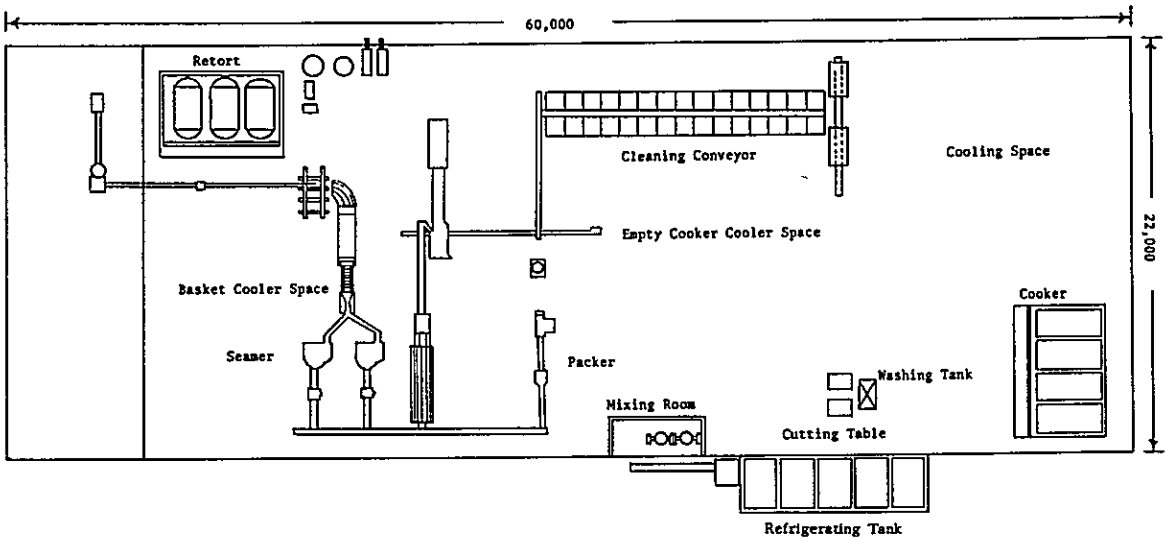
1) Canning Plant

2) Cold Storage

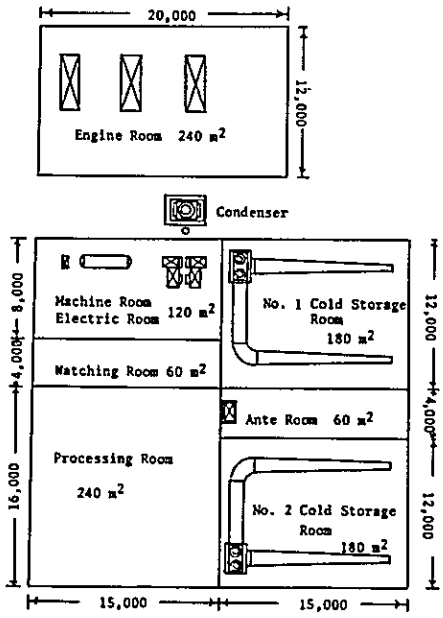
3) Fish Meal Plant

4) Piers

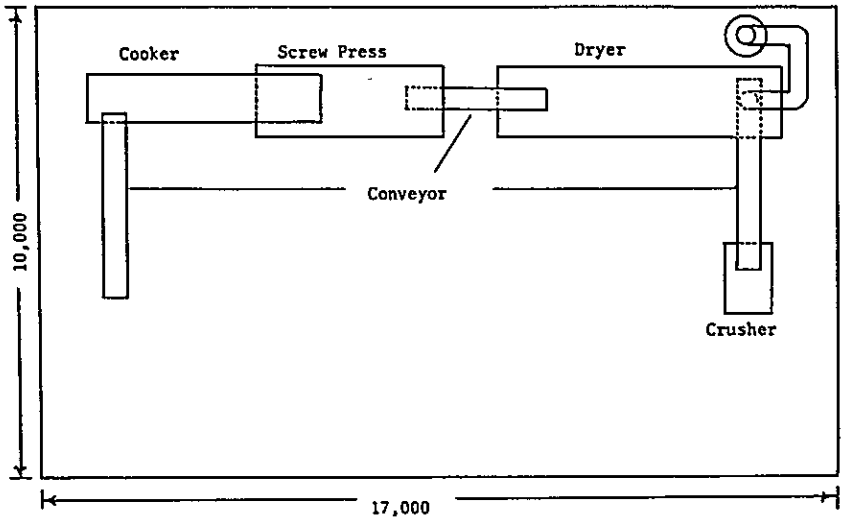
1. Canning Plant



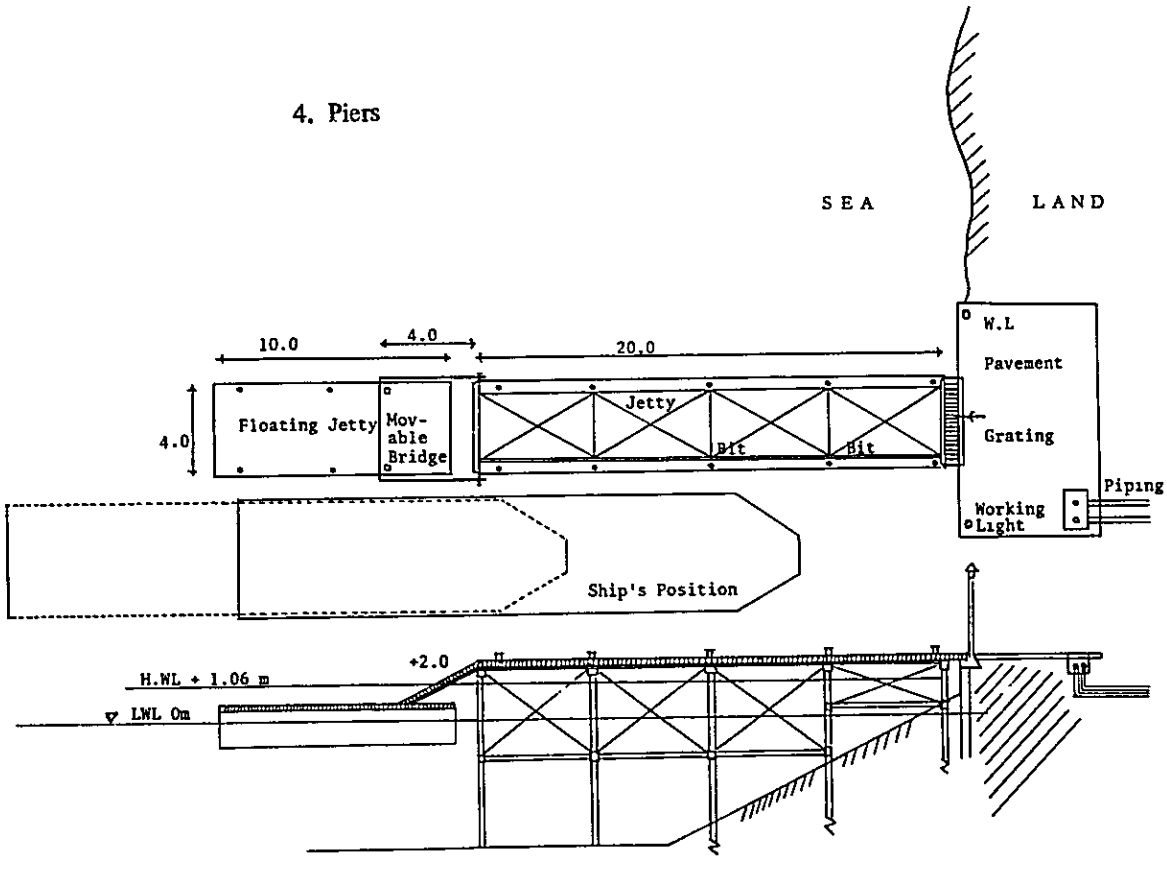
2. Cold Storage



3. Fish Meal Plant



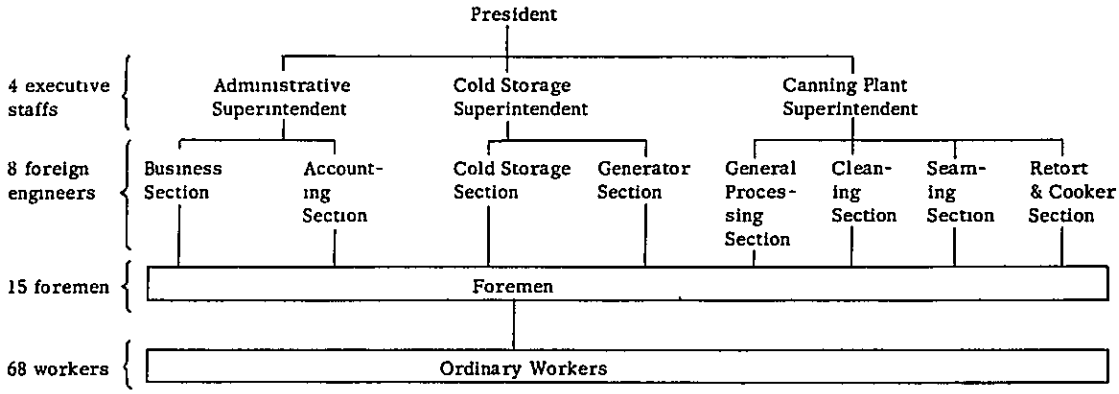
4. Piers



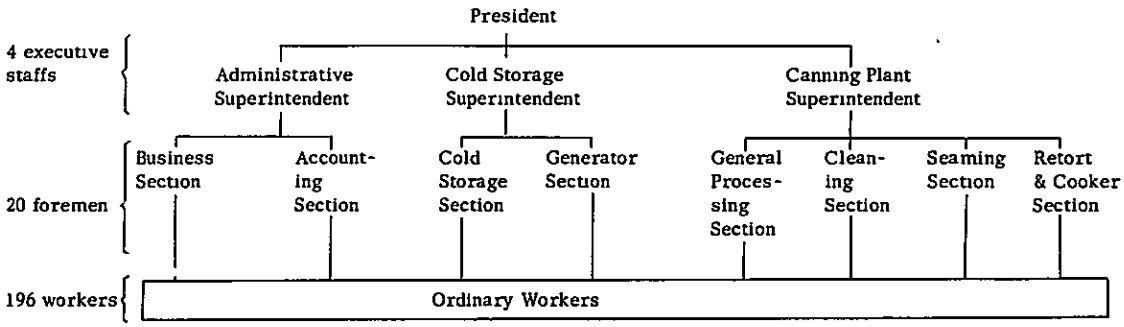
2. Details of Management Organization

(1) Chart of Management Organization

1) Organizational Chart at Time of Opening Commencement (2nd Year of Project Implementation)



2) Organizational Chart for Full-scale Operation (7th Year of Project Implementation)



(2) Assignment of Staffs, Foreign Engineers and Employees by Year

Unit: Persons

Year	Initial Year (con-struction)	2nd Year (operation commence-ment)	3rd Year	4th Year	5th Year	6th Year	7th Year
Executive Staffs	1	4	4	4	4	4	4
Foreign Engineers	3	8	8	8	4	4	-
Foremen	-	15*	15	15	16	16	20
Ordinary Workers	-	63	63	193	196	196	196
Total	4	90	90	220	220	220	220

(3) Capital Composition

Source	Amount ($ Thousand)	Ratio (%)	Remarks
Capital	300	100	Approx. 20% of equipment fund
Investment by local banking institution and private enterprises	150	50	Investment by the T. P. N. G. Development Bank and local enterprises
Investment by foreign enterprises	150	50	

3. Details of Complex Operation

(1) Details of Calculation for Material Processing Capacity and Production

(Production of Canned Skipjack)

Year	Material Processing Capacity (tons)	Canned Skipjack in Oil (1,000 cases)	Canned Flake Meat (1,000 cases)	Total (1,000 cases)	Production of Fish Meal (tons)
2nd Year	1,490	65.0 (42%)	13.0 (8%)	78.0	74 (5%)
3rd Year	2,730	130.0 (46%)	26.0 (9%)	156.0	136 (5%)
4th Year	5,200	260.0 (48%)	39.0 (7%)	299.0	260 (5%)
5th Year	8,840	442.0 (48%)	66.3 (7%)	508.3	442 (5%)
6th Year	8,398	442.0 (50%)	66.3 (8%)	508.3	419 (5%)
	↓	↓	↓	↓	↓

Note: Figures in parentheses indicate the yield rate of production against the material processing capacity.

Year	Canning Capacity (lines)	No. of Workers (persons)	No. of Working Days (days)	Yield Rate (%)	Remarks
2nd Year	1	86	260	55	Operation under training
3rd Year	1	86	260	60	"
4th Year	2	216	260	60	"
5th Year	2	216	260	60	Full-scale Operation
6th Year	2	216	260	63	"
	↓	↓	↓	↓	↓

(2) Details of Calculation for Purchase Price of Skipjack

Unit: Dollars/ton

Item	Cost (US $)	Remarks
International Market Price	408	Average Export Price of Frozen Skipjack during January - July period of 1971, FOB Japanese port
Freight	-75	Rabaul to Shimizu Port
Stevedorage	- 8	Loading and unloading
Sales Commission	-20	Trader's commission (5% of international market price)
Management Cost	-21	Cold storage cost, stevedorage and sales management cost (5% of international market price)
Balance	284	

(3) Details of Calculation for Charterage Cost of Skipjack

In order to supply the canning plant in Madang district with sufficient amount of material skipjack, a carrier with a loading capacity of 300 tons should be chartered for year-round operation so that skipjack caught in the waters of P.N.G. including the fishing grounds of Rabaul and Kavieng will be brought to Madang district.

Year	Material Requirement	Number of Carriers Required	Estimated Number of Days of Carrier Operation	Annual Transport Volume
2	1,490 tons	1	15 days	3,000 tons
3	2,730	1	15	3,000
4	5,200	1	30	6,000
5	8,840	2	15 30	3,000 6,000
6	8,398	2	15 30	3,000 6,000
7	↓	↓	↓	↓

o Calculation of Monthly Charterage in the Second Year

Charterage	500,000 yen	5,000,000 yen
Stevedorage	51,000 yen x 15 crews	765,000 yen
Fuel cost	3.5 kl (1 day) x 15 days x 13,000 yen	682,500 yen
Port charge	100,000 yen x 3 ports	300,000 yen
		6,747,500 yen

o Calculation of Charterage in the Third Year

6,747,500 yen x 12 months	80,970 thousand yen
80,970 thousand yen x 1.02	82,589 thousand yen

Note: 1.02 is the growth rate of commodity price.

4. Details of Income and Expenditure

(1) Details of Calculation for Expenditure

2nd Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes		
Sales proceeds of tuna in in sake lees	291,330	65,000 c/s x 4,482 yen = 291,330 yen
Sales proceeds of flake meat	16,692	13,000 c/s x 1 284 yen = 16,692 yen
Sales proceeds of fish meal	1,533	74 tons x 20,711 yen = 1,533, yen
Total income	309,555	
Expenditure:		
(Canning Plant)	356,788	
Cost of material fishes	171,359	250 c/s x 260 days = 6,500 c/s x 23 kg = 1,490 tons x 115,006 = 171,358,940 yen
Cost of subsidiary materials	26,000	65,000 c/s x 400 yen = 26,000,000 yen (Food oil 2.4 kg/c)
Cost of empty cans	56,160	78,000 c/s x 720 yen = 56,160,000 yen
Cost of rejected empty cans	281	78,000 c/s x 0.5% x 720 yen = 281,000 yen
Fuel cost	6,500	Boiler Fuel, Diesel oil 300 kg
Sales commission	12,018	291,330,000 yen x 4% = 11,653,200,(16,692,000 yen + 1,533,000 yen) x 2% = 364,500
Operation cost	3,500	Maintenance cost (cost of equipment included) 1,000,000 yen and Other expenses 2,500,000 yen
Charterage	80,970	Charter fee 500,000 yen, Crew charge 765,000,yen, Fuel 683,000 yen, Port charge 300,000 yen) x 12 months
(Cold Storage Facilities)	1,468	
Material cost	468	5 l. (Refrigerator oil) x 365 days x 180 yen = 329,000 yen, Medicine 250 l. x 556 yen = 139,000 yen
Operation cost	1,000	Maintenance cost 500,000 yen, Other expenses 500,000 yen
(Fish Meal Plant)	1,150	
Material cost	150	1,495 tons x 5% = 74.75 tons ÷ 20 kg = 3,738 sacks x 40 days ≒ 150,000 yen
Operation cost	1,000	Maintenance cost 500,000 yen, Other expenses 500,000 yen
(Generator Facility)	13,381	
Fuel cost	11,680	50 l./H x 24 H x 365 days x 20 yen = 8,760,000 yen, 50 l./H x 8H x 365 days x 20 yen = 2,920,000 yen
Lubricant cost	701	584 kl. x 2% x 60 yen = 701,000yen
Operation cost	1,000	Maintenance cost 500,000 yen, Other expenses 500,000 yen
Personnel cost	58,805	
Depreciation	45,180	
Total expenses including plant operation costs	476,772	
Gross profit	△ 167,277	
Business management cost	9,600	4 cars 2,400,000 yen, Traveling expenses 2,000,000 yen, Communication expenses 1,200,000 yen, Social expenses 1,200,000 yen, Other expenses 1,000,000 yen, Welfare expenses 90 persons x 20,000 yen = 1,800,000 yen
Operating profit	△ 176,817	
Interest on loans	28,712	396,000,000 yen x 3.5% = 13,860,000 yen 44,130,000 yen x 8% = 3,531,000 yen 61,500,000 yen x 8% = 4,921,000 yen 160,000,000 yen x 8% x 1/2 = 6,400,000 yen
Recurring profit	△2,056,529	

3rd Year

Item	Amount (Thousand Yen)	Details of caluculation
Income:		
Sales proceeds of canned fishes		
Sales proceeds of tuna in in sake less	605,930	130,000 c/s x 4,661 = 605,930
Sales proceeds of flake meat	34,034	26,000 c/s x 1,309 = 34,034
Sales proceeds of fish meal	2,873	136 t x 21,125 = 2,873
Total income	642,837	
Expenditure·		
(Canning Plant)	616,415	
Cost of material fishes	326,524	500 c/s x 260 yen = 130,000 c/s x 21 kg = 27,300 x 119,606 = 326,524,380
Cost of subsidiary materials	53,040	130,000 c.s x 408 yen = 53,040
Cost of empty cans	114,504	156,000 c/s x 734 yen = 114,504,000
Cost of rejected empty cans	573	156,000 c/s x 0.5 % x 734 yen = 572,520
Fuel cost	10,710	Boiler Fuel, Diesel Oil 500 kl.
Sales commission	24,975	Oil Soak 605,930,000 yen x 4% = 24,237,200 (34,034,000 yen + 2,873,000 yen) x 2% = 738,140
Operation cost	3,500	Same as the previous year
Charterage	82,589	Same as the previous year x 1.02 = 82,589,400
(Cold Storage Facilities)	1,477	
Material cost	477	Same as the previous year x 1.02 = 477,360
Operation cost	1,000	Same as the previous year
(Fish Meal Plant)	1,280	
Material cost	280	2,730 t x 5% = 136.5 t ÷ 20 kg = 6,825 x 41 yen = 279,825 yen
Operation cost	1,000	Same as the previous year
(Generator Facility)	13,629	
Fuel cost	11,914	Same as the previous year x 1.02 = 11,913,600
Lubricant cost	715	Same as the previous year x 715,020
Operation cost	1,000	Same as the previous year
Personnel cost	62,709	
Depreciation	45,180	
Total expenses including plant operation costs	740,690	
Cross profit	△ 97,853	
Business management cost	9,792	Same as the previous year x 1.02 = 9,792,000
Operating profit	△ 107,645	
Interest on loans	41,843	396,000,000 yen x 3.5% = 13,860,000 yen 71,000,000 yen x 3.5% x 1/4 = 621,000 yen 70,830,000 yen x 8% = 5,642,000 yen 221,500,000 yen x 8% = 17,720,000 yen 100,000,000 yen x 8% x 1/2 = 4,000,000 yen
Recurring profit	△149,488	

4th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	1,260,220	260,000 c/s x 4,847 yen = 1,260,220,000 yen
Sales proceeds of tuna in in sake less	52,065	39,600 c/s x 1,335 yen = 52,065,000 yen
Sales proceeds of flake meat	5,602	260 t x 21,547 yen = 5,602,000 yen
Sales proceeds of fish meal		
Total income	1,317,887	
Expenditure.		
(Canning Plant)	1,151,921	
Cost of material fishes	646,828	1,000 c/s x 260 days = 260,000 c/s x 20 kg = 5,200 t x 124,390 = 646,828,000
Cost of subsidiary materials	108,160	260,000 c/s x 416 yen = 108,160,000
Cost of empty cans	223,951	299,000 c/s x 749 yen = 223,951,000
Cost of rejected empty cans	1,120	299,000 c/s x 0.5% x 749 yen = 1,119,755
Fuel cost	16,830	Boiler fuel, Diesel oil, 800 kl
Sales commission	51,562	1,260,220,000 yen x 4% = 50,408,800 yen (52,065,000 yen + 5,602,000 yen) x 2% = 1,153,360 yen
Operation cost	7,000	Maintenance cost, 2,000,000 yen, Other cost, 500,000 yen
Charterage	96,470	Charter fee, 5,000,000 yen + Crew charge, 765,000 yen + Fuel expense, 1,365,000 yen + Port charge 600,000 yen = 7,730,000 yen x 12 months x 1.04
(Cold Storage Facilities)	1,987	
Material cost	487	Same as the previous year x 1.02 = 486,540 yen
Operation cost	1,500	Maintenance cost, 1,000,000 yen, Other expenses, 500,000 yen
(Fish Meal Plant)	2,046	
Material cost	546	5,200 t x 5% = 260 t 20 kg = 1,310 sacks x 42 yen = 546,000 yen
Operation cost	1,500	Maintenance cost, 1,000,000 yen, Other expenses 500,000 yen
(Generator Facility)	14,381	
Fuel cost	12,152	Same as the previous year x 1.02 = 12,152,280 yen
Lubricant cost	729	Same as the previous year x 1.02 = 729,300
Operation cost	1,500	Maintenance cost 1,000,000 yen, Other expenses 500,000 yen
Personnel cost	96,456	
Depreciation	51,570	
Total expenses including plant operation costs	1,318,361	Other expenses, 2,000,000 yen, Welfare expenses 220 persons x 20,000 yen/day = 4,400,000 yen
Gross profit	△474	
Business management cost	15,600	
Operating profit	△16,074	
Interest on loans	53,129	467,000,000 yen x 3.5% = 16,345,000 yen 128,300,000 yen x 8% = 10,264,000 yen 321,500,000 yen x 8% = 25,720,000 yen 20,000,000 yen x 8% x 1/2 = 800,000 yen
Recurring profit	△69,203	

5th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	2,228,122	442,000 c/s x 5,041 yen = 2,228,122,000 yen
Sales proceeds of tuna in in sake less	90,234	66,300 c/s x 1,261 yen = 90,234,000 yen
Sales proceeds of flake meat	9,714	442 t x 21,978 yen = 9,714,000 yen
Sales proceeds of fish meal		
Total income	2,328,070	
Expenditure:		
(Canning Plant)	2,028,893	
Cost of material fishes	1,143,587	1,700 c/s x 260 days = 442,000 c/s x 20 kg = 8,840 t x 129,367 = 1,143,586,600
Cost of subsidiary materials	187,408	44,200 c/s x 424 yen = 187,408,000 yen
Cost of empty cans	388,341	508,300 c/s x 764 yen = 388,341,200 yen
Cost of rejected empty cans	1,942	508,300 c/s x 0.57% x 764 yen = 1,941,706 yen
Fuel cost	27,030	Boiler fuel, Diesel oil 1,300 kl., Same as the previous year x 1.02
Sales commission	89,425	2,228,122,000 yen x 4% = 89,124,880,000 yen (90,234,000 yen + 9,714,000 yen) x 2% = 1,998,960
Operation cost	7,000	Same as the previous year
Charterage	184,160	Charter fee, 5,000,000 yen + Crew charge, 765,000 yen + Fuel oil 683,000 yen + Port charge 300,000 yen = 6,748,000 yen x 1.06 x 12 months, Charter fee 5,000,000 yen + crew charge 765,000 yen + Fuel oil 1,365,000 yen + Port charge 600,000 yen
(Cold Storage Facilities)	1,997	
Material cost	497	the previous year expense x 1.02 = 496,740 = 7,730,000 yen x 1.06 x 12 months
Operation cost	1,500	
(Fish Meal Plant)	2,450	
Material cost	950	8,840 t x 5% = 442 t — 20 kg = 22,100 sacks x 43 yen = 950,300
Operation cost	1,500	
(Generator Facility)	14,639	
Fuel cost	12,395	the previous year expense x 1.02 = 12,395,040
Lubricant cost	744	the previous year expense x 1.02 = 74,358
Operation cost	1,500	
Personnel cost	89,721	
Depreciation	51,570	
Total expenses including plant operation costs	2,189,270	
Gross profit	138,800	
Business management cost	15,112	the previous year expense x 1.02
Operating profit	122,888	
Interest on loans	58,894	467,000,000 yen x 3.5% = 16,345 215,360,000 yen x 8% = 17,229 291,500,000 yen x 8% = 23,320 50,000,000 yen x 8% x 1/2 = 2,000
Recurring profit	63,994	

6th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	2,316,964	442,000 c/s x 5,242 yen = 2,316,964,000 yen
Sales proceeds of tuna in in sake less	92,091	66,300 c/s x 1,389 yen = 92,091,000 yen
Sales proceeds of flake meat	9,413	419 t x 22,418 yen = 9,413,000 yen
Sales proceeds of fish meal		
Total income	2,418,468	
Expenditure:		
(Canning Plant)	2,037,872	
Cost of material fishes	1,129,859	1,700 c/s x 260 days = 442,000 c/s x 19 kg = 8,398 t x 134,539 yen = 112,985,822
Cost of subsidiary materials	190,944	442,000 c/s x 432 yen = 190,944,000 yen
Cost of empty cans	395,966	508,300 c/s x 779 yen = 395,965,700 yen
Cost of rejected empty cans	1,980	508,300 c/s x 0.57 x 779 yen = 1,979,828 yen
Fuel cost	27,571	Boiler oil and Diesel oil 1,300 kl., Same as the previous year x 1.02
Sales commission	94,709	2,316,964,000 yen x 4% = 92,678,560 yen (92,091,000 yen + 9,413,000 yen) x 0.2% = 2,030,080 yen
Operation cost	9,000	Maintenance cost 4,000,000 yen, Other expenses 5,000,000 yen
Charterage	187,843	Same as the previous year x 1.02 = 187,143,200 yen
(Cold Storage Facilities)	3,007	
Material cost	507	Same as the previous yearx 1.02 = 506,940
Operation cost	2,500	Maintenance cost 2,000,000 yen, Other expenses 500,000 yen
(Fish Meal Plant)	3,424	
Material cost	924	8,398 x 5% = 419 t ÷ 20 kg = 20,995 sacks x 44 yen = 23,780 yen
Operation cost	2,500	Maintenance cost 2,000,000 yen, Other expenses 500,000 yen
(Generator Facility)	15,902	
Fuel cost	12,643	Same as the previous year x 1.02 = 12,642,900
Lubricant cost	759	Same as the previous year x 1.02 = 758,880
Operation cost	2,500	Maintenance cost 2,000,000 yen, Other expenses 500,000 yen
Personnel cost	97,378	
Depreciation	51,570	
Total expenses including plant operation costs	2,209,153	
Gross profit	209,315	
Business management cost	16,230	Same as the previous year x 1.02 = 16,230,240
Operating profit	193,085	
Interest on loans	50,374	395,000,000 yen x 3.5% = 13,825 215,360 x 8% = 17,229 191,500,000 x 8% = 15,320 100,000,000 x 8% x 1/2 = 4,000
Recurring profit	142,711	

7th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	2,409,432	442,000 c/s x 5451 yen = 2,409,432,000 yen
Sales proceeds of tuna in in sake less	93,881	66,300 c/s x 1416 yen = 93,881,000 yen
Sales proceeds of flake meat	9,581	419 t x 22,866 yen = 9,581,000 yen
Sales proceeds of fish meal		
Total income	7,512,894	
Expenditure.		
(Canning Plant)	2,103,264	
Cost of material fishes	1,175,057	1,700 c/s x 260 days = 442,000 c/s x 19 kg = 8,398 t x 139,921 yen = 1,175,056,558 yen
Cost of subsidiary materials	194,922	442,000 c/s x 441 yen = 194,922,000 yen
Cost of empty cans	404,099	508,300 c/s x 795 yen = 404,098,500 yen
Cost of rejected empty cans	2,020	508,300 c/s x 0.5% x 795 yen = 2,020,492 yen
Fuel cost	28,122	Same as the previous year x 1.02 = 28,122,420 yen
Sales commission	98,447	2,469,432,000 yen x 4% = 96,377,280 yen (93,881,000 yen + 9,581,000 yen) x 2% = 2,069,240 yen
Operation cost	9,000	
Charterage	191,597	Same as the previous year x 1.02 = 191,596,800 yen
(Cold Storage Facilities)	3,017	
Material cost	517	Same as the previous year x 1.02 = 517,140 yen
Operation cost	2,500	
(Fish Meal Plant)	3,445	
Material cost	945	20,995 sacks x 45 yen = 944,775 yen
Operation cost	2,500	
(Generator Facility)	16,170	
Fuel cost	12,896	Same as the previous year x 1.02 = 12,895,860 yen
Lubricant cost	774	Same as the previous year x 1.02 = 774,180 yen
Operation cost	2,500	
Personnel cost	89,583	
Depreciation	51,570	
Total expenses including plant operation costs	2,267,049	
Gross profit	245,845	
Business management cost	16,535	Same as the previous year x 1.02 = 16,554,600 yen
Operating profit	229,290	323,000,000 yen x 3.5% = 11,305,000 yen 215,360 x 8% = 17,229 91,500,000 yen x 8% = 7,320,000 yen
Interest on loans	39,854	100,000,000 yen x 8% x 1/2 = 4,000,000 yen
Recurring profit	189,436	

8th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	2,505,698	442,000 c/s x 5,669 yen = 2,505,698,000 yen
Sales proceeds of tuna in in sake less	95,804	66,300 c/s x 1,445 yen = 95,804,000 yen
Sales proceeds of flake meat	9,772	419 t x 23,323 yen = 9,772,000 yen
Sales proceeds of fish meal		
Total income	2,611,274	
Expenditure:		
(Canning Plant)	2,171,696	
Cost of material fishes	1,222,052	1,700 c/s x 260 days = 448,000 c/s x 18 kg = 8,398 t x 145,517 yen = 1,222,051,766 yen
Cost of subsidiary materials	198,900	442,000 c/s x 450 yen = 198,900,000 yen
Cost of empty cans	412,231	508,300 c/s x 811 yen = 412,231,300 yen
Cost of rejected empty cans	2.061	508,300 c/s x 0.5% x 811 yen = 2,061,157 yen
Fuel cost	28,184	Same as the previous year x 1.02 = 28,684,440
Sales commission	102,339	2,505,698,000 yen x 4% = 100,227,920 yen (95,804,000 yen + 9,772,000 yen) x 2% = 2,111,520 yen
Operation cost	10,000	Maintenance cost 4,000,000 yen, Other expenses 6,000,000 yen
Charterage	195,429	Same as the previous year x 1.02 = 195,428,940 yen
(Cold Storage Facilities)	4,127	
Material cost	527	Same as the previous year x 1.02 = 527,340
Operation cost	3,600	Maintenance cost 3,000,000 yen, Other expenses 600,000 yen
(Fish Meal Plant)	4,566	
Material cost	966	20,995 sacks x 46 yen = 965,770 yen
Operation cost	3,600	Maintenance cost 3,000,000 yen, Other expenses 350,000 yen
(Generator Facility)	17,543	
Fuel cost	13,154	Same as the previous year x 1.02 = 13,153,920 yen
Lubricant cost	789	Same as the previous year x 1.02 = 789,480 yen
Operation cost	3,600	Maintenance cost 3,000,000 yen, Other expenses 600,000 yen
Personnel cost	96,887	
Depreciation	51,570	
Total expenses including plant operation costs	2,346,389	
Gross profit	264,885	
Business management cost	16,886	Same as the previous year x 1.02 = 16,886,100 yen
Operating profit	247,999	
Interest on loans	25,060	251,000,000 yen x 3.5% = 8,785,000 yen 100,000,000 yen x 8% = 8,000,000 yen 206,860,000 yen x 8% x 1/2 = 8,275,000 yen
Recurring profit	222,939	

9th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes	2,696,032	442,000 c/s x 5,896 yen = 2,606,032,000 yen
Sales proceeds of tuna in in sake less	97,726	66,300 c/s x 1,474 yen = 97,726,000 yen
Sales proceeds of flake meat	9,968	419 t x 23,790 yen = 9,968,000 yen
Sales proceeds of fish meal		
Total income	2,713,726	
Expenditure:		
(Canning Plant)	2,245,272	
Cost of material fishes	1,270,937	1,700 c/s x 260 days = 442,000 c/s x 19 kg = 8,398 t x 151,338 = 1,270,936,524
Cost of subsidiary materials	202,878	442,000 c/s x 459 yen = 202,878,000 yen
Cost of empty cans	420,364	508,300 c/s x 827 yen = 420,364,100 yen
Cost of rejected empty cans	2,102	508,300 c/s x 0.5 x 827 yen = 2,101,821 yen
Fuel cost	29,258	Same as the previous year x 1.02 = 29,257,680 yen
Sales commission	106,395	2,606,032,000 yen x 4% = 104,241,280 yen (97,726,000 yen + 9,968,000 yen) x 2% = 2,153,880 yen
Operation cost	14,000	Maintenance cost 8,000,000 yen, Other expenses 6,000,000 yen
Charterage	199,338	Same as the previous year x 1.02 = 199,337,580 yen
(Cold Storage Facilities)	4,138	
Material cost	538	Same as the previous year x 1.02 = 537,540 yen
Operation cost	3,600	
(Fish Meal Plant)	4,587	
Material cost	987	20,995 sacks x 47 yen = 986,765 yen
Operation cost	3,600	
(Generator Facility)	17,822	
Fuel cost	13,417	Same as the previous year x 1.02 = 13,417,080 yen
Lubricant cost	805	Same as the previous year x 1.02 = 804,780 yen
Operation cost	3,600	
Personnel cost	99,641	
Depreciation	51,570	
Total expenses including plant operation costs	2,423,030	
Gross profit	290,696	
Business management cost	17,224	
Operating profit	273,472	
Interest on loans	10,265	{ 179,000,000 yen x 3.5% = 6,265,000 yen { 100,000,000 yen x 8% x 1/2 = 4,000,000 yen
Recurring profit	263,207	

10th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes		
Sales proceeds of tuna in in sake less	2,709,902	442,000 c/s x 6,131 yen = 2,709,902,000 yen
Sales proceeds of flake meat	99,649	66,300 c/s x 1,503 yen = 99,649
Sales proceeds of fish meal	10,167	419 t x 24,265 yen = 10,167
Total income	2,819,718	
Expenditure.		
(Canning Plant)	2,317,536	
Cost of material fishes	1,321,770	1,700 c/s x 260 days = 442,000 c/s x 19 kg = 8,398 t x 157,391 = 1,321,769,618 yen
Cost of subsidiary materials	206,856	442,000 c/s x 468 yen = 206,856,000 yen
Cost of empty cans	429,005	508,300 c/s x 844 yen = 429,005,200 yen
Cost of rejected empty cans	2,145	508,300 c/s x 844 yen x 0.5 = 2,145,026 yen
Fuel cost	29,843	Same as the previous year x 1.02 = 29,843,160 yen
Sales commission	110,592	2,709,902,000 yen x 4% = 108,396,080 yen (99,649,000 yen + 10,167,000 yen) x 2% = 2,196,320 yen
Operation cost	14,000	
Charterage	203,325	Same as the previous year x 1.02 = 203,324,760 yen
(Cold Storage Facilities)	5,149	
Material cost	549	Same as the previous year x 1.02 = 548,760 yen
Operation cost	4,600	Maintenance cost 4,000,000 yen, Other expenses 600,000 yen
(Fish Meal Plant)	5,608	
Material cost	1,008	20,995 sacks x 48 yen = 1,007,760 yen
Operation cost	4,600	Maintenance cost 4,000,000 yen, Other expenses 600,000 yen
(Generator Facility)	19,106	
Fuel cost	13,685	Same as the previous year x 1.02 = 13,685,340
Lubricant cost	821	Same as the previous year x 1.02 = 821,100 yen
Operation cost	4,600	Maintenance cost 4,000,000 yen, Other expenses 600,000 yen
Personnel cost	102,396	
Depreciation	51,570	
Total expenses including plant operation costs	2,501,365	
Gross profit	318,353	
Business management cost	17,568	Same as the previous year x 1.02 = 17,568,480 yen
Operating profit	300,785	
Interest on loans	3,745	107,000,000 yen x 3.5% = 3,745,000 yen
Recurring profit	297,040	

11th Year

Item	Amount (Thousand Yen)	Details of calculation
Income:		
Sales proceeds of canned fishes		
Sales proceeds of tuna in sake less	2,818,634	442,000 c/s x 6,377 yen = 2,818,634,000 yen
Sales proceeds of flake meat	101,638	66,300 c/s x 1,533 yen = 101,638,000 yen
Sales proceeds of fish meal	10,371	419 t x 24,761 yen = 10,371,000 yen
Total income	2,930,643	
Expenditure:		
(Canning Plant)	2,392,129	
Cost of material fishes	1,374,643	1,700 c/s x 260 days = 44,200 c/s x 19 kg = 8,398 t x 163,687 yen = 1,374,643,426 yen
Cost of subsidiary materials	210,834	442,000 c/s x 477 yen = 210,834,000 yen
Cost of empty cans	437,646	508,300 c/s x 861 yen = 437,646,300 yen
Cost of rejected empty cans	2,188	508,300 c/s x 861 yen x 0.5% = 2,188,232 yen
Fuel cost	30,440	Same as the previous year x 1.02 = 30,439,860 yen
Sales commission	114,986	2,818,634,000 yen x 4% = 112,745,360 yen (101,638,000 yen + 10,371,000 yen) x 2% = 2,240,180 yen
Operation cost	14,000	
Charterage	207,392	Same as the previous year x 1.02 = 207,391,500 yen
(Cold Storage Facilities)	5,160	
Material cost	560	Same as the previous year x 1.02 = 559,980 yen
Operation cost	4,600	
(Fish Meal Plant)	5,629	20,995,000 sacksx 49 yen = 1,028,755 yen
Material cost	1,029	
Operation cost	4,600	
(Generator Facility)	19,396	
Fuel cost	13,959	Same as the previous year x 1.02 = 13,958,700 yen
Lubricant cost	837	Same as the previous year x 1.02 = 837,420 yen
Operation cost	4,600	
Personnel cost	105,150	
Depreciation	51,570	
Total expenses including plant operation costs	2,579,034	
Gross profit	351,609	
Business management cost	333,690	Same as the previous year x 1.02 = 17,919,360 yen
Operating profit	332,070	
Interest on loans	1,335	35,000,000 yen x 3.5% = 1,225,000 yen
Recurring profit	332,465	

(2) Details of Calculation for Personnel Cost

Year	Division of workers	Calculation Method: Wages in Yen (Weekly wage)	(No. of weeks)	No. of workers (Yearly wage)	(Total)	Total
2nd Year	Ordinary workers	3,847 yen	x 52 =	200,044 yen x 78 =	15,605,000 yen	58,805,000 yen
	Engineers			3,600,000 yen x 12 =	43,200,000 yen	
3rd Year	Ordinary workers	4,455 yen	x 52 =	231,660 yen x 78 =	18,069,000 yen	62,709,000 yen
	Engineers			3,720,000 yen x 12 =	44,640,000 yen	
4th Year	Ordinary workers	4,657 yen	x 52 =	242,164 yen x208 =	50,376,000 yen	96,456,000 yen
	Engineers			3,840,000 yen x 12 =	46,080,000 yen	
5th Year	Ordinary workers	5,265 yen	x 52 =	273,780 yen x212 =	58,041,000 yen	89,721,000 yen
	Engineers			3,960,000 yen x 8 =	31,680,000 yen	
6th Year	Ordinary workers	5,872 yen	x 52 =	305,344 yen x212 =	64,738,000 yen	97,378,000 yen
	Engineers			4,080,000 yen x 8 =	32,640,000 yen	
7th Year	Ordinary workers	6,480 yen	x 52 =	336,960 yen x216 =	72,783,000 yen	89,583,000 yen
	Engineers			4,200,000 yen x 4 =	16,800,000 yen	
8th Year	Ordinary workers	7,087 yen	x 52 =	368,524 yen x216 =	79,607,000 yen	96,887,000 yen
	Engineers			4,320,000 yen x 4 =	17,280,000 yen	
9th Year	Ordinary workers	7,290 yen	x 52 =	379,080 yen x216 =	81,881,000 yen	99,641,000 yen
	Engineers			4,440,000 yen x 4 =	17,760,000 yen	
10th Year	Ordinary workers	7,492 yen	x 52 =	389,584 yen x216 =	84,156,000 yen	102,396,000 yen
	Engineers			4,560,000 yen x 4 =	18,240,000 yen	
11th Year	Ordinary workers	7,695 yen	x 52 =	400,140 yen x216 =	86,430,000 yen	105,150,000 yen
	Engineers			4,680,000 yen x 4 =	18,720,000 yen	

Note: Wages are assumed to be raised by a fixed amount of 202.5 yen (50 cents) for ordinary workers and of 405 yen (A$1.00) for improvement of skill. In the above calculation, wages are raised by a fixed amount in the 2nd and 3rd years when many unskilled workers are to be newly recruited as well as in the 9th and subsequent years when all workers are assumed to have attained the necessary skill. Wages of foreign engineers are assumed to be raised by 120 thousand yen each year.

(3) Details of Calculation for Economic Effect

Calculation basis of Internal Rate of Return (R)

Unit: Thousand Yen

Year	Investments ①	Operation Cost ②	Input ③ = ①+②	Output ④	Profits P = ④ - ③
1st	491,500	59,570	551,070	0	△ 551,070
2nd	0	441,192	441,192	309,555	△ 131,637
3rd	71,000	705,402	776,402	642,837	△ 133,565
4th		1,282,391	1,282,391	1,317,887	35,496
5th		2,153,612	2,153,612	2,328,070	174,458
6th		2,173,813	2,173,813	2,418,468	244,655
7th	17,550	2,232,014	2,249,564	2,512,894	263,330
8th		2,311,705	2,311,705	2,611,274	299,569
9th		2,388,684	2,388,684	2,713,726	325,042
10th		2,467,363	2,467,363	2,819,718	352,355
11th		2,545,383	2,545,383	2,930,643	459,780

"Try and error method" has been used to seek "R" in the following formula:

$$\Sigma \frac{Pn}{(1+R)^n} = 0 \quad , \quad R = 15.6\%$$

ANNEX 7 PRODUCTIVITY BY PRODUCTION SCALE

1. Profit and Loss by Production Scale

Profit and loss of the present project calculated on the basis of one, two and three production lines are as tabulated below.

Item \ Production Scale	1 Line (850 c/s)	2 Lines (1,700 c/s)	3 Lines (2,550 c/s)
Sales proceeds of canned fishes	thousand yen	thousand yen	thousand yen
Sales proceeds of canned tuna in oil	1,114,061	2,228,122	3,342,183
Sales proceeds of flake meat	45,117	90,234	135,351
Sales proceeds of fish meal	4,857	9,714	14,571
Total Income	1,164,035	2,328,070	3,492,105
Canning Plant:	1,022,271	2,028,893	3,051,164
Cost of material fishes	571,793	1,143,587	1,715,380
Cost of subsidary materials	93,704	187,408	281,112
Cost of empty cans	194,170	388,341	582,511
Cost of rejected empty cans	971	1,942	2,913
Fuel cost	14,596	27,030	37,842
Sales commission	44,712	89,425	134,137
Plant operation cost	4,000	7,000	10,000
Charterage	98,325	184,160	269,980
Cold Storage Facilities:	1,200	1,997	2,800
Material cost	300	497	700
Operation cost	900	1,500	2,100
Fish Meal Plant:	1,375	2,450	3,525
Material cost	475	950	6,425
Operation cost	900	1,500	2,100
Generator Facility:	8,790	14,639	20,501
Fuel cost	7,440	12,395	17,360
Lubricant cost	450	744	1,041
Operation cost	900	1,500	2,100
Personnel Cost	53,832	89,721	125,608
Depreciation Expense	34,020	51,570	68,940
Total Expenditure Including Plant Operation Costs	1,121,488	2,189,270	3,272,538
Gross Profit	42,547	138,800	219,567

Note: The profit and loss calculated on 5th year.

2. Capital Requirement by Production Scale

Unit: Million yen

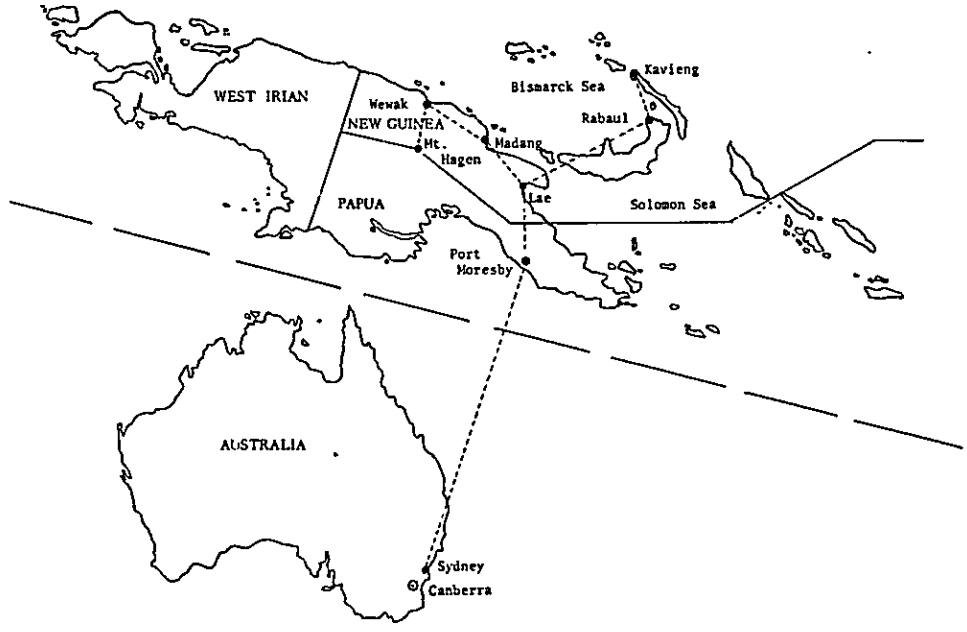
Facilities \ Scale / Amount	1 Line Investment	2 Lines Investment	3 Lines Investment
1. Canning Plant	188	286	409
2. Cold Storage Facilities	93	143	200
3. Fish Meal Plant	20	26	40
4. Generator Facility	43	58	71
5. (Land)	(9)	(9)	(9)
6. Trucks and Conveyors	15	19	27
7. Piers, etc.	9	9	9
8. Water Supply and Drainage Facilities	10	10	10
Total	378	551	766
	(9)	(9)	(9)
Depreciation	34	49	69

Note: Depreciation is assumed to be effected by fixed instalment with the rate of residual value after amortization set at 10%.

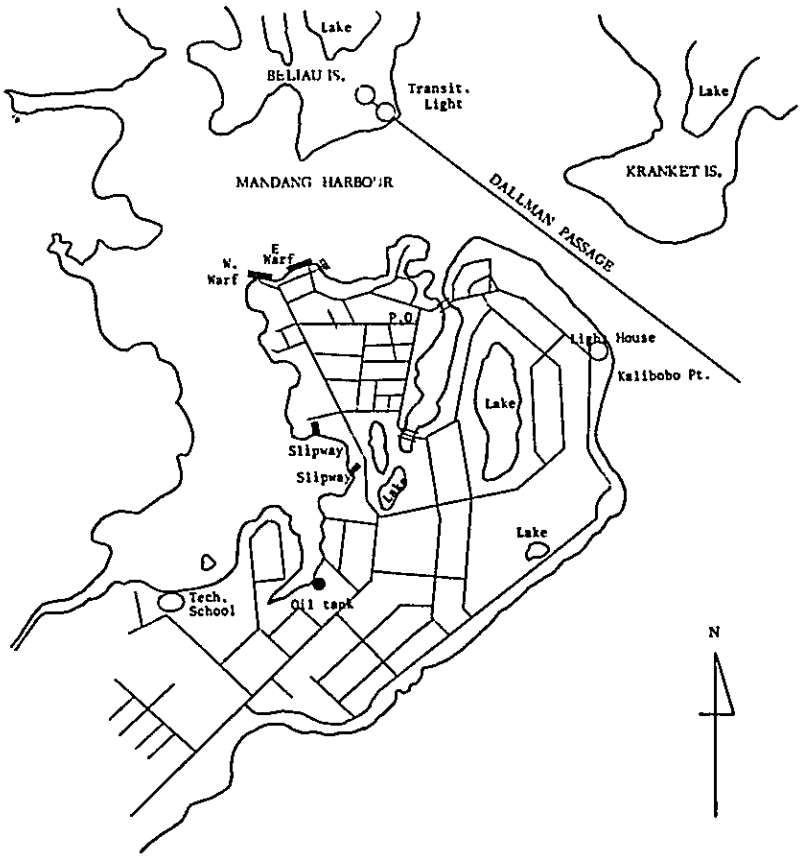
ANNEX 8 SCHEDULE OF CONSTRUCTION AND OPERATION

ANNEX 9 MAPS

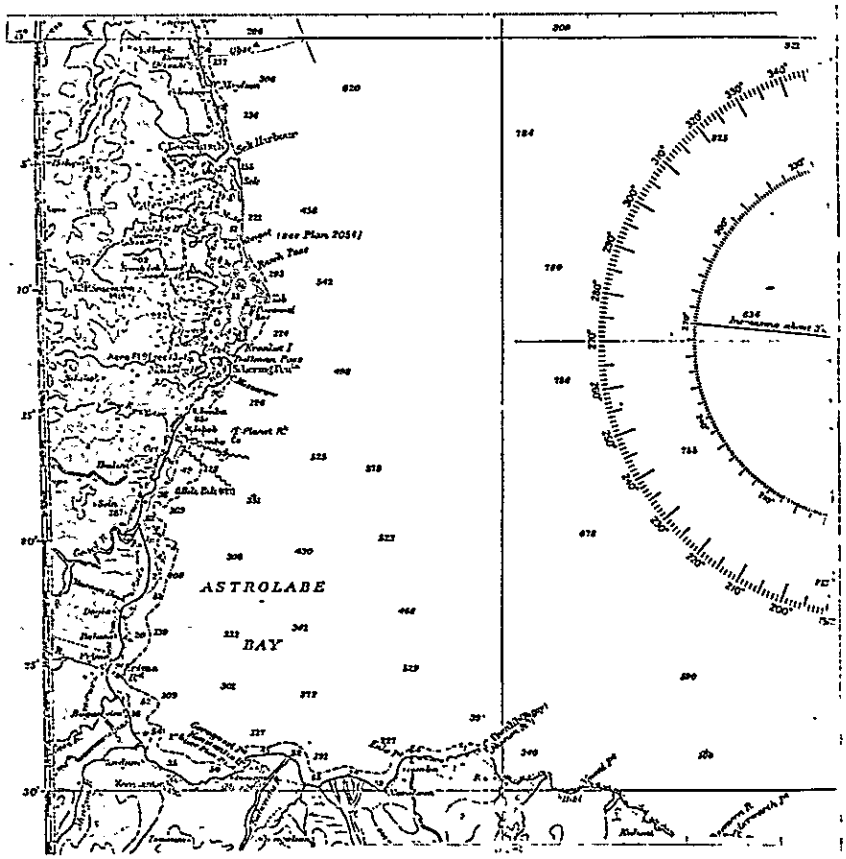
1. Map of P.N.G.



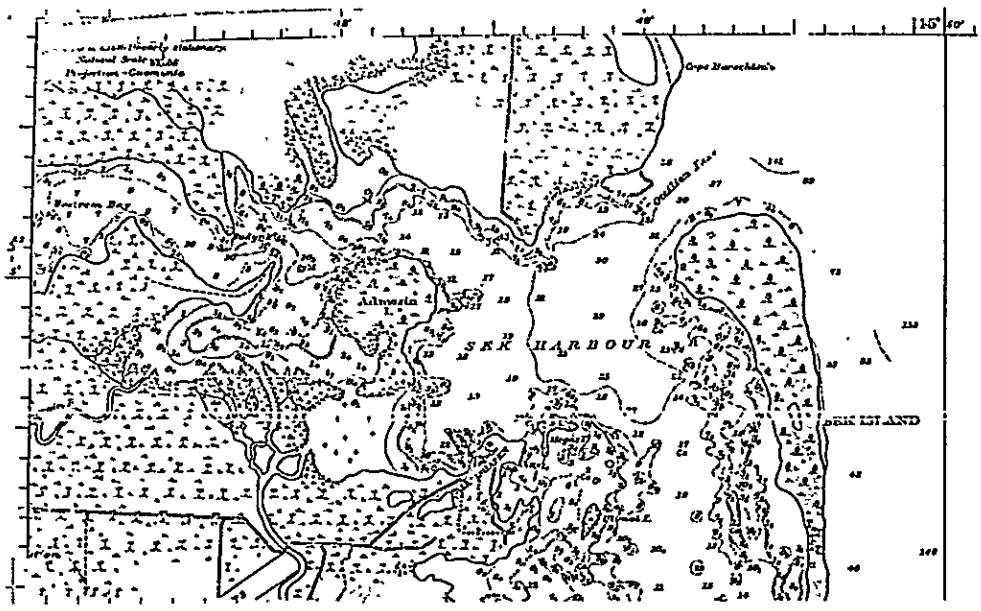
2. Map of Madang Town



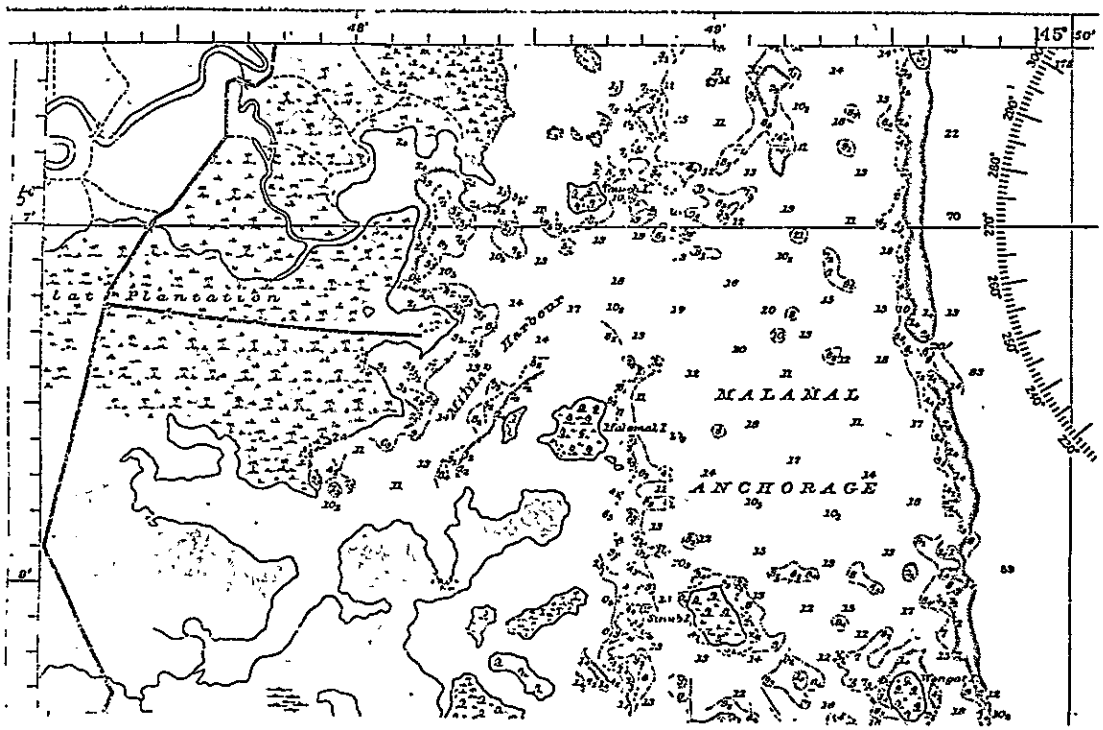
3. Map of Madang Waters



4. Map of Sek Harbour



5. **Map of Mililat Harbour**



6. **Map of Nagada Harbour**