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ASSISTANCE FOR INSTITUTION-BUILDING
FOR INDUSTRIAL PROMOTION
DP/PNG/86/002
PAPUA NEW GUINEA

Technical report: Assessment and Promotion of Engineering Industry
Sub-sector in Papua New Guinea*

Prepared for the Government of Papua New Guinea
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Mr. M.M. Luther
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of manufacturing sector

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United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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BASIC DATA

General

Surface Area : 462,840 sq. km.
Capital City : Fort Moresby
Population : 3.6 million (1989 estimate)
Annual Growth : 2.3%
Density : 8 per sq. km.
Climate : Tropical
Languages : English, Pidgin, many local languages
Adult Literacy : 32% (1980)
Currency : 1 Kina (K) = 100 Toea
Exchange Rate : K = 0.9411 \$ (May 1992)

Economy

GDP per Capita : Kina 679 (1988)
GNP per Capita : Kina 834 (1988)
Inflation Rate : 4.5% (1988/89)

Government Finances

Expenditure : 1,082.3 Mill Kina (1990 Budget)
Revenue : 1,095.7 Mill Kina (1990 Budget)
Foreign Aid : 190.6 Mill Kina (1989 Revised)
Foreign Debt : 831.6 Mill Kina (1989)
Foreign Reserves : 340.7 Mill Kina

Trade

Export-Total Value : 1097 Mill Kina (1989)
As % of GDP : 36.4% (1989)
Major Items : Copper concentrate, Gold, Silver, Cocoa,
Coffee, Tea, Copra, Copra Oil, Palm Oil,
Rubber, Logs, Woodchips, Prawns

Imports-Total Value: 1049 Mill Kina (1989)

As % of GDP : 36.0% (1989)

Major Items : Machinery & Transport Equipment, Food,
Mineral Fuels, Chemicals, Manufactured
Goods

Major Suppliers : Australia, Japan, USA, Singapore,
New Zealand, United Kingdom

Manufacturing

Value Added (VA) : 2446 Mill Kina (1988)

As % of GDP : 7.9% (1988)

VA per Capita : Kina 70

VA per Labour : Kina 10,066 (1988)

Employment : 24299 (1988)

LIST OF ABBREVIATIONS

ATDI	: Appropriate Technology Development Institute
CNC	: Computer-Numerically Controlled
CPI	: Consumer Price Index
DWT	: Dead Weight Tonnage
GDP	: Gross Domestic Product
GNP	: Gross National Product
HRD	: Human Resource Development
IAB	: Industry Assistance Board
ILO	: International Organisation
IPA	: Investment Promotion Authority
ISIC	: International Standard Industry Classification
K	: Kina
KVA	: Kilovolt ampere
KWA	: Kilowatt hour
LIKBA	: Liklik Bisnimanmeri Association
LNG	: Liquefied Natural Gas
LPG	: Liquefied Petroleum Gas
MIS	: Management Information System
MTIA	: Metal Trade Industry Association
NCD	: National Capital District
NEC	: National Electricity Corporation
NIDA	: National Electricity Development Authority
NISIT	: National Institute of Standards and Industrial Technology
NSC	: Nuigini Steel Corporation
PIP	: Public Investment Programme
PNG	: Papua New Guinea

FNGLAS : Papua New Guinea Laboratory Accreditation Scheme
SBDC : Small Business Development Corporation
SFATF : South-Pacific Appropriate Technology Foundation
Sq. Km. : Square Kilometer
SSIs : Small Scale Industries
TLAC : Testing and Laboratory Accreditation Committee
TQM : Total Quality Management
UNIDO : United National Industrial Development Organisation
UNITECH : University of Technology
USA : United States of America
VA : Value Added

ABSTRACT

This project is an integral part of the Project No. DF/PNG/86/002 and its purpose was to prepare a profile of the PNG engineering industry and its sub-sector and recommend measures for the promotion of its sub-sector. The Project commenced on 6.4.1992 and with a visit to Vienna for briefing. Duration of stay in PNG was four weeks from 12.4.1992 to 9.5.1992. The draft Report was completed at Delhi between 10.5.1992 and 29.5.1992. Debriefing was done by Mr. Mueller at Delhi on 28th and 29th May 1992.

The main conclusions reached were that the engineering industry has considerable potential to grow and meet the country's requirements, particularly for the booming mining sector. Various policy measures have been recommended to make this feasible.

INTRODUCTION

This Report was compiled by Mr. M M Luther, C. Eng., F.I. Mech. E (London), F.I.E.E. (London), F.I.C.A., Consultant in macro and micro level analysis of the manufacturing sector. The job description is at Appendix II.

The Project activities began on the 6th of April 1992 for briefing in UNIDO headquarters at Vienna.

During the stay in PNG, the author visited the premises and workshops of all the 16 members of the Metal Trade Industry Association besides the University of Technology at Lae and the defence workshop at Fort Moresby as well as a few smaller workshops, not members of MTIA. The author had also discussions with professionals and trade associations as well as senior officers of the Department of Trade and Industry. Discussions were also held with various other institutions connected with engineering industry as well banks and financial institutions. The Project work was considerably facilitated by the preparatory work that had been done by Mr. Brenning, CTA. The Polgera gold mine was also visited for on-the-spot assessment of requirements of engineering goods.

All the objectives of the Project were completed and conclusions were informally presented to the Secretary, Department of Trade and Industry and all his colleagues at a meeting on 4th May 1992. All the suggestions and recommendations were informally accepted

by them.

Reference was made to World Bank Reports on PNG as well as to the UNIDO Briefing Note on Papua New Guinea in February 1991 and Technical Report : Project Identification and Promotion of the Manufacturing Sector in Papua New Guinea (Project No. DP/PNG/86/002) by Mr. W. B. Baumert.

Methodology for the Study

Data was collected by personal discussions with Government officials, industry associations, private sector firms and other relevant bodies. The format used is at Appendix I to this Report.

Data was then analysed to come to tentative conclusions which were then discussed at different fora before drawing up this Report and recommendations contained herein.

EXECUTIVE SUMMARY

The socio-economic setting of Papua New Guinea is marked by wide divergence in population density, difference in emoluments of citizens and expatriates, and the population consisting of 700 tribes speaking nearly 700 different languages. The availability of infrastructure also varies considerably in different regions.

The country is endowed with rich resources of timber and minerals, including gold, silver and copper. Formal production in the oil sector is expected to commence during the current year. It also has rich fishery resources.

The Government has recently come out with a Medium-Term Industry Plan in which it has identified the role of the private sector as well as the responsibilities of different promotional agencies. Various incentives have been listed although their application with engineering industry is limited.

Engineering industries do not seem to figure high in the priorities of the Government or those of the financial institutions.

The present system of tariffs and duties acts as a dis-incentive to the engineering industry because of various exemptions given to Government, Government contractors and mining industry.

The engineering sector has considerable potential for growth and

increasing its contribution to the national economy provided its constraints are removed.

The linkages between the engineering industry and other sectors of the economy need to be assessed and taken into account for planning the future of engineering industry.

The ship-building facilities at Port Moresby need to be extensively utilised as a matter of policy. It can fabricate and repair ships of 800 DWT.

There is urgent need for a structural analysis of the engineering industry to be carried out. A methodology has been suggested in this Report.

The facilities at UNITECH at Lae need to be improved and put to much better utilisation than is being done at present.

The Defence General Engineering Workshop has facilities which should be put into use both for defence and civilian sectors.

A complete SWOT analysis of the engineering industry has been given in the Report.

Specific suggestions have been made for development of small-scale industries in the context of the Government's declared policy to promote this sector.

A methodology has been suggested for planning of manpower for engineering industry.

The Metal Trade Industry Association is the representative body of engineering industry. Interaction between the Government on the one hand and all associations representing the industry and professionals needs to be promoted.

The present roles of different institutions, directly or indirectly connected with the engineering sector, have been assessed and recommendations made for improving their contribution.

A separate Chapter VIII summarises all the recommendations, including those for UNIDO assistance.

REPORT ON ENGINEERING INDUSTRY IN PAPUA NEW GUINEA

CHAPTER I

PAPUA NEW GUINEA -- THE COUNTRY

1.1 HISTORICAL AND GEOGRAPHICAL BACKGROUND

Papua New Guinea is a country comprising of the eastern parts of the island of New Guinea and about 600 small islands, lies just below the equator and is the eastern part of the island of New Guinea, the western part being the Irian Jaya province of Indonesia.

The country got self-government in December 1973 and full independence on September 16, 1975. It has a system of government based on Westminster or the UK type of democracy.

Papua New Guinea is divided into 19 provinces plus a national capital district. Each province is run by a provincial government. The government of the country comprises of the legislative or the parliament, the executive or the bureaucracy and the judiciary or the courts.

1.2 THE SOCIO-ECONOMIC SETTING

The socio-economic structure of Papua New Guinea is dominated, on the one hand by urban rural contrast, and a marked degree of technological ignorance on the other. 80% of the population is in rural areas.

The population in 1971, 1980 and 1989 (estimated) by region and density is shown in Table 1.1. As will be seen, density ranges from 1 per sq. km. in the western province to 642 in the

Table 1.1

Land Area Pollution And Density By Province

Province	Area Sq.Kms.	Population			Density per sq.kms
		1971 (Census)	1980 (Census)	1989 (Census)	
Western	99,300	70,339	78,337	98,600	1
Gulf	34,500	58,273	63,843	75,400	2
Central	29,500	175,515	116,361	141,200	5
National Capital	240	*	112,429	154,100	642
Milne Bay	14,000	108,528	127,725	162,100	12
Northern	22,800	65,918	77,097	97,200	4
Southern Highlands	23,600	192,047	235,350	271,900	11
Enga	12,800	131,816	164,270	185,800	15
Western Highlands	8,500	211,456	264,129	317,500	37
Chimbu	6,100	159,729	178,013	189,800	31
Eastern Highlands	11,200	236,752	274,608	321,500	29
Morobe	34,500	240,930	305,356	383,300	11
Madang	29,000	168,212	209,656	266,300	9
East Sepik	42,800	180,149	220,827	273,900	6
Sandaun (West Sepik)	36,300	93,479	113,849	135,400	4
Manus	2,100	24,356	25,859	32,100	15
New Ireland	9,600	58,507	65,657	83,300	9
East New Britain	15,500	108,238	130,730	167,000	11
West New Britain	21,000	60,783	88,415	117,900	6
North Solomons	9,300	90,382	125,506	170,300	18
Papua New Guinea	4,62,840	2,435,409	2,978,057	3,644,600	8

Source : National Statistical Office.

Note : * National Capital District was part of Central Province until 1978.

National Capital District. The number of provinces with population density between 1 and 10 per sq. km. is 9, those between 11 and 20 is 7, those between 20 and 30 is 1, those between 30 and 40 is 2 and only 1 with more than 40 per square kilometre.

The people who live in New Guinea and nearby countries of the Solomons and parts of city are described as Melanesians. There are nearly 700 tribes in Papua New Guinea and there are nearly 700 languages with very little common between them. Pidgin is however widely spoken & understood in the urban areas. Only about 12.5% of the total work force in the country is in formal employment with the public sector, counting for the most of identifiable employed population followed closely by the plantation sector. Its rate of urbanisation has been very high (9%) compared with 2.3% rate of growth of population.

There is considerable difference in emoluments between the citizens and expatriates and could well be a determinant factor in the attitude of both towards each other. This can get marked when their competence and ability to do managerial, supervisory and manual skilled work is considered comparable. Table 1.2 shows the difference in earnings by citizens and non-citizens in different economic sectors. As can be seen, in the manufacturing industry, the ratio of average weekly earnings in professional, technical and related workers is 60:211 and in the case of others in the production and related industries, transport and engineering sectors, it is 32:186.

Table 1.2. . Average Weekly Earnings of all Workers by Citizenship, Sector and Major Occupational Group

	Professional, Technical and Related Workers		Law-Making Officials, Court Admin. & Managers		Clerical and Related Workers		Sales Workers	
	Citizens	Non-Citizens	Citizens	Non-Citizens	Citizens	Non-Citizens	Citizens	Non-Citizens
Primary Production	34	250	74	245	31	107	18	•
Mining and Quarrying	84	320	121	338	75	237	•	•
Manufacturing	60	211	92	255	45	122	206	195
Public Utilities	60	254	101	254	49	184	•	•
Building and Construction	76	225	86	297	49	158	42	•
Transport, Storage and Communications	52	297	99	254	47	182	39	•
Finance and Property	55	255	99	317	51	196	69	141
Commerce	74	219	76	251	45	164	36	•
Community and Business Services	29	160	64	230	44	141	21	•
Amusement, Hotels	63	198	94	209	50	119	39	•
Education	64	153	115	312	60	221	•	•
Central Government	84	212	118	239	59	168	•	•
Public Authorities, N.E.I.	38	•	60	•	44	•	•	•
Total - All sectors	60	203	93	266	48	170	36	152

Table 1.2 (Contd..)

	Service Workers		Agricultural (Husbandry, Forestry, Fishery)		Production and re- lated Industries, Transport and Engineering		Total	
	Citizens	Non- Citizens	Citizens	Non- Citizens	Citizens	Non- Citizens	Citizens	Non- Citizens
Primary Production	16	.	12	164	16	182	13	225
Mining and Quarrying	42	.	.	.	60	282	63	291
Manufacturing	30	.	24	.	32	186	34	205
Public Utilities	39	.	39	.	40	291	47	251
Building and Construction	35	.	.	.	35	214	37	235
Transport, Storage and Communications	40	191	18	.	37	194	41	252
Finance and Property	27	.	16	.	37	233	51	246
Commerce	31	.	20	.	34	183	38	219
Community and Business Services	27	.	14	.	24	188	28	168
Amusement, Hotels	35	189	29	.	40	230	43	190
Education	43	.	.	.	43	.	64	161
Central Government	58	.	64	215	57	164	87	209
Public Authorities, N.E.I.	29	.	17	.	25	.	30	129
Total - All sectors	33	171	12	181	34	201	37	215

Source: National Planning Office 1981: 25-27

* Less than 10 observations and not significant

• No observations - It should be noted that the average for total is lower than those of the individual sectors in columns. This is due to the weight of the earnings of those shown in other sectors.

There is also considerable imbalance between different regions of the country not only in income but also in terms of infrastructure. Economic & social infrastructures to a considerable degree, influence the level of socio-economic activities for individuals as well as the society. Socio-economic structures have been considerably fragmented by the physical characteristics of the country. Different areas even towns exist almost in complete isolation from each other culturally, economically and socially. This has put considerable strain on government's efforts in achieving integration of all citizens with the national economy in general.

Major Socio-Economic indicators and access of population to basic services is at Table 1.3

1.3 RESOURCE ENDOWMENTS

1.3.1 TIMBER

Nearly 90% of Papua New Guinea's land area is covered by tropical rain forest. These forest resources have a sizable impact on exports. In 1988, they represented 8% of the country's total export revenues at 98.5 million K. However, the current rate of depletion of forest resources is alarming and value added to the country's economy is limited since nearly 35% of its timber is sold as logs even though capacity and capability exist for processing timber products. This is evident by the fact that locally processed timber products sell well not only domestically but also in overseas markets.

Table 1.3. Socioeconomic indicators and access to Basic Services

Province a/	Population b/			Income			Education		Health	
	Population ('000)	% annual population growth 1980-2000	% urban	Per capita income (kina) (1983)	Per capita income growth g/	Formal employment g/ (%) (1980)	Pop. with no schooling (%) (1980)	Primary enrollment ratio (%) (1985)	Infant mortality rate (per 1000) (1985)	MCH coverage (%) (1984)
Nat'l Capital Distt.	112.4	3.9	100	2,115	178 d/	45	36	75	35	88
North Solomons	125.5	3.4	16	1,973	218	20	50	73	33	66
East New Britain	130.7	2.7	12	770	114	18	55	76	57	90
Western	78.3	2.6	12	673	329	6	71	77	83	94
New Ireland	65.7	2.6	8	534	141	15	59	86	62	94
Central	116.4	2.1	4	528	178 d/	10	68	70	59	63
West New Britain	88.4	4.9	6	483	60	15	51	75	60	85
Morobe	305.4	2.6	22	473	84	12	51	61	62	66
Manus	25.9	2.6	20	416	55	13	51	84	55	79
Northern/Oro	77.1	2.6	8	413	161	10	61	67	67	77
Madang	209.7	2.6	10	387	110	8	80	58	62	73
Western Highlands	264.1	2.1	6	337	70 d/	11	89	50	81	83
East Sepik	220.8	2.3	11	320	96	5	81	72	94	67
Eastern Highlands	274.6	1.8	8	290	58	5	91	63	55	95
Milne Bay	127.7	2.7	5	280	85	5	64	73	50	66
Enga	164.3	1.3	1	267	70 d/	3	94	51	91	91
Chimbu	178.0	0.7	3	264	86	3	93	60	87	88
Southern Highlands	235.4	1.5	2	258	90	4	94	51	116	98
West Sepik	113.8	1.9	6	255	55	5	84	59	104	56
Gulf	63.8	1.8	10	198	29	6	71	67	71	89
Total/Average	2,978.1	2.3	12	520	124	10	78	64	72	80

a/ Provinces, listed here in order of per capita income, have been divided into 5 groups, each representing approximately one quintile of the total population.
 b/ 1980 estimates.

c/ Percentage growth in per capita income (at factor cost) in nominal terms between 1971/72 and 1983.

d/ In 1971/72, both Central/NCI and Enga/Western Highlands were combined.

e/ Percent of economically active population.

f/ Percent of children aged 0-1 y; cars served by; maternal and child health care.

1.3.2 MINERAL SECTOR

This sector plays a very large and important role in Papua New Guinea's economy. Nearly 3/4th of the export earnings, 15% of GDP & 10% of fiscal revenues are accounted for by this sector alone. The sector is experiencing a boom and is expected to grow rapidly in next five years.

(i) Bougainville Copper Mines

This copper mine which was one of the world's largest, has been closed due to unrest and differences between the local landowners and the foreign company which was operating this mine. Efforts are being made by the Central Government to recommence the mining operations.

(ii) Oktedi Mining Limited

This company is jointly owned by BHP Mineral Holdings (30%), GOMCO Minerals - Papua New Guinea (30%), Star Mountain Holding Company (20%) and the state of Papua New Guinea (20%). The processing plant mills approximately 70,000 dry tonnes of ore/day today to produce 1200 tonnes of copper concentrate with significant gold strips. It employs over 3,000 persons. It is estimated to annually yield about 500,000 tonnes of copper concentrate containing 500,000 ounces of gold, 900,000 ounces of silver and 150,000 tonnes of copper.

(iii) Misima Mines Limited

These mines are jointly owned by Placer New Guinea (80%) and the

state of Papua New Guinea (20%). Two reserves of 52 million tonnes containing an average of 1.35 gm per tonne of gold and 20 gms per tonne of silver which will assure a mine life of 10 years at a milling rate of 15,000 dry tonnes per day. Construction in this mine was commenced during January 1988 and it is estimated that nearly 300,000 ozs of gold were produced during 1991. The development of this mine is planned in five stages. The first and the second featuring high strip ratio are nearly complete.

(iv) Folqera Mines

This is a joint venture with both underground and surface mines. Reserves estimated are at 60 million tonnes at an overall grade of 6.5 gms per tonne of gold and 9.9 gms per tonne of silver. This mine produced nearly 500 thousand ozs of gold for the first six months of 1991. This mine is expected to have a life of over 25 years.

(v) Lihir Islands

This is considered to be the largest gold mine in the world in this century and is a joint venture between Kennekott Explorations of Australia (80%) and New Guinea Mining Limited (20%). This is a remote island presenting considerable difficulties in exploration and mining and it is expected to have reserves of nearly 170 billion tonnes containing 18 million ozs of gold. Its production in the first year is expected to be

around 250,000 ozs. going upto 800,000 ozs. per annum later. The life of this mine is expected to be around 37 years.

(vi) MT. KARE (ENGA Province)

Minable ore reserves in this site are estimated at 2 million cubic metres with an average grade of 7.5 gms per cubic metre. Extraction is expected to be done by open cast mining using gravity processing. The area is being served by helicopter in the absence of any roads.

1.3.3 OIL SECTOR

Construction of \$ 15 Billion plus Kutabu Project is in full swing and formal production is expected to commence during the current year.

1.3.4 OTHER RESOURCES

Papua Guinea is rich in fishery resources as well as resources for solar energy and hydro electric power. The potential of these resources, however, has not been fully planned or assessed.

CHAPTER II

INDUSTRIAL POLICY AND ENGINEERING SECTOR

2.1 INTRODUCTION

2.1.1 The main stay of the economy is agriculture which produces nearly 30 per cent of GDP and produces employment for nearly 75 per cent of the working population. The Government is giving priority to investment in agriculture. The progress, however, has been hampered by shortages of manpower and support services. The major export crops are coconut, copra, coffee, cocoa, palm oil, tea, rubber and pyrethrum. The processing of agricultural output, however, is limited. Values of GDP by economic sectors during 1983-91 at 1983 prices & current prices are at Annexures I & II. Volume of exports by products (1983-91) is at Annexure I(I).

2.1.2 Nearly 35 per cent of exports from forestry is in logs and various foreign owned companies are operating for cutting down logs and exporting them. Local processing of logs before export is, however, limited although the government is having a fresh and urgent look at this aspect.

2.1.3 While the fishery resources are significant, they are largely undeveloped. The fishery development plan envisages installation of cold storages and processing facilities. There seems to be considerable scope for developing this industry since nearly 50% of fish consumed in this country is imported.

2.1.4 In the mining sector which is the most active element of the economy, gold, silver and copper are mined, produced and exported. Since the closing down of Bougainville Mine in 1989, this sector has been effected adversely. Mineral Production (1984-90) is at Annexure IV.

2.1.5 In the energy sector, Papua New Guinea has considerable oil reserves which are now under exploration. The national hydro-electricity capacity is around 130 million watts and is in excess of the demand but power leakages and other factors result in power shutdowns for industry.

2.2 MEDIUM TERM INDUSTRY PLAN

2.2.1 The Government has recently came out with a Medium Term Industry Plan, during the first phase of which, in addition to the conventional instruments such as incentives geared directly towards industry and trade, other issues such as macro-economic policies, labour policies & infrastructure have been addressed. The second phase of the plan will involve more focus on those areas of industry where private sector investment is likely to contribute most to government's objectives.

This report aims to suggest the direction of growth of engineering industry in Papua New Guinea as well as strategy and specific action by the government and industry to ensure its effective follow up.

2.2.2 BACKGROUND OF THE INDUSTRY PLAN

After rather bleak periods of industrial trade in 80's, the

economy picked up in 1985. Between 1985 and 1988, real GDP grew at an average rate of 3.2% as against 1.3% per annum in 1st half of 1980's. In 1989 and 1990, the GDP growth was actually negative decreasing by 1.5% and 1.6% respectively. This was mainly caused by the shutdown of BCL Mine.

Out of total work force of about 2 million, only 250,000 or 12.5% are estimated to be engaged in the formal sector. Increase or the growth of the total labour force is now estimated at about 60,000 per annum. Foreign trade plays a vital role in the economy amounting to around 75% of GDP in 1987-88.

2.2.3 ROLE OF PRIVATE SECTOR

As a matter of policy, the government has announced its intention to leave industrial investments primarily to the private sector. The government has already drawn up a plan for privatisation of some existing public sector units and facilities.

2.2.4 ROLE OF THE MANUFACTURING SECTOR

The manufacturing sector is relatively small in Papua New Guinea and it contributed for 11.2% of the GDP in 1989. In 1988, the sector employed 24,299 persons out of which the basic metal industries, fabricated metal products, machinery equipment and other manufacturing industries accounted for 4,171. The total output of the manufacturing sector in 1988 was 621.7 million K with 39.3% (244.6 million K) value added. Food, beverages and tobacco account for 54.6% of the value added with the metal industries following at 17.4%. Wood and wood products come next

with around 11%. There is a sugar factory at Ramu producing 33,000 tonnes in terms of gross output.

During period 81-85, the value added by the manufacturing sector grew at an average rate of 1.5% per annum as compared to 1.3% for the economy as a whole. During the next three years, however, in the period 85-88, the sector witnessed a negative growth of -0.9% per annum whereas the GDP was growing at an average rate of 3.2% per annum. The manufacturing sector share of GDP accordingly came down from 12% in 1982 to 10% in 1988. It has gone up slightly in 1990 to 13%. However, this is not because of the growth of the sector but rather as fallout or the decline of the mining sector because of the closure of BCL Mine.

2.2.5 MAJOR MANUFACTURING SUB-SECTORS

Food, beverages, tobacco, is the largest manufacturing sub-sector followed by basic metal and metal product industry. Their contribution to value-added being 54.6% and 17.4% respectively. Textiles, wearing apparel account for less than 1% of the value added. Wood products range from sawn timber and sawmill products to wood chips, plywood as well as wooden building material. There are several firms which produce good quality furniture. Exports are dominated by minerals accounting for about 65% in 1989. Imports are dominated by machinery and transport equipment and other manufactured goods.

2.3 INVESTMENT PROMOTION POLICIES

2.3.1 Considering the limited capacity of domestic economy to generate adequate savings for investment as well as realising the

need for import of skills not available locally, the Government has announced a policy for welcoming direct foreign investment in medium and large scale, resource-based and export-oriented industries.

2.3.2 PUBLIC INVESTMENT PROGRAMME (PIP)

The government's vehicle to generate public investment for development activities is the Public Investment Programme. The 1991-95 PIP envisages an allocation of 2,853 million K. The IPA will cater to all categories of business investments with the exception of mining, agriculture and tourism where it will only act as a promotional body with technical issues to be dealt with by specialised agencies. The intention of the government is to lay down criteria making the approval for setting up of manufacturing, processing or service units almost automatic, once the basic criteria are met.

2.3.3 FEASIBILITY CONTRIBUTION SCHEME

This is meant to reduce risk of potential investors to investigate viability of new projects. However, the usefulness of this is likely to be only to small scale units as large scale units like to get their studies done themselves partly for reasons of confidentiality and partly because they would like to be more certain of the quality of work. For small scale units same data on feasibility studies can be obtained from UNIDO. It is suggested that feasibility studies which are brief and not in the form of detailed project reports should be distributed free by Small Business Development Corporation. They should only be 2

to 3 page documents which gives the bare minimum indication of requirements of capital, space, utilities as well as skilled and supervisory manpower.

2.3.4 GUARANTEES

2.3.4.1 Credit Rating Scheme has been conceived to help small business in non-agricultural sector with national ownership of at least 74%, to obtain commercial bank loans. The government carries guarantee of 80% medium term loans (5 years) upto K 100,000. This facility can be of substantial importance to small engineering units which have to built up their credit rating in order to get regular commercial bank financing. The SBDC should be able to provide assistance in this regard.

2.3.4.2 Investment Guarantee Treaties have been included by the Government on bilateral basis with other countries. These treaties are extremely important for promotion of foreign investments in the country, to protect the foreign investor from nationalisation and also to provide for repatriation of funds.

2.4 INCENTIVES AND THEIR OPERATION

2.4.1 INCOME TAX INCENTIVES

2.4.1.1 Export Incentives for Manufacturers

Tax payers who commenced exporting certain qualifying goods manufactured by them in PNG on or after 1st September, 1984 are entitled to an income tax exemption of 100 per cent of the net export income for the first 4 years of income. For the following

3 years, the excess of export sales over average export sales of the previous 3 years is exempt.

The engineering goods which qualify for the exemption include:

Dry cell batteries

Electrical appliances.

Fabricated steel

Fibreglass products

Founded & manufactured metal products

Glass products

Hand tools

Motor vehicles

Plastic products

Sawn timber, mouldings, plywood & laminated products

Ship & boat building & repairing

Wooden furniture components & doors

In addition, the exemption applies to new manufactured products approved by the Taxation Office.

This has not helped the firms who have taken advantage of it to gain permanent export markets but has often given tax breaks to one-off export contracts. It is recommended that it may be simplified by applying to export earnings in each financial year. It should also be extended to deemed exports for successful tenders against international bidding by mining companies or against World Bank/ADB or other foreign aid tenders.

2.4.1.2 Rural Development Incentive

Qualifying new business started in certain specified under-developed areas will be exempt from income tax on their net income from carrying out a rural development industry for 10 years after the year of commencement of business.

Losses arising from these newly exempt activities will be deductible against taxable income from other activities.

There has been no application of this because of overall lack of an investment climate but should be popularised.

2.4.1.3 Double Deduction for Export Market Development Costs

Expenditure on export market development for goods manufactured in PNG qualifies for a double deduction. The double deduction is not absorbed by any exempt export sales income. The types of expenditure to qualify include overseas publicity and advertising, market research, tender preparation, samples, trade fair expenses, overseas sales office expenses and certain travel costs.

The tax saving resulting from the allowance of the deduction may not exceed 75 per cent of the expenditure actually incurred. Possibly due to lack of awareness, hardly any firm in the engineering sector has made use of this.

2.4.1.4 Flexible Depreciation for Manufacturers

Industrial plant, not previously used in PNG, is eligible for

increased depreciation upto 100 per cent of cost. The taxpayer can elect the amount to be claimed in any year, but not so as to create a loss. To qualify, the plant must have a life exceeding five years and be used by the taxpayer or any other person (eg a lessee) in a manufacturing process. Expenditure on buildings housing such plant or for storing raw materials or finished products also qualifies.

100 % Initial Depreciation for Agriculture and Fishing Industries

2.4.1.5 Initial Year Accelerated Depreciation

An initial year accelerated depreciation is available on the capital cost of certain new assets, converting existing oil-fired plant to non oil-fired plant, or in improving the efficiency of fuel-using plant, as follows:

Type of Plant	Rate in addition to normal depreciation
New plant (other than residential property with a cost exceeding K100,000) with a life exceeding five years used in PNG in manufacturing, construction, transport, storage, communication or agricultural production	20 %
Modification of plant for the purpose of conserving fuel input	20 %
Expenditure on converting oil-fired plant to non oil-fired plant	30 %

Expenditure on acquiring new non oil-fired plant 30 %

2.4.1.6 Solar Heating

Expenditure on the acquisition and installation of solar heating plant for use in deriving income is available as an outright deduction.

Although there is no application, this should be encouraged and the scheme popularised.

2.4.1.7 Staff Training Costs

Employers are allowed a double deduction for the salaries or wages of:

- Registered apprentices
- Indigenous citizens attending a full-time course at a Government training institute or a prescribed tertiary institution.
- Training officers engaged full-time in training activities and not engaged directly in deriving the employer's income.

The tax saving from these deductions is limited to 75 per cent of actual expenditure incurred. This needs to be extensively advertised.

2.4.1.8 Incentive to Pioneer Industries

A person undertaking a new economic activity which is considered

to be of benefit to the country and which meets certain specific criteria may apply for certification as a Pioneered Industry.

The income of a qualifying activity is exempt from income tax for a period ending on the last day of the fifth year the qualifying activity commenced.

Where a qualifying entity incurs a tax loss in any year during the period of exemption the loss is carried forward to offset against profits subsequent to the period of exemption and not against other profits arising during the period of exemption.

The extent to which this has been used genuinely is not clear but a conditionality of a minimum of 20 per cent value added should be applied.

2.4.2 SUBSIDIES & GRANTS

2.4.2.1 Wage Subsidy for Manufacturers

Companies manufacturing new products may receive a subsidy payment for upto 5 years based on a percentage of the relevant minimum wage for each full time employee who is a citizen. The subsidy, itself taxable, is a reducing percentage of the relevant statutory minimum wage, as follows:

First year of subsidy	40 %
Second year of subsidy	30 %
Third year of subsidy	20 %
Fourth year of subsidy	15 %
Fifth year of subsidy	10 %

This has not contributed to any substantial number of additional jobs. The engineering industry by and large, does not seem to be aware of this.

2.4.3 CONCLUSION

2.4.3.1 The extent of actual utilisation of incentives by the engineering units is at Table 2.1.

2.4.3.2 Most of the incentives have not been effective because at least as far as the engineering industry is concerned there is an almost total lack of information. It is recommended that the Government should consider revising the incentives so as to make them:

- simple to understand
- transparent
- easy to implement expeditiously.

2.5 FINANCING FACILITIES FOR NATIONALLY-OWNED SMALL AND MEDIUM SIZED BUSINESS ENTERPRISES

The Bank of PNG has recently launched a scheme to assist the nationally owned industry. The public notice issued on 3rd April 1992 is at Annexure V. A major problem anticipated is the inability of the local entrepreneur to fill up the necessary forms and to be able to answer questions that invariably any bank would ask before lending money. This is one of the areas in which SBDC or government institutions should be able to assist intending entrepreneurs.

TABLE 2.1

INCENTIVE CLAIMS BY METAL TRADE FIRMS

There are 16 different companies identified as belonging to the industry. The number of beneficiaries of the respective incentives in each year are as follows :

1.	Double Deduction Staff Training	
	Year	No. of Firms
	1987	4
	1988	4
	1989	3
	1990	4
	1991	4
2.	Accelerated Depreciation	
	Year	No. of Firms
	1987	1
	1988	5
	1989	4
	1990	0
	1991	0
3.	Flexible Depreciation	
	Year	No. of Firms
	1987	2
	1988	3
	1989	3
	1990	1
	1991	1
4.	Export Income Double Deduction	
	Year	No. of Firms
	1987	2
	1988	1
	1989	1
	1990	0
	1991	0
5.	Export Market Development Cost Double Deduction	
	Year	No. of Firms
	1987	0
	1988	1
	1989	0
	1990	0

1991

0

6. Coastal Shipping Double Deduction

Year

No. of Firms

1985

1

1986

1

1987

1

1988

Discontinued

7. Wage Subsidy

None Ever

8. Others

None Ever

2.6 PRIORITIES OF GOVERNMENT AND ENGINEERING SECTOR

2.6.1 A study of perception of industrial policy and its implementation shows that the engineering sector assumes a rather low priority in the decision making processes of the government. It is felt that decision making organs of the government need to realise that engineering sector is the most important vehicle for economic development. This is one area which will ensure a sustainable growth of economy without being subjected to the pressure of fluctuation in international business and economic politics. This is particularly critical for supply of spares for operating equipment. Not to be underestimated also is its role in promoting socio-economic policies of the government such as providing equipment for schools and hospitals, construction material for houses etc.

2.6.2 It is recommended that the Department of Trade and Industry should re-examine its policy framework and take conscious, deliberate steps to give a thrust to the engineering industry in PNG.

2.7 PROTECTION POLICIES

2.7.1 The tariff structure in PNG has historically been designed to meet the twin objectives of revenue generation and industry protection. Even though intended to be used primarily as an instrument for industry protection, in actual practice, however, as far as engineering industry is concerned, its operation has been having an opposite effect to what was intended principally because of many exceptions made and exemptions given.

2.7.2 Industries, as far as policy is concerned, may be granted either a general protection or an infant industry protection. General Protection could be accorded to both new and existing industries while the infant industry protection is to only new industries. Protection however is expected to last for a maximum period of five years. The government proposes to calculate the effective rate of protection for each sub-sector. Intention of the government is to see that protection does not result in inefficient industries and only low value added production.

2.8 PROCUREMENT POLICIES OF DEVELOPMENT PROJECTS

2.8.1 At present, PNG manufacturing sector participates in a small way in resource development projects. It is necessary to ensure that resource developments in the mining and oil sectors result in lasting gains to the PNG economy in general and long term industrial development in particular by increasing the share of local engineering sector in their projects.

2.8.2 In fact, involvement of engineering sector relevant to mine and resource infrastructure appears to have decreased despite a protectionist tariff policy and government attempts to induce job growth.

2.8.3 Mining and resource developers have an established pattern of implementing projects in PNG. Generally they spread the work in small packages across selected suppliers. The effect of this is to pit PNG companies against foreign suppliers in

neighbouring countries. Recession in Australia and New Zealand has resulted in companies undercutting local units.

2.8.4 Major developers justify their practice on their impressions that PNG engineering industry has the following characteristics:

- limited capacity
- poor quality standards
- low level of technology and management; and
- unreliability.

2.8.5 This is in spite of the fact that some local firms have effectively shown their capability in engineering in the Kutubu and Porgera projects and OK Tedi mining company has used local engineering capabilities extensively without adverse effect on quality or time schedules. Recently they undertook to design their lime kiln project to reflect PNG capability and conditions. Similar gestures by other companies need to be encouraged.

2.8.6 Project developers argue that technology is not available to manufacture project equipment and infrastructure in PNG. Since however basic equipment to manufacture a large range of project items is available, project developers should be induced to look for ways of getting PNG industry involved by supplying design and if necessary, manufacturing technology for them.

2.8.7 Polgera and Kutubu projects, for example, had the following characteristics:

i. Negotiated tariff to ensure access to offshore suppliers - this opened up avenues for avoiding even reduced tariffs;

ii. Developers sourced offshore because most equipment and services are only available offshore but in many cases they sourced offshore simply because it was convenient to their offshore based procurement offices.

iii. PNG companies were not invited to bid for complex work because of project developer's perception of local capability.

iv. Very little value added in PNG with even assemblies put together offshore.

v. Relatively few permanent manufacturing jobs created with the result that few wider economic benefits from manufacturing activity flowed to the PNG economy.

2.8.8 RECOMMENDED ACTION

It is suggested that the government should introduce zero tariff on all items and equipment either manufactured, assembled in PNG or included in assemblies put together in PNG provided a minimum 20 per cent value is added by PNG industry. This value adding incentive would provide a financial inducement for foreign

companies to team with competent PNG manufacturing industries to supply the development project. The developer would stand to make substantial projects savings. (The World Bank uses 20 per cent value added to define local content).

The most important benefits would be:

- A high level of sustained manufacturing activity which would enable good quality training programmes to be implemented and maintained.
- PNG industrial capability would be expanded and enhanced at no cost to the government.
- A clear example of PNG industrial capability would be established and set precedents for a higher level of involvement in future developments.
- Wider multiplier effects would benefit the PNG economy.

2.9 OPPORTUNITIES IN MANUFACTURING ENVISAGED FOR THE PRIVATE SECTOR

2.9.1 The Government has outlined its concept of possibilities and opportunities for private sector investments in the near future. These are summarised below :

A. Agricultural Industries

- (i) Palm Oil Processing
- (ii) Coconut Processing
- (iii) Coffee Processing
- (iv) Cocoa Processing
- (v) Rubber Processing

- (vi) Food Processing
- (vii) Confectionary Industry
- (viii) Vegetable Processing
- (ix) Pyrethrum Processing
- (x) Spices processing

B. Livestock Industry

- (i) Chicken Farms and Poultry Processing Plants
- (ii) Animal Feed
- (iii) Hides and Skins
- (iv) Honey Processing
- (v) Snail Processing
- (vi) Silk Worm

C. Forest Based Industry

- (i) Furniture
- (ii) Floor Tiles
- (iii) Rattan Processing
- (iv) Pulp and Paper
- (v) Plywood, Veneer and Chip Board
- (vi) Wooden Toys

D. Fisheries and Marine Resources Based Industries

- (i) Tuna Fishery
- (ii) Other Fisheries
- (iii) Shell Buttons

E. Mining and Petrol Based Industry

- (i) Copper Smelting
- (ii) Cement Manufacture
- (iii) Brick and Roof Tiles
- (iv) Mini-Refinery
- (v) Methanol and Derivatives
- (vi) LNG, LPG, Ammonia and Urea

F. Textile, Wearing Apparel and Leather Industry

- (i) Textiles and Garments
- (ii) Footwear

G. Chemical Industries

- (i) Plastic Industry
- (ii) Sodium Cyanide
- (iii) Explosives
- (iv) Pharmaceuticals

H. Construction and Engineering Industry

- (i) Structural Components
- (ii) Other Construction Material
- (iii) Automotive Parts

I. Other Industries

- (i) Corrugated Boxes
- (ii) Waste Paper Recycling
- (iii) Stationery

CHAPTER 3

THE ENGINEERING SECTOR

3.1 ROLE OF THE ENGINEERING INDUSTRY

3.1.1 No sector of economy operates in isolation. All sectors are inter-independent and outputs of one serve as inputs of another. Not only major sectors but sub-sectors of each industry are more often than not inter-twined in a matrix representing close forward and backward linkages. The engineering sector has a critical role to play since it introduces equipment, parts and components for all sectors of economy. Table 3.1 shows the purchases made by industrial sectors from the engineering sector. As will be seen, the engineering sector itself absorbs most of its output in the shape of components, spares and sub-assemblies. The two assumptions made are :

Population growth 2.5% per annum, and

Life of equipment 10 years.

Table 3.2 shows the purchases made by the engineering industries from other sectors on current account. Iron, steel and non-ferrous metals, are principal raw material for the engineering sector and machinery and transport equipment provided by the sector itself are major inputs into the engineering industry. Standardisation of parts and components plays a major role in effective development of the industry. While these tables are based on data from a few developed countries, the conclusion that engineering sector has a vital role to play in the development of economy, applies equally, forcefully to Papua New Guinea.

Table 3.1

Purchases from the Engineering Sector by Industrial Sectors
(dollars per thousand dollars of output of purchasing sector)

		Assuming 1% annual growth in per capita income					Assuming 4% annual growth in per capita income				
		Value of purchases from engineering sector					Value of purchases from engineering sector				
		Capital account					Capital account				
		Current account	total	for expansion	for replacement	Total	Current account	total	for expansion	for replacement	Total
1.	Engineering industries	167	39	14	25	206	167	53	28	25	220
2.	Basic metals	6	58	22	36	64	6	80	44	36	86
3.	Paper and products	1	42	14	28	43	1	59	31	28	60
4.	Printing and publishing	3	38	12	26	41	3	51	25	26	54
5.	Chemicals, petroleum & coal products	0	41	14	27	41	0	53	26	27	53
6.	Textiles	2	35	11	24	37	2	44	20	24	46
7.	Wood products	2	32	9	23	34	2	43	20	23	45
8.	Rubber products	0	33	11	22	33	0	43	21	22	43
9.	Food, beverages and tobacco	0	15	4	11	15	0	18	7	11	18
10.	Clothing and footwear	1	12	3	9	13	1	16	7	9	17
11.	Leather products	1	11	3	8	12	1	13	5	8	14

Source : For current account coefficients, see Chenery and Watanabe, "International Comparisons of the Structure of Production", *Econometrica*, Oct. 1958 (averages for Italy, Japan, Norway and the United States).

For capital account coefficients, see *Industrialisation and Productivity*, Bulletin No.7, United Nations publication (Sales No. 64.II.B.1)

TABLE 3.2

**Purchases by the Engineering Sector on Current Account
from Other Industrial Sectors**

(dollars/thousand dollar of output engineering sector)

Supplying Industry	Dollars
Iron and Land	168
Machinery	111
Non-ferrous metals	52
Transport Equipment	46
Trade	25
Transport	18
Lumber and wood products	15
Services	14
Rubber Products	13
Chemicals	12
Non-metallic mineral products	10
Shipbuilding	10
Industry n.e.s.	9
Coal products	8
Electric power	7
Petroleum products	6
Textiles	5
Paper and products	4

3.1.2 For the engineering industry to optimally utilise available resources and skills, it has to develop a sound technological base for manufacture of commonly used consumer durables and provide for a dependable supply of spare parts for itself as well as for other sectors of economy. Emphasis will be necessary on both quality and cost factors.

While optimum use must be made of local raw materials, economies of scale of manufacture of most materials make it imperative for the country to develop a viable engineering industry on the basis of imported raw materials. The same applies to mass produced items like compressors, petrol and diesel engines.

3.1.3 Many engineering industries are labour intensive, can be efficient at low levels of output with relatively low levels of investment and have strong forward and backward linkages. In many cases in PNG, they can be evolved on the basis of traditional skills and upgraded with motivation and training. The typical structure of engineering industry in industrialised countries is as under :

- Simple metal products	:	61%
- Machinery except electrical	:	33%
- Electrical machinery	:	24%
- Transportation equipment	:	33%
- Instruments	:	4%

In PNG, simple metal products including sheet metal work, metal mesh and re-inforcing steel for construction and fabrication of

aluminium fittings, doors and windows constitute the bulk of engineering industries.

3.1.4 The engineering industry in PNG has to face the import of consumer goods to meet the demand of a growing middle class as well as intermediate goods for development projects. This points to the urgency of planning for an organised, coordinated growth of an efficient engineering sector.

3.1.5 PNG has fairly extensive agricultural sector. Before independence, very little was done to promote this sector of industry and so far the impact of the government policies on development of agro-based industry has been minimal. The role of engineering sector in the growth and maintenance of agro-based industries is obvious.

3.1.6 For a variety of reasons which have affected the profitability of the engineering sector in recent years, the private sector is shy of making investments.

3.1.7 Growth as represented by increased percentage of GNP, originating in engineering industries as per capita income rises, follows a typical pattern (Table 3.3). Studies show that the engineering industry typically grow at a much faster rate than all manufacturing. This is an important reason for a special emphasis to be placed on engineering industries in PNG, taking into account, local conditions and environment. Specific plans for contribution by engineering industry in the shape of components and spares will need to be drawn up.

Table 3.3

Statistical Trends for the Engineering Industries

	Population (million)	Per capita income in dollars			
		100	200	400	800
		Expected value in dollars			
1. Apparent consumption of engineering products (gross production value), per capita	any	5.8	17	51	150
2. Apparent consumption of engineering products on a value added basis, per capita.....	any	2.9	8.6	25	75
3. Value added in all manufacturing production, per capita	1	13	33	84	217
	5	15	40	103	265
	25	19	48	125	324
	125	23	59	153	396
4. Value added in engineering industries production, per capita	1	0.6	2.5	10	38
	5	1.0	4.0	16	63
	25	1.7	6.7	26	105
	125	2.8	11	44	173
		Expected percentage			
5. Apparent consumption of engineering products, on a value-added basis, per cent of national income	any	2.9	4.3	6.3	9.4
6. Value added in all manufacturing production per cent of national income ...	1	13	16	21	27
	5	15	20	26	33
	25	19	24	31	40
	125	23	30	38	50
7. Value added in engineering industries production per cent of national income.....	1	0.6	1.2	2.4	4.8
	5	1.0	2.0	4.0	8.4
	25	1.7	3.3	6.6	13
	125	2.8	5.5	11	22
8. Value added in engineering industries production, per cent of value added in all manufacturing	1	5.0	7.5	12	18
	5	6.6	10	16	24
	25	9.0	14	21	32
	125	12	19	29	44

Source : United Nations, *A Study of Industrial Growth, 1963* (Sales No. 63.II.B.2)

3.1.8 With the relative lack of development of the engineering industry, the linkages between it and other economic sectors is limited. This has been made even more pronounced as a result of lack of incentives for development of this sector and shortage of skills. The share of engineering sector in the number of factories, employment, output and value added in manufacturing in 1988 is shown in Table 3.4.

3.1.9 Relative standing of importance of engineering industries in policy framework in PNG is low as compared to that in other countries. As a result of lack of adequate efforts to develop the engineering industries, domestic processing of raw material is much less than is otherwise possible and the potential of the industry is not fully realised. For example, logs are exported without processing, skins and hides are exported raw, there is little processing of copper which could be perhaps re-imported from countries and companies to which copper concentrates are exported for processing into wires, cables and other items. PNG could also consider using idle capacities in refining units in other countries (Oman has one such facility).

3.1.10 This report has drawn up a plan for the engineering industry. It is believed that if it is effectively implemented, the country can reasonably expect to see a rapid growth of its engineering industry in the next 5 to 10 years. The development will be fast and its structure will undergo a very perceptible change. Efforts of development projects to support a cross-section of local engineering industries will need to be

Table 3.4 NUMBER OF FACTORIES, EMPLOYMENT, OUTPUT AND VALUE ADDED IN MANUFACTURING, 1988

Sector	(1)	(2)/a	(3)	(4)	(5)	(6)
Food, Beverages and Tobacco	149	11,859	383.9	141.9	37.0	58.0
Textile, Wearing Apparel & Leather	19	585	6.4	3.3	51.6	1.3
Wood and Wood Products	101	5,170	56.8	26.8	47.2	11.0
Paper and Paper Products, Printing	28	1,041	26.1	12.0	46.0	4.9
Chemicals, Petroleum, Coal, Rubber and Plastic Products	22	850	31.2	13.9	44.5	5.7
Non-metallic Mineral Products	17	623	17.3	8.7	50.3	3.6
Basic Metal Industries, Fabricated Metal Products, Machinery Equipment and Other Manufacturing Industries	119	4,171	99.9	38.0	38.0	15.5
Total	455	24,299	621.7	244.6	39.3	100.0

Source: National Statistical Office

- (1) Number of Factories
- (2) Number of Employees
- (3) Output Value (K million)
- (4) Value Added (K million)
- (5) Value Added (Percentage of Output)
- (6) Value Added (Percentage of Total)

/a Average weekly employment over the whole year, including working proprietors

monitored. Incentives will be necessary to stimulate positive responses from all classes of entrepreneurs in this sector.

3.1.11 CHARACTERISTICS OF METAL INDUSTRIES

Typically, this sector in developing countries is very efficient at the large scale level but only profitable at the small scale level. Small scale establishments also generate relatively large ratios of value added per unit of gross output.

In production of mechanical fixtures and household appliances and servicing of motor vehicles, the processing coefficients are very high. This is not true, however, of production in the large enterprises with the exception of structural metal products. Labour productivity coefficients are generally relatively high in most large establishments.

Labour productivity also rises as more tools are made available per worker and generally, the correlation coefficient for labour productivity and capital intensity is high in this sector.

Capital intensities also tend to rise with the average size of the establishment. The larger the establishment, the more they provide labour with capital.

Larger establishments tend to pay higher wages although in PNG, the tendency is to pay only the minimum wages laid down by law.

The overall structure of this sector in PNG shows a heavy dependence on foreign spare parts, raw materials and machinery. Linkages amongst branches and sectors and sub-sectors are not evident.

3.2 INTER-INDUSTRY LINKAGES

Planning for engineering industries in order to be practical, has to take into account its linkages with the manufacturing and other sectors whose development, in turn is related to inter-sectoral linkages. Engineering industry for example, will serve the food, beverages and tobacco sector which has in turn, its linkage with the agricultural sector. The agricultural sector is again linked to the chemical and the engineering sector, the latter providing equipment, spares and tools. Most household goods like fans, ovens, kettles, plastic utensils, cutlery etc. are provided by the engineering sector.

3.2.2 The structure of the mining sector in particular, for metals as well as for the oil sector, will necessarily result in import of the most of the machinery for not only exploration but also for mining and processing. The engineering sector has to be geared to see that supply of spares for them is timely and adequate to ensure their proper utilisation. Growth of the engineering sector will promote strengthening of linkages between local resources and related industries.

3.2.3 Engineering products are used to supply inputs to all manufacturing industries as well as service of sectors of economy. The survey conducted by this project does not show that any deliberate coordination has been attempted between the production capacity of the engineering sector and the requirements of other industries and economic sectors. This is possibly due to the fact that there has been no attempt at a scientific, quantitative and qualitative projection on a long

term basis of requirements of parts, components, sub-assemblies and assemblies by each industry and their analysis carried out to determine the sectorwise demand on engineering industries according to production parameters of items to be manufactured. The most important areas of economy of PNG is mining and agriculture but there appear to be no projections of requirements of these sectors in terms of machinery, plant and spares as well as implements which can be supplied by the local industry.

3.2.4 While planning the role of engineering industry in the growth, development and productivity of the manufacturing sector, it is necessary to visualise the type of engineering goods and services, it is expected to supply to each of its sub-sector individual product level. Each product has different stages of manufacture and each stage requires different types of equipment which is again determined by the technology and size of the plant. A brief look at some of the selected branches of the manufacturing sector will illustrate this.

(i) Food, Beverages and Tobacco

Most of the small units in this sub-sector are labour intensive and use simple machinery. The exception of course, is a sugar production unit. Planning for spare parts for the sugar in plant as well as for other agro-based industry that are and now under consideration will be essential for un-interrupted utilisation of the installed plants.

(ii) Tannery and Leather Products

Most of the hides exported from the PNG are unprocessed resulting in substantial loss of value added. The organised gradual growth of processing leather hides right upto the ultimate stage of manufacture of finished goods like shoes and bags, will be helped by the enhancement in capability of the engineering sector to provide goods and services for it. Complex machines will need to be imported and simple equipment as well as many spares for the imported equipment can be locally made. Development of both the sectors leather and engineering sector which will service it, will require to be coordinated. Due regard will be need to be paid to the requirements of the small scale sector as well as medium-sized modern tanneries with an eye on exports.

(iii) Handicrafts

This is a traditional industry of PNG and the engineering industry must aim to provide ergonomically efficient tools for this sector to economically produce implements and domestic consumer goods as well as artifacts taking into account the locally available material and facilities. Its importance lies not only as an important source of employment to rural labour but also as a potential tool for skilled labour to be used in the more sophisticated branches of engineering industry.

3.3 STRUCTURE OF THE ENGINEERING SECTOR

The engineering industry in PNG consists almost entirely of steel and aluminium fabrication and there is only one foundry. A brief

description of the units visited and those with whom discussions were held is given below :

(i) Atlas Steel

This is only unit with large galvanising facilities which have been shut down because of non-viability of the operation, partly because of labour costs which are considerably more than in neighbouring countries and partly because disruption in power supply makes it impossible for the galvanising tanks to be in continuous operation. It manufactures re-inforced mesh, nails, chain-mesh, fencing, barbed wire, gabion baskets and even coat hangers. The hot dip galvanising bath is 5 meters x 1 meter x 1 meter. The plant has a capacity of 50 tonnes a month of finished gabions.

(ii) Barlow Industries

This unit with roughly about 200 employees has facilities for roofing iron, sheet metal products, aluminium products, sheet glass work. It produces solar heaters, security grills and doors. It is also handling air-conditioning duct work, stainless steel products, hoods and canopies and various kinds of tanks. Another division of Barlows in Lae is Kai Kai Cookware which specialises in the production of a wide range of aluminium cookware.

(iii) BHP LYSAGHT

This unit has two plants, one in Lae one at Pt. Moresby. It has roll-forming equipment to produce a fairly wide range of roofing and accessories and structural products. The range includes meshes, purlins, decking and roofing etc. Its Lae factory also

produces buckets and garbage bins. It has deep drawing facilities. It also manufactures a fairly wide range of office furniture and storage equipment. It has a unit at Mt. Hagen (Metal Industries Division), which produces sheet metal products. It has nearly 250 employees. The company has introduced some initial steps in Total Quality Management. It follows Australian standards for its manufacture and has an installed capacity of nearly 800 tonnes per month whereas its total production at present is around 560 tonnes.

(iv) BHP TITAN

This unit with a workforce between 150-175, manufactures a wide variety of wire products and reinforced mesh. It manufactures chain link mesh and galvanised tanks, barbed wire and produces gates and doors for trucks.

It has machinery for straightening, bending and shaping of rod products as well as for making barbed wire besides sheet plate work.

(v) BISHOP BROTHERS

This engineering unit employs approximately 400 persons in Pt. Moresby, Lae, Kimbe, Tabubil. Its machine shop consists of large capacity lathes and a horizontal borer besides milling, shaping and grinding machines and gear cutting machines. It has fairly good fabrication facilities. It has a diesel pump room and has the capacity to service diesel ejectors besides building up with metal deposition and machining crank shafts. Its unit, Tabubil Engineering has been supplying OK Tedi Mine, heavy fabrication and provides maintenance facilities for some mine equipment.

(vi) Development Engineering Services

This is 100% nationally owned foundry and 98% of its equity is owned by the provincial government. It is the nationally owned & managed engineering unit in the country. It employs about 25 workers but has fairly old and not fully operative foundry equipment including a 1 tonne capacity electric furnace for cast iron, 2 waste oil fired furnaces for aluminium and brass. It produces stoves, coffee pulper and cast aluminium cookware. It is desperately in need of modern equipment, being the only foundry in PNG.

Its capacity is said to be 360 tonnes per annum as against which it is doing now 20 tonnes of low quality castings. Not surprisingly, the non-reliability of the power supply has very serious implications on the operation of the foundry. The unit is in also considerable financial difficulties.

(vii) Fletcher Manufacturing Company

This unit has its works in Lae. It manufactures geotextiles and gabions. Its capacity is around 200 tonnes per month. It has also facilities for producing bridges and corrugated pipes. Its metal fabrication facilities include brake presses and machinery for operations of flanging, shearing gas and plasma cutting, sheet corrugating, punching, rolling and curving.

(viii) Hornibrook Constructions

This is the largest steel fabricator in the country and can

fabricate 400 to 500 tonnes per month from its facility located at Port Moresby and Lae and is looking for additional avenues for expansion of its activities. Its facilities include high quality welding, including stud welding machine for bridges, plate bending, rolling and punching. At Lae alone, it has 25 static welders and 13 diesel portable welding machines. It has sand blasting and painting facilities besides supporting machine shops at both the units. The company has started a project to get itself certified for Quality Assurance to ISO 9000.

(ix) Huon Industries

This unit employs approximately 120 persons and has considerable facilities for aluminium, mild steel and stainless steel fabrication, fibre glass work, boiler repairs and maintenance. It has a supporting machine shop with 8 lathes which can handle a maximum of 2.2 mtrs diameter. Its fabrication facilities limitation is 8 mm plates but it can roll upto 10 mm plates.

(x) JD Hayes

This unit employs around 80 persons & also has considerable experience in fabrication and erection work. It can also handle stainless steel and aluminium fabrication besides assembly of truck bodies, road tankers and trailers. It can handle stainless steel fabrication upto 8 mm, aluminium upto 20 mm and mild steel upto 50-60 mm thickness.

(xi) Morobe Engineering

This unit has a fairly extensive machine shop, grossly under-

utilised and at present employs only 20 persons.

Its facilities include centre lathes with a maximum of 18" and 20" swing, a crank shaft grinder, a horizontal borer and accessories, milling machines, radial drills, a 60 tonne hydraulic press, and tool and cutter grinder presses, and welding equipment.

(xii) Lae Builders and Contractors

This is basically a wood working shop with fairly extensive facilities right from sawmill to finished furniture of a fairly high quality. It employs around 250 persons working in different sections in 1-2 shifts.

(xiii) Niugini Steel Corporation (NSC)

At its Port Moresby plant, it has 50 employees and fabricates steel products. Its manufacturing facilities include guillotine capable of cutting upto 10 mm thick plates, a 70 tonne press and radial drilling machines besides a variety of other supporting equipment. Apart from normal static welders, it has MIG, TIG machines for aluminium and stainless steel welds. It specialises in fabrication and manufacture of transport equipment. Its transport equipment facilities are concentrated in its subsidiary, NSC Freighters in Lae.

(xiv) Steel Industries

This unit employs 120 persons and is essentially a steel fabricating unit. It is stated to be able to fabricate upto 500

tonnes per month of a mixture of heavy and light steel. It has its own sand blasting and painting facility, and a supporting small machining capability. It has facility for hot dip galvanising of small pieces of metal, but this is not being utilised.

(xv) TGA Limited

This unit employs round 40 persons and is basically involved in brass and aluminium frames and has considerable potential for expanding in a big way for aluminium doors, windows and fittings. Its maximum capacity is bending 20 mm, rolling 6 mm and welding 50 mm. It has facilities for stainless steel welding and also has a 120 tonnes guillotine.

(xvi) Rouma Industries

This unit fabricates pre-fabricated housing units and employs around 60 persons in the factory besides another 100 in the field. It can fabricate flooring, wall and roof panels but gets structural components from others.

(xvii) Rabaul Metal Industries

This is the largest steel fabricator in Rabaul. It can manufacture structures for small buildings, houses and ware houses. In addition to structural fabrication capability of around 100 tonnes per month, it has a plate shop, which can do API tanks but not pressure vessels. It completed and erected a 100,000 litre fuel tank in Rabaul and has experience in manufacture of chutes, hoppers, ducting and water tanks.

3.4 SHIP BUILDING

3.4.1 This is an important segment of country's economy and deserves a special mention as an engineering industry. PNG is dependent on shipping for mass movement of cargo. The Government is now placing special emphasis on development of its shipping transport system, including the inland water-ways which so far have not received adequate attention. It is felt that it is necessary to take steps for an efficient operation of this important linkage between sea and land and a close look at available facilities would be essential for this purpose. There is already a joint funding programme between the National Government and ADB of nearly K-26 billion for development of ports of the country. The inland transport will mainly serve two main rivers i.e. the Fly and the Sepik. The other navigable rivers are Kikori and Ramu. These receive hardly any calls from coastal vessels. At present it appears that there are nearly 200 coastal vessels operating in PNG.

3.4.2 The available slipway in PNG in Moresby provides the following services :

- Slipway facility for vessels upto 600 tonnes for survey, repair, cleaning and repainting of hull;
- Periodic inspection and repair of life rafts.
- Machining services to the marine as well as general industries.

- Maintenance of emergency power generators.

3.4.3 THE FACILITIES

The slipway complex is located within the harbour of Port Moresby adjacent to the main ship berths due west of the port. Four slipways provide launch and retrieval facilities for vessels ranging from 100 tonnes to approximately 500 tonnes capacity. The largest cradle 50 meters in length, is of steel construction and had approximately 25% of structural members replaced in 1991.

The three other launch cradles are constructed of timber and will require some refurbishment to maintain their rated capacities of 100 tonnes to 400 tonnes.

The complex also has a large area suitable for water side fabrication, storage and barge load out. Compressed air and electrical power is available to provide utility services to all the four slips and the berthing jettty.

The fabrication and machine shop are equipped with the following machinery :

- Band-Saw
- Circular Saw
- Drilling Machines
- Shaping Machines
- Milling Machines
- Guillotine
- Punch Shear and Cropper

- Welding Machines
- Four Lathes with variable length of beds
- Shaft Borer
- Pipe Bender
- Air Compressor
- Power Generator

3.4.4 CURRENT ACTIVITIES

At present this slipway services a total of 35 to 40 vessels consisting of 9 fishing vessels, 5 navy patrol boats, 10 junk barges, 4 motorised barges and 10 tugs and coastal vessels. Discussions indicate that there are approximately 3 to 4 times as many vessels of the same type operating in the vicinity of mainland in PNG. Most of the repairs and refits have been done to Australia even though a majority could be handled in this facility. No new ship construction of any significance has been done in PNG in recent years.

3.4.5 POTENTIAL

- Ship construction, repair and refits to all ships upto 600 tonnes.

With backup support from experienced ship builders/repairers abroad, this unit should be able to provide complete marine support from structural design to fitting and repair of marine electronics.

- Machining for marine as well as heavy mining industry

The equipment in its machine shop can be used for manufacture and repair of a wide range of components and assemblies for the mining industry.

- Steel fabrication for oil and gas exploration and production facilities

Structures can be fabricated and assembled for load out on barges and heavy lift vessels.

3.5 STRUCTURE OF EMPLOYMENT IN THE ENGINEERING SECTOR

Out of 15 companies visited, data was available for 13 and number of managers and supervisors, expatriates and local is as under :

Expatriate Managers	36
Expatriate Supervisors	42
Local Managers	9
Local Supervisors	47
Local Other Staff	1153

This shows that there is a considerable scope for development of local supervisors into managers. Assistance can and should be sought for this through international agencies if necessary. A specific area of responsibility of expatriate management of workshops in the engineering companies should be to develop local managers within time schedules, agreed between them and the Government or other Government sponsored bodies and professional institutions.

3.6 STRUCTURAL ANALYSIS

3.6.1 The engineering industries in PNG can be covered as under :

SECTOR 37 - Basic Metal Industries including --

- Sub-sector 3710 - Iron and Steel basic industries
- Sub-sector 3720 - Non-ferrous metal basic industries

SECTOR 38 - Manufacture of fabricated metal products, machinery and equipment including --

- Sub-sector 3811 - Manufacture of cutlery and of general hardware
- Sub-sector 3812 - Manufacture of furniture and fixtures, primarily of metal
- Sub-sector 3813 - Manufacture of Structural Metal Products
- Sub-sector 3819 - Manufacture of fabricated metal products except machinery and equipment
- Sub-sector 3821 - Manufacture of engines and turbines
- Sub-sector 3822 - Manufacture of agricultural machinery and equipment
- Sub-sector 3823 - Manufacture of metal and wood working machinery
- Sub-sector 3833 - Manufacture of electrical appliances and houseware

- Sub-sector 3839 - Manufacture of electrical apparatus and supplies

- Sub-sector 3843 - Manufacture of auto vehicles

3.6.2 For the purpose of this analysis, manufacture is intended to cover both repairs as well as manufacture.

3.6.3 Efforts were made through NSO to obtain statistics of the engineering industry upto 4 digits of ISIC Codes 37 and 38. Analysis, however, was not possible because of legal restrictions on NSO to make available data to ISIC four digits. A representative list of items manufactured under these codes is at Table 3.5.

3.6.4 It is felt that the Government should undertake a structural analysis on following lines :

(i) Information should be collected on the following items for each sub-sector upto four digits :

(a) Number of Establishment

(b) Number of Employees

(c) Wages and Salaries

(d) Gross Output

(e) Gross Value Added and

(f) Capital

TABLE 3.5

Items manufactured in PNG as per ISIC Codes

371	Iron and Steel	
3710		Foundry Products
372	Non-Ferrous Basic Metal Industries	
3720		Refining of Gold & Silver
381	Manufacture of Fabricated Metal Products	
3813		Sheet Metal Products Structural Metal Products
3819		Drums Buckets Nails Wire Fencing Metal Bottle Caps
3829		Cookware
382	Manufacture of Machinery Except Electrical	
3822		Coffee Pulpers
3823		Workabout Sawmill
384	Manufacture of Transport Equipment	
3841		Ship Building
3843		Trailers
3849		Wheelbarrows

(ii) The information should be then split up according to size of units and type of ownership. Proformas for recording data are at Annexure VI.

(iii) In order to make a comparison with international operations in this sector, it would be useful to make a comparison of the following important performance indices in a format shown at Annexure VII.

- Gross value added/Gross output. This represents the degree of processing undertaken. Higher the ratio, greater is the processing done by the units.

- Gross output/Number of employees, is a measure of productivity of employees.

- Capital employed/Number of employees, would represent a capital intensity of the sub-sector.

- Gross value added/Number of units, would show how the size or type of ownership has been reflected in the efficiency of operations represented by the ratio.

- Wages/Number of employees, should be related to productivity i.e. gross output/number of employees.

- $[\text{Gross value added} - \text{wages}] / [\text{Capital}]$ is the ratio of operating surpluses i.e. Value added minus wages minus depreciation and fixed capital and only very roughly provide an estimate of the profitability of the enterprises.

3.6.5 A few general observations, applicable however, to the

impact of structure of engineering industries on national economy would be in order.

3.6.5.1 One of the characteristics of the engineering sector is that viable units can be set up with low capital and a small number of employees.

3.6.5.2 At the present stage of development of PNG's engineering industries, the small scale sector will have a decisive role in respect of both generation of employment and contribution to GDP.

3.6.5.3 The plan for engineering industries has to be drawn up in the context of current and anticipated economic situation in the country. The medium-term plan of the Ministry of Trade and Industry should reflect more positively, its concern for development of engineering industries in the PNG.

3.6.5.4 When examining value added, care should be taken that to the extent it is possible, assembly industries i.e. the nut & bolt industries are replaced by a gradual increase in locally manufactured items, particularly those which are metal pressings and small machined items which are within the capability of the engineering sector. Refrigerators, TVs, air conditioners are examples of some items which could have value added by importing only mass produced items (eg. compressors, picture tubes) and manufacturing steel fabrication items with local facilities. Only some balancing equipment may be required.

3.6.5.5 Since the engineering sector is highly skill intensive, it will be necessary to ensure that adequate training facilities

for workers, supervisors and managers are available.

3.6.5.6 Engineering sector in general is today affected by the small size of the market, high cost infrastructure and shortage of skills. The current rate of growth of GDP, however, offers tremendous possibilities for the expansion of the engineering industry.

3.6.5.7 The engineering sector invariably, has to face the demand of a growing middle class in the fast developing economy for consumer durables as well as intermediate and capital goods for development projects.

3.6.5.8 Sub sector 3320 which is for manufacture of wooden furniture and fixtures except primarily of metal and which did not fall within the terms of reference of this study, has an important bearing on engineering industry and its skill requirements. It is felt that with the resources available, both in terms of raw materials as well as skills within the country, there should be a complete ban on import of wooden furniture.

3.6.5.9 Similarly sub sector 3560 covers manufacture of plastic products not elsewhere specified. This is another sector which could be developed considerably. Some facilities are available for injection moulding, extrusion and blow moulding. The possibilities of existing units by expansion or new units being set up for thermoplastic items like sheets, ropes, wires, packaging and insulating materials on the one hand and thermo-set items like electric fittings and household utensils could be considered. Diversification could also cover rigid water and

drain pipes and fittings, printing of shopping bags, three phase wires and cables, woven sacks for sugar, flour and animal feed industries and containers of different types and sizes.

3.6.6 BASIC METAL INDUSTRIES SECTOR 37

The PNG basic metal sector consists of only one unit -- a small foundry at Lae. This does not reflect the crucial importance of foundry forge capacity for the entire economy, since, many cases, it represents the first step in production of spare parts for different sectors of economy. This is an area which at factory level, will generate a fair ratio of value added per unit of gross output.

3.7 FACILITIES AT UNIVERSITY OF TECHNOLOGY (UNI-TECH) AT LAE

3.7.1 This University was established in 1965 and is entirely residential. Departments which are relevant to the development of engineering industries in PNG and courses which they are responsible are given below :

- Business Studies
 - Bachelor of Commerce (Management)
 - Bachelor of Information System
 - Diploma in Commerce (Accountancy, Management or Micro...
Computer Information Processing)

- Electrical and Communication Engineering
 - Bachelor of Engineering (Electrical)

Diploma in Communication Engineering

Diploma in Electronic Engineering

- Mechanical Engineering

Bachelor of Engineering (Mechanical)

- Mining Engineering

Bachelor of Engineering (Mining)

Bachelor of Science (Mineral Process Engineering)

The other University in PNG concentrates on arts, humanity and science education.

3.7.2 The present secondary educational system in PNG provides education through grade 12. Many students of University in the past entered after grade 10 but now they join either after grade 12 as "direct entry" or they are given initial preparatory education if they come after passing grade 10.

3.7.3 While the primary education has to be financed by the students, tertiary education is financed by the government and covers teacher training, technical and secretarial colleges, vocational training, management training as well as university education.

3.7.4 SOME IMPORTANT FACILITIES EXCLUDING MECHANICAL ENGINEERING DEPARTMENT

3.7.4.1 Attached to the university is an Appropriate Technol

Development Institute which concentrates on developing simple technologies for village use. It is a joint venture between South Pacific Appropriate Technology Foundation, the University and the Melanesian Council of Churches for the development of appropriate tools and techniques for the country and the dissemination of information on appropriate technologies.

3.7.4.2 The University has a fairly well-developed computer centre which is intended to develop as the main scientific computer centre in the country.

3.7.4.3 The new department of Mining Engineering is of vital importance to the country with the discovery of large deposits of gold, copper and oil. This department offers 4-year course leading to degree of Bachelor of Engineering in Mining Engineering and Bachelor of Science in Mineral Technology.

3.7.5 MECHANICAL DEPARTMENT OF UNITECH

3.7.5.1 The Department of Mechanical Engineering offers a 4-year full-time course. The curriculum is spread approximately 40-40 between engineering and non-engineering courses. About 20 per cent of the programme is specifically mechanical engineering major (area of specialisation with options in the final year for energy systems or production engineering).

3.7.5.2 Equipment

The Department has a Computer-Aided Engineering Laboratory equipped with the latest 33MHz 386 PCs, printers and plotters using several general as well as specialist software.

The Department's CNC-CELL has two computer-numerically controlled machines, a Mazak NC Lathe and a Mazak Machining Centre. They should be utilised for production runs for a number of items to suit the mining industries as well as other manufacturing sectors. This will help not only students who have to learn new methods of manufacture but also help in increasing value added in manufacture.

The Department's Workshop is equipped with various lathes, grinders, milling machines and is complemented with qualified technical staff. It also has a small foundry and a Metrology Laboratory. It also employs a specialist Senior Electronics Technical Officer who provides support on electronics repair maintenance and design.

Its various laboratories have specialised equipment and instrumentation.

The Mechanical Engineering Department workshops can and should be developed into a centre of excellence for training for high grade skills.

3.7.5.3 Consulting Services Offered

(i) Objectives

- Assist industries and other organisations to solve problems of Mechanical Engineering and related nature
- Cooperate with industries and other organisation in enhancing the use of Mechanical Engineering and related technology to

optimise productivity, efficiency and competitiveness of industries and organisation in PNG.

- Provide the University staff, both academic and technical, and both within and outside the Mechanical Engineering Department, with a practical approach to problem-solving in engineering industry.

- Provide engineering students with the possibility of authentic engineering projects.

(ii) Types of Consultancy

(a) Training short courses and workshops

Precision Manufacture

Material Testing

Instrumentation calibration.

(b) Mechanical Engineering Consulting Services

Computer-Aided Engineering

AutoCAD or Computer-Aided Drafting and Design

Computer applications to engineering problems eg Finite Element Methods, Databases, Modelling

Computer Numerically Controlled machining

- Quality Assurance/Total Quality Management

Value Analysis and Value Engineering

Cost and productivity optimisation
Quality Assurance for the Chief Executives
Quality Assurance and the ISO 9000 series
Quality Audit and Implementation

- Energy Management and Appropriate Technology

Energy optimisation and design
Energy Planning and Economics
Micro-Hydro Design and Technology
Renewable Energy

- Workshop Management and Technology

Secondment to the Mechanical Engineering Workshop under supervision

Plant and Machine maintenance

- The role of Technical Support in Engineering research

- Maintenance Technology

- Vibration analysis
- Condition monitoring
- Maintenance audit

The capabilities of the University to provide all these services are limited even though the will is there. It should be encouraged and assisted to fulfill its consultancy objectives.

3.7.5.4 Another area which would be very useful to entire manufacturing industry is for the University Mechanical Engineering Department to set up complete material testing

facilities which can be used both for teaching as well as for rendering service to the industry. Specifically, the department should be equipped with complete testing of welds both destructive as well as non-destructive. It already has hardness testing machines and other tools and instruments for metrology should be added. Not only will it be necessary to suitably equip but it will be also necessary to advertise the fact that it will be so equipped. National Standards Body should associate with this centre to ensure that wherever it is necessary, testing of welds is made mandatory with the help of its facilities. It could also associate itself with international organisations or also similar organisations like Institutes of Welding in other developing countries to develop expertise and knowledge. This should enable the University to provide to industry, trained and educated engineers but also in addition to service for material testing.

3.7.5.5 In order to develop the Department of Mechanical Engineering as a testing centre, it would be advisable to equip it with following equipment --

(i) Argon gas and other equipment for welding steel and aluminium,

(ii) Complete weld testing facilities,

(iii) Small heat treatment facilities,

(iv) Training of University staff both in welding and weld

testing.

3.7.5.6 UNIDO's assistance should be sought to develop these capabilities. It is recommended that UNIDO should support a feasibility study for a full fledged National Testing Laboratory, with UNITECH as a possible location.

3.7.5.7 The University has a core staff for operating and introducing TQM concepts in industry and explain ISO 9000 series to management as well as other categories of staff in engineering units. It is suggested that the university should choose one unit where the management is committed to introduce TQM and embark, as a joint venture, on a time-bound programme, for getting accreditation to ISO 9000.

3.8 DEFENCE GENERAL ENGINEERING WORKSHOP

3.8.1 The equipment in the Centre consists of radial drills, pillar drills, bench drills, grinding machines, lathes with 6", 7", 9" height of centres and one with 25" swing, milling machines, hacksaws, shapers and band saws. In addition, it has a boring machine for engine cylinders and grinding and honing machines for connecting rods. It also has hydraulic honing machine, perhaps the only one available in the country. It also has tool grinders, welding shop including a brand new welding machine which has been out of commission for a few months. A part of the workshop has facilities for sheet metal and pipe bending and welding work. It has a shearing machine and a punch and shear machine and a hydraulic press.

3.8.2 This workshop which is situated in the outskirts of Port Moresby has excellent facilities for machining and welding. Their equipment, however, is grossly under-utilised and quite a good number of machines are out of order or broken down.

3.8.3 It is necessary to examine urgently the use to which the very well laid out workshop can be put to use not only for Defence but also for civilian needs. The machinery needs to be repaired and re-commissioned as early as possible by making use of locally available talents and resources in the service sector. The private sector units which are already able to carry out extensive and complicated repairs on automobiles and internal combustion engines can be effectively utilised for this purpose.

CHAPTER 4

SWOT ANALYSIS

4.1 STRENGTHS

4.1.1 EQUIPMENT FOR STRUCTURAL WORK AND SHEET METAL INDUSTRY

The industry in general had good equipment for structural work and also has fairly good sheet metal shops to support it. It will however be desirable to establish a complementarity for different units so that a combination of resources in different units can be used for locally handling heavier and more complex jobs for the industries in general and mining sector in particular.

4.1.2 ASSOCIATION WITH AUSTRALIA

Most of the units in the Engineering Sector either are subsidiaries of or have intimate relations with companies in Australia. While this has given them access to the technologies being used there, it can, sometimes be a drawback because they are not open to technologies being used successfully in other parts of the globe, particularly in other competing South-East Asian countries.

4.1.3 VOCATIONAL TRAINING

The country has a good track record of vocational training and the industry has good experience of the boys trained in the vocational institutes for taking up positions of tradesmen. However, their skills need to be kept up and developed through vocational courses for upgrading their skills.

4.1.4 MANAGEMENT INFORMATION SYSTEM (MIS)

The use of computers and modern communication facilities like faxes are common. Most of the units have been using computers but the use to which they are being put, is relatively limited -- mostly for accounting, and personnel functions. The knowledge and experience gained can certainly be used for developing complete management information systems which do not have to be complicated but would be a key resource for improving productivity of the organisations. This is an area where they can get assistance from friendly countries and international agencies.

4.2 WEAKNESSES

4.2.1 WAGE STRUCTURE

Labour wages, in PNG are much higher than their competitors in neighbouring countries. The Minimum Wages Board establishes binding guidelines on minimum wages for a 3 years period. The government is only one of the parties and employees and labour representatives are the other. The next Minimum Wage Board guidelines will be set during 92.

It is easy to realize difficulties that would be there in introducing legislation for a complete ban on increase in labour wages. It is however, felt that it should be possible to find a via media that minimum wages should not be increased any further. They could be regulated to the extent possible but directly linked to productivity. Small units, should be exempt from the minimum wage guidelines.

The following Tables clearly indicate the urgency of rationalisation of wage structures :

Table 4.1 Minimum Rates of Pay in Papua New Guinea

Table 4.2 Manufacturing Costs : Comparative Measures (including Labour Costs, Power and Long Distance Telecommunications)

Table 4.3 Unskilled Wage Rates in Manufacturing, 1989 in some countries.

Table 4.4 International Comparison of Weekly Wage Earnings

Table 4.5 Urban and Rural Wages in Papua New Guinea, 1975-1991.

It is understood that Government has proposed a productivity based wage determination system and it is hoped that this will be adopted as early as possible so that there is a downward adjustment in real wages and total labour cost per unit becomes comparable with that in neighbouring countries. Comparative productivity growth rate in PNG and some neighbouring countries is shown at Table 4.6.

4.2.2 LACK OF INDUSTRIAL ENGINEERING

By and large, the engineering industry is not aware of modern industrial engineering practices and in particular norms, that should be adopted for assessing labour productivity. International standards/norms for operations like welding should be procured from ILO or UNIDO and widely distributed to the industry.

TABLE 4.1

**INDEPENDENT STATE OF PAPUA NEW GUINEA DEPARTMENT OF
LABOUR AND EMPLOYMENT MINIMUM RATES OF PAY FOR CENTRES
DESIGNATED**

As level 1 and level 2 areas effective as from 1 September, 1991 following the consumer price index increase of 3 per cent (3%) and retrospective to 1 July, 1991

CLASSIFICATIONS	LEVEL ONE CENTRE		LEVEL TWO CENTRE	
	WEEKLY RATES (K)	FORTNIGHTLY RATES (K)	WEEKLY RATES (K)	FORTNIGHTLY RATES (K)
YOUTH UNDER 22 YEAR OF AGE	29.97	59.94	25.31	50.62
GENERAL LABOURERS AND MARRIED YOUTHS	59.98	119.96	50.61	101.22
CLASS 1	63.65	127.30	54.41	108.82
CLASS 2	67.15	135.64	58.71	117.42
CLASS 3	73.15	146.30	64.13	128.26
CLASS 4	79.56	159.12	79.52	159.12
CLASS 5	85.96	171.92	85.96	171.92
QUALIFIED TRADESMAN CLASS (B1 AND B2)				
QUALIFIED TRADESMAN CLASS (A)	92.40	184.80	92.40	184.80
RURAL: National Minimum Wage (Rural) K22.36 per week K44.72 per fortnight				

YOUTH: Junior Wages Scale was abolished on 26 June, 1986 by the Minimum Wages Board Determination No. 1 of 1986. New wage for Youth which commenced 26 June, 1986 is 50% of current Level One and Level Two General Labourer's rate, paid only to those who enter employment on or after 26 June, 1986. Youth employment prior to 26 June will stay on Junior Rate until the age of 22 years.

Employers employing youth groups of not less than ten youths shall negotiate the wage or wages applicable, directly with the groups concerned.

APIMELEDY K JOEL, OBE
Secretary for Labour and Employment

**TABLE :MANUFACTURING COSTS: COMPARATIVE MEASURES A/
(1989 US\$)**

COST ITEM	PNG	THAILAND	SRI LANKA	KOREA	FIJI
LABOUR (\$/ANNUM)	5338	1377	474	8786	4991
UNSKILLED	2800	760	285	3200	n.a.
SKILLED	25000	n.a.	n.a.	n.a.	9400
POWER (USC/KWH)	14.0	6.9	5.9	5.8	16.1
LONG-DISTANCE TELECOM B/	2.6	.3	n.a.	1.2	0.5

SOURCE: : NATIONAL STATISTICS OFFICE OF PNG, SIEMANS CORPORATION, INTERNATIONAL LABOUR ORGANIZATION AND WORLD BANK.

A_ / PNG VALUES REFER TO MOST RECENT ESTIMATES. OTHER NATION VALUES REFER TO 1989 OR 1990 ESTIMATES.

B_ / FOR A 3 MINUTE CALL UP TO 100 KILOMETERS.

TABLE 4.3

UNSKILLED WAGE RATES IN MANUFACTURING, 1989

COUNTRY	WAGE RATE (\$/day)	PER CAPITA GNP d_ (\$)
PAPUA NEW GUINEA	12.2 a_ /	890
INDONESIA	2.3 b_ /	500
THAILAND	3.8 b_ /	1,220
PHILIPPINES	3.0 c_ /	710
INDIA	2.0 c_ /	340
PAKISTAN	2.5 c_ /	360
BANGLADESH	1.8 c_ /	180

a_ / Government of PNG

b_ / Fiji: Incentive Policies for Growth, World Bank Report 9516, July 1, 1991.

c_ / World Bank country economic reports

d_ / World Development Report (1991)

TABLE 4.4

INTERNATIONAL COMPARISON OF WEEKLY WAGE EARNINGS

COUNTRY	PERCENT OF PNG AVERAGE WAGES		PERCENT OF PNG MINIMUM WAGES	
	AGRICULTURE	NON- AGRICULTURE	AGRICULTURE	NON- AGRICULTURE
NIGERIA	--	8.8	--	18.6
INDIA	19.6	14.4	24.7	30.3
SRI LANKA	20.2	8.2	25.4	17.3
MALAYSIA	58.0	21.9	72.9	46.3
PHILIPPINES	28.9	15.3	36.4	32.2
INDONESIA	51.9	17.9	65.3	37.8
KOREA	207.5	67.4	260.8	142.2
HONG KONG	--	60.0	--	126.6
SINGAPORE	257.9	61.9	324.2	130.7
W. SAMOA	40.2	11.6	50.5	24.5

NOTES: These data were taken by DFP from International Labour Office, Yearbook of Labour Statistics - most relate to 1985 and 1986. These data were made comparable through the US\$ - local currency exchange conversion. At 1986, Papua New Guinea minimum wages were K17.70 (rural) and K47.47 (urban level 1). DFP state Papua New Guinea wages in US\$ as follows:
 - average US\$ 21.56 (rural) US\$ 97.20 (urban)
 - minimum US\$ 17.15 (rural) US\$ 46.05 (urban)

Source: Adapted from DFP (1989, Table 20:74)

TABLE 4.5

URBAN AND RURAL MINIMUM WAGES, 1975-1991
(Kina per week)

	NOMINAL WAGES		REAL WAGES (1985 TERMS)	
	RURAL	URBAN	RURAL	URBAN
1975	8.5	24.2	16.5	46.7
1980	12.5	33.4	17.1	45.8
1985	17.0	45.5	17.0	45.5
1987	18.6	49.8	17.1	45.7
1988	19.1	51.3	16.7	44.7
1989	20.1	54.0	16.8	44.9
1990	20.8	55.7	16.2	43.4
1991	21.7	58.2	15.9	42.7

A_ / 1991 values refer to June quarter estimates. Real wages are estimated using the CPI as the deflator.

SOURCE: Bank of Papua New Guinea. Quarterly Economic Bulletin, various issues.

TABLE 4.6

**COMPARATIVE PRODUCTIVITY GROWTH, 1980-1990
(% p.a.)**

COUNTRIES	AVERAGE LABOR PRODUCTIVITY IN MANUFACTURING
MALAYSIA	3.8
INDONESIA	6.7
THAILAND	3.4
PAPUA NEW GUINEA	0.3

SOURCE: World Bank country economic reports and staff estimates

4.2.3 TOTAL QUALITY MANAGEMENT (TQM)

By and large, with one or two exceptions, the industry is unaware of the basic concepts of TQM which ensures quality assurance & reduces dependence on normal concepts of quality control. However, the lead taken by a couple of companies and the effort being made by them alongwith National Standard Organisation are in the right direction but need to be pursued a little more vigorously.

4.2.4 VALUE ANALYSIS

At the current stage of development of engineering industry, value analysis which is a useful tool for product development, should be encouraged. This management tool besides being applied for product development can also be used for methods and organisation.

The value depends on the cost of each function and it could be variable or fixed. Only variable costs are used in value analysis so that calculation remains simple and fast. Industry has to be trained to see that lack of time, lack of information, lack of ideas, misconceptions, change in circumstances, fear to express ideas and opinions, habits and attitudes are major causes which adversely effect product development efforts. But it is also necessary for industry to realise the differences in traditional Cost Reduction and Value Analysis. While in cost reduction the product gets analysed, in value analysis function get analysed. At the same time, while traditional cost reduction aims to reduce

cost and increase profits, in value analysis the purpose is not only to reduce costs, but also to produce better value and quality for the consumer.

4.2.5 STANDARDS

The important functions of PNG's National Standards Council and Standards Division are:

- i To simplify and control the variety of products and procedures used in PNG.
- ii To assist the suppliers who produce goods and services, to meet customers' needs.
- iii To promote and assist in improving manufacturing process capabilities to achieve better quality products, higher productivity and lower production costs.
- iv To maintain the Measurement Standards Laboratory and provide Calibration Services to industries and institutions.
- v To establish and coordinate a National measurement system.
- vi To assist in formulation of relevant National policies on Science and Technology Transfer under the newly established National Science and Technology Council.

Its functions relating to Quality Assurance and Quality Control are:

- i To operate and coordinate PNG Laboratory Accreditation Scheme (PNGLAS)
- ii Quality Assurance Advisory Service to industries
- iii Preshipment Inspection and Certification
- iv To provide assistance to Testing and Laboratory Accreditation Committee (TLAC)

v To coordinate Training Programmes

vi To coordinate 'Made in PNG' Scheme.

The Division will need to be considerably strengthened at the professional level and given opportunities to gain experience from other developing countries.

The National Standard Organisation is developing standards for welds. This exercise should be carried out very expeditiously and widely circulated to the industry. At present with a few exceptions, the knowledge of international standards for welds is extremely limited.

4.2.6 MATERIAL TESTING

This is an area which needs to be given immediate attention. Even for non-destructive testing of welds, experts are flown from Australia. There is an urgent need for developing material testing facilities particularly for conducting non-destructive tests on welds. There are different options for setting them up. The Metal Trade Industry Association or the University of Technology at Lae could set up these facilities for use by the industry. UNIDO could be asked to assist in this venture.

4.2.7 TOOLS, DIES, JIGS AND FIXTURES

At the moment, there is no facility available in the country for the manufacture of simple tools and dies and even their repair is carried out in almost a primitive manner. There is need to urgently set up a small tool room which will be able to manufacture tools, dies, jigs and fixtures for machining

operation and at the same time be able to carry out repairs of tools, when necessary. This project should be developed by the Small Business Development Corporation for assistance to entire engineering industry, as a separate profit centre. UNIDO should provide technical assistance by way of a Feasibility Report.

4.2.8 WORKSHOP PRACTICES

In general, welding practices in most shops are not modern and do not make it possible for international quality to be ensured. There are exceptions where extremely good welding of stainless steel as well as mild steel structures is done to international standards. But awareness of sound workshop practices for quality and safety, needs to be spread across the board, in the entire industry.

Similarly in machining operations, most of the tools that are used do not have the right angles for efficient metal removal and there are hardly any tool and cutter grinders. The suggested tool room could also take up this activity on behalf of industry.

4.2.9 INFRASTRUCTURE

4.2.9.1 Power

The power tariff structure currently in vogue is shown in Table 4.7. The cost of power is amongst the highest in the world possibly owing to a small market, rugged terrain as well as relative inefficiency of generation, distribution and transmission.

The tariff rates for electricity applicable from 1.4.92 are shown in Table 4.7.

The power rate in some countries as assessed by the World Bank in US cents per KW/H is given below for comparison.

PNG	14.0,
Thailand	6.9,
Srilanka	5.9,
Korea	5.8 and
Fiji	16.1.

As at present, an industry working 3 shifts, 7 days a week pays a low rate approximately 10 Toya per unit. But in actual practice, the capacity of the entire engineering industry is underutilised and most units are working in one shift and pay the maximum rate of nearly 18.4 Toya per unit. There is a case for consideration for reducing the tariff for engineering industry which is a comparatively high user of electrical energy.

As happens in many developing countries, wherever there is a monopoly in Power generation and transmission the cost of inefficiency is passed on to the consumer. It is suggested that figures for cost of generation, distribution and transmission worldwide, should be taken and compared with those in PNG. It should not be difficult to draw up a comparison with countries

Table 4.7

**Papua New Guinea Electricity Commission
New Tariff Rates - Effective 1st April, 1992
For Electricity Supplied to the Following Consumers**

Domestic Tariff Rate :

First 100 KWH	-	12.6 Toea/KWH/Month
Balance	-	18.4 Toea/KWH/Month

In each case :

(1) Minimum monthly account for each connected meter is K4.25

(2) Accounts for periods of less or more than one month will be calculated on a Pro-Rate basis.

General Supply Rate :

All Energy	-	18.4 Toea/KWH/Month
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In each case :

(1) Minimum monthly account for each connected meter is K4.75

(2) Accounts for periods of less or more than one month will be calculated at 17.3 toea per KWH.

Industrial Tariff Rate :

All Energy	-	9.8 Toea/KWH/Month
Demand Charge	-	12.25 per KVA/Month

In each case :

(1) Minimum Demand Charge is 2450 per month which is equivalent to a demand of 200 KVA per month.

(2) Applicable upon application, to large industrial and commercial consumers with a demand of approximately 200 KVA or more in the Centres of Port Moresby, Goroka, Kainantu, Kundiawa, Lae, Madang, Mendi, Mt. Hagen, Yonki, Wabag, Rabaul and Kieta/Arawa.

which have similar difficulties of terrain and fragmentation of users.

4.2.9.2 Telecommunications

The telecommunications rates are very high as compared to other countries. A comparison of long distance telecommunication rates for 3 minutes call upto 100 km in US\$ is given below.

PNG	2.6,
Thailand	03,
Korea	1.2 and
Fiji	0.5.

4.2.10 Non-availability of market data

There is at present no system or organisation for assessing the demands on the engineering industry on a scientific basis to enable it to prepare for competition well in advance. This is an industry which takes time to set up facilities not only in terms of machinery, plant and equipment but also for training of manpower for necessary skills. An exercise in this field could be taken up by the Department of Trade and Industry in association with industry.

4.2.11 Lack of Managerial Skill

There is a lack of local managerial skills in the country. Most of the managers in the engineering industry are expatriates and

there is a case for the government to take special steps to develop local managerial skills in association with the industry to bring down costs as well as to promote a feeling of industry's total involvement with local interests and aspirations.

4.2.12 Apprentices Training

There is a consistent complaint from the industry that when apprentices who are under training with them are sent for block courses to Universities in PNG, the latter do not send any feedback to the sponsoring engineering unit either of attendance or performance of students. This is a major flaw in operation of the Apprentices Training Scheme and it needs to be ensured that with modern communication facilities available, results of all aspects of performance of students are conveyed to sponsoring units by fax as soon as the student completes his block course to enable the engineering unit to decide its course of action for further training.

4.2.13 Technology Planning

4.2.13.1 Training for Technology

Scientific & Technology investigation as well as R&D in the engineering field are still being done in PNG on a very limited scale.

The objectives of Technical Education in PNG as drawn up by Department of Education include, offering post-secondary

education and training to school leavers and non-school leavers who are not eligible for University Studies, and to provide technical-vocational training, to other potential work-force. Specifically the policy aims that there is a supply of adequate technically skilled work force, for the industry besides commerce & government. It also aims at retraining people who are already in employment but whose skills are outmoded by changes in technology. It also aims to offer high level management training but the results so far as at least the engineering industry is concerned, are not visible.

4.2.13.2 As technological considerations play a large role in industrial development in any country, these need to be adapted as basic parameters in the policy and programme of the Department of Trade and Industry. In its planning exercises, it needs to consciously include technological considerations particularly when dealing with development of new industries and projects. Choice of technique and development of new technologies as well as standardisation of techniques, although considered in theory, needs to be done professionally for it have an impact on the engineering industry. At least in private sector, there is no awareness in the industry that there is any effort being made towards planning future technologies in the country. One possible reason is that technological choices are not taken on their own merit because social, political and economic aspects also play a role. For example, employment of nationals, conservation of environment play a big role in decision-making on technology. There is evidence that technological considerations are taken for granted in new projects and from the point of view of engineering

industry, not much attention is paid to see whether technology is too advanced or appropriate to the country or not. It is possible, that the Department of Trade and Industry is not able to contribute effectively to decisions on technology choices on account of inadequacy of qualified professionals to assist it.

4.2.13.3 Essential to the entire operation of technology planning in the engineering industry is collection of relevant data and its dissemination to various agencies including the mining industry and participants in different development projects as well as the engineering industry. The government has already identified some international sources for technical data and know-how.

Assistance could be taken from UNIDO and other friendly countries which have specific programme for collection of data on technology.

4.2.14 GOVERNMENT PRIORITIES

Very specific action should be taken by the government in its medium-term industry plan for promotion of engineering industry as a vehicle for overall economic development of the country. It should enjoy a relatively high priority because of its contribution to efficient maintenance and operation of revenue earning facilities of the mining and power sector.

4.2.15 PRIORITIES OF FINANCIAL INSTITUTIONS

It was noted that financial institutions have very little role to play in project development in the form of capital. Except in some large companies, financial institutions do not seem to have taken much interest in providing equity capital. Surprisingly for even working capital most of the companies are currently using their resources which limits their ability to take up jobs which require rather large volumes of capital. This is particularly because engineering industry is totally dependent on import of raw materials like steel and aluminium bars, sections and sheets. PNG engineering units are forced to keep a high level of inventory which is not the case in many other countries which are competing with PNG for the local market as well as market for neighbouring countries.

4.2.16 CORPORATE CULTURE FOR ENGINEERING INDUSTRY

The Industry has to take immediate steps on a number of directions to develop an efficient and capable structure. These will include :

- (i) Communication with clients to understand their needs (an essential requirement of TQM)
- (ii) An innovative approach to adapt existing products or to come up with new products to satisfy the clients' needs.
- (iii) A quality culture that will only accept the highest standard of workmanship and encourages and rewards cooperation and performance.
- (iv) A commitment to deliver on time and on target.

(v) A commitment of after-sales service to the clients to ensure total customer satisfaction.

(vi) Reduction of overheads to the extent possible.

(vii) A sound management information system to monitor the performance of units and to plan in advance for changes in management or its organisational setup. The market sector characteristics of PNG of fabricated steel are at Table 4.8.

4.2.17 The engineering industry has some PNG related costs which are inescapable. These include domestic sales tax by some provincial governments and excise tax which is around 3%, training of national artisans, security related costs, expatriate benefits such as home leave, housing, etc.

4.2.18 PNG has copied certain unhelpful aspects of Australian Labour Regulations. One example is the Industrial Relations Act which enforces the Australian System of Preference for Employment for trade union members which in actual practice could make it legal to discriminate against other qualified citizens. Similarly the Employment Act (1981), restricts payment by performance for non-agricultural employment. It is felt that the government should have a look at the regulatory arrangements for labour market policy and shed those aspects which are either harmful or unnecessary and simplify those which are unduly complex. The government's labour market policies have focussed on convening Minimum Wage Boards and sending comments to it either for or against unions' or employers' views. The Government may consider taking steps towards competitiveness by providing an environment in the Minimum Wage Board for cooperation for the national good.

Table 4.8

MARKET SECTOR CHARACTERISTICS - FABRICATION

PRODUCT TYPE	MARKET SECTOR	CLIENT PROFILE	PRODUCTS
A. ROAD TRANSPORT EQUIPMENT	END USERS	MANY SMALL SUBCONTRACT TYPE OPERATORS MOSTLY NATIONALS	TRUCK BODIES MAINLY, SOME TRAILERS. REPAIRS AND SPARES
	AGRICULTURAL	MANY SMALL FARMS	AGRICULTURAL TRAILERS & BINS. TRAYS & TIP TRAYS TRAILERS & SPARES
	TRANSPORT CO'S	TRANSPORT CO'S	
	MINING CO'S	MOSTLY AUSTRALIAN OR US BASED. PURCHASES MOSTLY AT PROJECT START UP	TRUCKS, TRAILERS, SPARES, SERVICE VEHICLES DUMP TRUCK BODIES
	GOVT. DEPTS	FEDERAL & PROVINCIAL GOVTS.	- TRUCKS MOSTLY - SERVICE VEHICLES - SOME TRAILERS - TRUCK CRANES
	EXPORT	MAINLY SMALL ISLANDS IN REGION. ALSO FIJI & SOLOMON ISLANDS	TIPPER BODIES, AGRIC - TRAILERS
B. MATERIALS HANDLING EQUIPMENT	RETAIL OUTLETS	3 MAIN CHAINS, SEVERAL MEDIUM CHAINS. SMALL STORES AND SUPER MARKETS	WASTE PAPER COMPACTORS, TROLLEYS
	WAREHOUSE & MANUFACTURERS	LARGE CHAINS, BAKERIES. BOTTLERS ETC.	DOCK EQUIPMENT, TROLLEYS, WASTE PAPER, COMPACTORS, PALLETS AND RACKING
	MINING CO	AUSTRALIAN OR US BASED	TAILGATES, MAINTENANCE SCISSORS
	TRANSPORT OPERATORS	TRANSPORT COMPANIES AND SMALL END USERS	TAILGATES, WAREHOUSE EQUIPMENT
	EXPORT	FRAGMENTED MARKET - SMALL & WIDESPREAD	TAILGATES, SCISSORS

4.2.19 PRODUCTIVITY

There is a good case for a National Productivity Council to be set up under the aegis of Department of Trade & Industry. Its principal responsibility would be to assist industry in all aspects of productivity and in particular set up productivity norms in association with ILO and other international agencies.

4.3 OPPORTUNITIES

4.3.1 There is at the moment only one small foundry with very limited capacity and facilities. Its level of production is low because of non-availability of financial resources even though the government owns almost 98% of its equity.

This is a critical sector for development of the entire engineering industry and its importance should be realised in the context of very large volume of low complexity castings that will be required for operational spares in the form of grinding balls for FAG and Ball Mills and liners for mills and crushers. The requirements for Lihir Project alone are estimated to be approximately 1050 kgm per thousand tonnes of ore and that of liners at approximately 122 kg per thousand tonnes of ore. The annual requirement for the Lihir Project alone are estimated to be upto 3,000 tonnes of grinding balls and 370 tonnes of liners every year. There seems to be a very good case for urgently considering the possibility of setting up a foundry shop at a suitable location taking into consideration locally available materials and those which have to be imported. It is proposed

that UNIDO should assist in taking up a feasibility study for this project.

There are at present no forge facilities either for ferrous and non-ferrous items. With the proposed foundry facility, at least a small forge shop to meet some basic requirements of spares and some other items could be considered to make it economically more viable.

4.3.2 MINING EQUIPMENT OTHER THAN FOUNDRY AND FORGE ITEMS

4.3.2.1 The Engineering Sector's main market is going to be mining and energy projects, agricultural infrastructure and equipment, transport, residential and industrial buildings, road transport infrastructure particularly bridges. Its products could certainly include structural steel, tankage and vessels, piping, bridges, steel sections, pipe fittings, mobile cranes and ship repair. According to one estimate the larger projects in next three years are likely to require 40,000 tonnes of fabricated steel. Oil and gas industry is likely to offer additional opportunities.

4.3.2.2 It is essential to urgently identify the kind of equipment particularly in the form of structures, pipes, pressure vessels that can be made within the country. Many units have shown their capability to handle very heavy structures to international standards of welding. There seems to be no reason why almost all the structures and a major portion of tankage can

not be supplied from within the country.

4.3.3 SPARES FOR MANUFACTURING INDUSTRIES

4.3.3.1 All industries have equipment which need spares as castings, forgings, or machined components. Their demand should be assessed and then analysed according to the type of manufacturing facilities required for them. Additional capacity can then be considered taking into account existing capacity. The proposed foundry forge shop will go a long way in meeting some essential requirements of spares for the entire manufacturing sector.

4.3.3.2 Some industries other than mining sector for which tools and maintenance spares will be required to be supplied by the engineering sector are:

- Tree crops
- Palm oil processing
- Coconut products processing
- Coffee processing
- Cocoa processing
- Rubber processing
- Fruit juice production
- Potato processing
- Pyrethrium processing
- Spices processing
- Chicken farm and processing
- Animal feed mil
- Hides & skins processing
- Honey processing
- Logging sawmills
- Plywood manufacture
- Wood furniture manufacture
- Pulp mill
- Fish industry
- Refrigeration industry
- Cement
- Chemical & petrochemical industry
- Plastic industry

4.3.4 Studies have been carried out earlier in 1961 on a number of areas of interest to the engineering industry. These include manufacture of domestic steel and aluminium utensils, agricultural handtools, forged hand tools, electric fans, builders' hardware. A list is at Annexure 13.

It is felt that in the interest of long term development of the engineering sector as a key to the economic development of the country, these reports should be updated and actively followed up with the specific objective of setting up these facilities on a high priority. To be added to this list are electrical appliances and fittings -- manufacture as well as assembly.

4.3.5 EXPORTS

The possibilities of exports for engineering sector in the near future are limited considering the advantages of neighbouring countries in cost of labour and infrastructure as well as available skills in manufacture and marketing on the one hand and the long gestation period generally required for setting up manufacturing units in this sector on the other. However, if constraints of costs are removed, there is certainly a possibility for the engineering sector to compete for supplies of steel structures, wire products, spares, piping and tankage to some developing countries in the region. The possibility of the proposed Foundry-Forge to supply castings and forgings to neighbouring countries will certainly deserve consideration.

4.4 THREATS

4.4.1 GOVERNMENT POLICIES ON LEVIES AND TAXES

At present the Government allows completely duty free imports for the Government and also allows reduction even to 0% on items imported by construction companies taking up projects awarded by the Government, even for items for which the normal duty ranges from 8 to 30%. Similarly in the case of mining sector special privileges for duty free imports or nominal duties are extended although it requires the approval of the National Executive Council which is headed by the Prime Minister. So far almost all mining leases have been favoured with these exemptions which allows them to import items paying far less import duties than the private sector. This puts the engineering units at great disadvantage when competing with foreign companies. The application of import duties as at present and how they work as a disincentive, are shown at Table 4.9.

The private sector has to contend with the high cost of wages and infrastructure besides elements such as high wage expatriates and their security on account of law and order situation which means additional costs not borne by their counterparts abroad. If they are further burdened by the excise duty of about 3% and provincial taxes, they will, in effect be prevented from making a large volume of supplies to mining units and Government Contractors. In fact, there are cases where Government contractors have been allowed to bring labour which could be obtained locally. The impact of this is not only on the engineering industry. It has a social impact because it denies

TABLE 4.9

APPLICATION OF IMPORT DUTIES AS A DISINCENTIVE

Items	Normal Customs Regulation	Actual Practice with Exemption granted by Government			
		Government	Government Contractors	Mining Sector	Private Sector
Raw material	0%	0	0	0	0
Finished goods (not made locally)	30	0	0	max 12**	30
Finished goods (made locally)	30	0	0*	max 12**	30
Intermediates	8	0	0*	8	8
Spares	8-10	0	0*	8-12* (12% MAX)	8-30

* Require NEC Approval

** Average duty, applicable to specific mining equipment certified by Department of Mines.

employment to local people as well as robs the country of a chance of developing its technology on a long-term basis.

It is for the consideration of the Government that duties on engineering goods should be

(a) uniform,

(b) transparent, and

(c) simple to comprehend and apply.

There should be no duty exemption at all whether for the Government or Government contractors or the mining sector for engineering goods. There could be a possible argument by the mining sector that this may result in the cost of their construction going up. On account of the fact that even the token increase in cost will be limited to those few items which are being made locally, the impact on the total project costs will be negligible. However, the impact of such a decision and encouragement on the local industry that will have to contribute to the development of infra-structure for future economic well-being of the country, will be considerable.

It was understood that, some mining companies use small, may be one-man offices, in other countries particularly Australia to make routine purchases on their behalf and supply them as imports from Australia. Some steps will be necessary to avoid this

practice which denies the local industry opportunity to compete with foreign suppliers.

It is recommended that the Government should consider increase in duty on all semi-finished and finished goods if produced within PNG. A reasonable figure would be 25%.

The country has to take a conscious decision whether it should go in for relative short term benefits of saving some money by importing admittedly cheaper products from other countries or for a much more desirable long-term objective of promoting the engineering industry as the principal vehicle for developing its infrastructure and sustaining economic development. Considering various cost-benefit aspects, it is recommended that the Government should decide to forego the additional marginal cost to projects, by discouraging import of such items which can be produced in PNG, in order to develop capabilities of the local industries.

CHAPTER V

SMALL SCALE INDUSTRIES

5.1 NATIONAL GOALS AND OBJECTIVES

5.1.1 The Government has targeted the industrial sector to develop the economy in order to achieve National Government development goals and objectives.

"The time has come for the new generation of Papua New Guineans to play their part to build this country into an economically strong, self-reliant, independent and proud nation."

. . . Hon. John Giheno, Minister of Trade and Industry, Statement of Parliament 1991 on the Medium Term Industry Development Action Plan.

5.1.2 The private sector will be the major player in implementing projects to achieve government objectives under its Medium Term Industry Development Plan.

. . . "It is the private sector which will be relied upon to make the actual investments in these projects."

. . . Hon. John Giheno, Minister of Trade and Industry
"As well there is direct policy mandate for development of indigenous technologies as a priority policy!"

. . . (excerpt from S & T policy document) :

5.1.3 Small industries are the building blocks from which a country establishes its industrial base and for this Papua New Guineans themselves will need to take the initiatives in producing goods and services they need. It must however be recognised that some industrial sectors, even with a high potential, will not attract the private sector if financial returns on investment are too low or it takes too long before they are realised.

5.2 DEFINITION

5.2.1 Small Scale Industries (SSIs) are defined as those whose value of fixed assets is less than 100,000 K. It is recommended that from the point of view of work done, units engaged in repair should be distinguished from those engaged in manufacture.

5.3 POLICY FORMATION, COORDINATION AND IMPLEMENTATION

5.3.1 The management structure in SSIs is generally unorganised with little evidence of professionalisation or scientific management. It is not generally realised that basic principles of scientific management apply to the small scale units as much as to the organised sector. For example, most small units in PNG do not keep any books of accounts nor do they follow cost accounting procedures or systems for elementary financial control. There is, as a rule, no practice of MIS and inventory control.

5.4 SMALL BUSINESS DEVELOPMENT CORPORATION (SBDC)

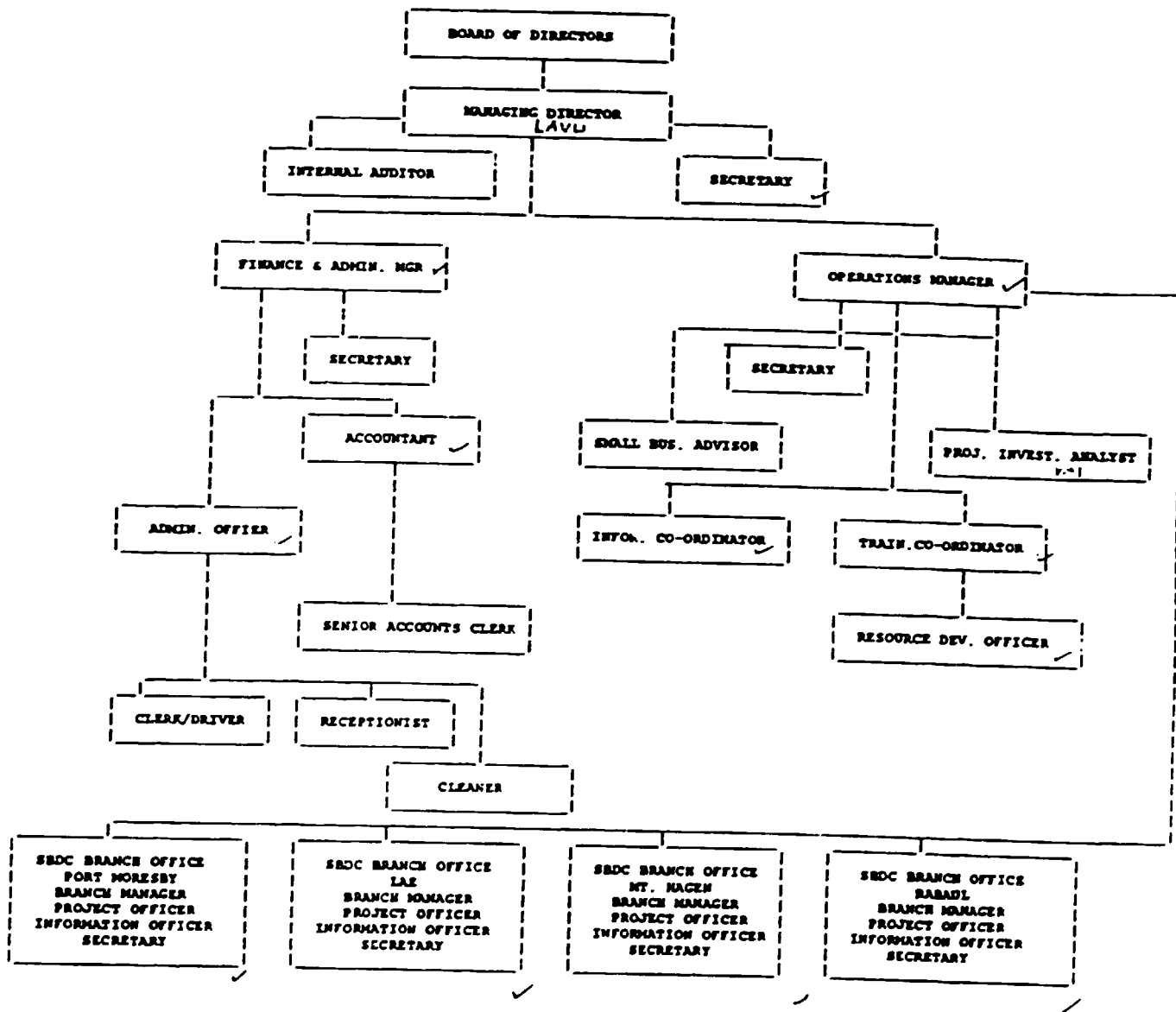
5.4.1 The Government of PNG has recognised the development of national small business entrepreneurship as an important vehicle to foster increasing national participation in industrialization. One of the steps it has taken in this direction, is establishment of SBDC. Its main functions are to formulate and implement policies to promote small business, provide advisory and management services for development of small business, assist in securing finances, establish and maintain a business information service, arrange trade training and skill development programmes and assist in development of business practices and promote liaison between associations of different groups representing small business. While the objectives of SBDC are laudable, its organisation to achieve them is still to get off the ground. It is necessary right in the beginning to lay emphasis on professionalism of this corporation to enable it to provide timely and efficient services to industry so that it actually supplies cost effective, high quality goods. At present, it is not equipped to provide these services

The present organisation chart of SBDC is shown in Table 5.1.

It is recommended that SBDC be developed as an independent, autonomous corporation to provide single window direct assistance to the small units and also make recommendations to the Government on the basis of its experience in the field.

Table 5.1

SMALL BUSINESS DEVELOPMENT CORPORATION
 ORGANISATION CHART
 MINISTER FOR TRADE AND INDUSTRY



5.4.2 ACTIVITIES OF SBDC

5.4.2.1 Process upgradation, design and development assistance:

SBDC should coordinate its work in this area with SPATF. It is also possible that individual entrepreneurs develop new designs and other organisations may be working in the same field. SBDC could coordinate these activities and also provide a feedback to the design and development organisations on desired changes and modifications.

5.4.2.2 Quality Control and Testing Facilities

While Unitech could be developed as a quality control centre for the engineering industry as a whole, it will be necessary to develop quality consciousness amongst the small units and make available to them at nominal cost, quality control and material testing facilities. Small elementary units for providing this service will be necessary at suitable locations in each region. This could be done by SBDC.

5.4.2.3 Central Tool Room, Pattern Shop and Training Centre

The tools used even in the large machine shops are generally in very poor condition and there is considerable waste in the absence of tool brazing and tool grinding facilities in most workshops. Dies and moulds are imported and there is very little use of jigs and fixtures. SBDC could set up a central unit for:

a Dies and moulds including their repairs (Extension centres for only tool grinding could be considered)

b Upgradation of skills of employees in the small scale sector in various trades

The Centre would need to be equipped with:

- A workshop for repair and production of tools
- Training premises (including classrooms and a library)
- Small administrative block

It is recommended that UNIDO should provide technical assistance for preparation of a Feasibility Report for this facility.

5.4.2.4 Rural Workshops

Agriculture and rural economy is an important segment of national priorities. The trades most needed in rural areas are blacksmithy, tinsmithy and carpentry - mainly to provide services for production, maintenance and repair of agricultural tools and implements.

A network of small rural workshop set up by SBDC could provide these services. The items to be handled in the workshop could, for example, be:

Hoes, axes & machettes

Shafts for hoes, axe handles, etc.

Hand carts for carrying agricultural products

Hand operated water pumps

Household items

Knives

Tools for metal working artisans (eg chisels)

Tools for carpenters (eg plane blades)

These rural workshops would be linked to the central workshop which should provide the infrastructure required for them. This will include training, supply of spares and coordination of development of simple equipment for small holder farmers.

ILO could be approached for setting up multipurpose workshop training and research centres to provide rural artisans and micro industries, access to tools and equipment they cannot afford, to business and technological improvements and to a revolving fund.

5.4.2.5 Labour Productivity

SBDC should liaise with the Productivity Centres in other countries for coordinating training in different regions and for different trades.

5.4.2.6 Consultancy

SBDC should develop expertise to provide consultancy to the small scale units on workshop practices, cost control and other related issues.

5.4.2.7 Entrepreneur Development

Entrepreneur Development programmes and creating awareness amongst people in general and professionals, in particular, will be an important step towards promotion of the engineering sector. Special attention could be paid to PNG professionals returning

from other countries as also others who are unemployed.

5.4.2.8 Marketing Assistance & Subcontracting Exchange

Marketing is and will be a problem for small scale entrepreneurs and this will be particularly difficult in areas where medium and large scale units operate. Considering the present state of marketing skills, SBDC could plan to provide an institutional framework for an outlet for products of small units. This could cover consultancy as well as physical marketing. It could organise and coordinate purchases by the government and public sector agencies from the small scale sector. It could encourage the entrepreneurs by holding exhibitions and acting as an intermediary between buyers and sellers. It could work as a subcontracting exchange to promote the use of small scale units as ancillaries to the Government and large units in both public and private sectors.

5.4.2.9 Reservation of Items for Small Scale Industries

Reservation of some items for production only in the small scale sector may be considered in initial stages to protect it from competition from the larger units and serve as an incentive to small scale entrepreneurs. A watch on quality aspect will however be necessary.

5.4.2.10 Financial Assistance

In cooperation with PNGBC, commercial banks and other financial

institutions, the SBDC could serve as a conduit for financial assistance to SSIs. These could take the form of term loans for purchase of land, construction of factory sheds and purchase of machinery and plant for either new units or expansion of existing ones.

5.4.2.11 Supply of Machinery & Plant

This should cover supply of machinery on easy hire-purchase terms with special concessions if necessary to underdeveloped regions.

5.4.2.12 Supply of Raw Materials

With most of the engineering industry dependent on imported raw materials, SBDC could maintain inventories of materials for use by the small scale sector bulking the latter's requirements. This will result in economic purchases and cheaper supply to the actual users.

5.4.2.13 It should consider setting up Service Institutes at different locations which should have elementary machines and tool/ implement repair facilities for use by all sectors of economy. It should be supported by in this endeavour by the Government who can seek international assistance. This will go a long way in developing entrepreneurship in the country.

5.5 SOUTH PACIFIC APPROPRIATE TECHNOLOGY FOUNDATION MISSION

5.5.1 PRESENT STATUS

The South Pacific Appropriate Technology Foundation was established as a community-based organisation to promote national

development through appropriate technology in 1977. It is incorporated as an independent company and is governed by a Board of Trustees drawn from the government and private sector.

5.5.2 ACTIVITIES

5.5.2.1 SPATF's mission is to contribute to sustainable development of Papua New Guinea and improved welfare of its people by supporting and promoting transfer, diffusion and effective management of beneficial and environmentally sound technologies for community and industrial development in the small scale sector. Some of its activities related to the engineering industries are:

5.5.2.2 Scrap Metal (as Hanuacast)

Hanuacast was initiated in 1982 and is engaged in sorting and melting metal scrap which is sold as ingots to the Australian market. It is recommended that this should instead be processed into items like grills using traditional local designs.

5.5.2.3 Aluminium Foundry

This technology has been developed by the Kum Gie organisation in Lae to start as a base industry for spin-off manufacturing industries in the Northern, Highlands and Islands regions. There is no aluminium foundry servicing the Southern region. One unit combined with Hanuacast activities should be considered.

5.5.2.4 Water supply technologies

Based on the initial success of the Manua deep well water pump (40 are sold and in use in the Cape Rodney Agricultural Development Project), production at the Foundation Headquarters has begun. Design needs to be simplified and production technology improved. Extension training aspects in the use and maintenance of the pump will be critical.

5.5.2.5 Wokabout sawmill

The wokabout saw mill is one of the more well known success stories of the Foundation. Since its inception, over 600 units have been introduced with significant results in local employment generation. Its design however needs improvement. The frame needs strengthening, transmission needs to be simplified and made more robust and a more durable engine provided.

5.5.2.6 Micro Hydro Technology

Micro Hydro turbines for small scale electricity generation in remote areas have been followed up by the Foundation's affiliate organisation in Lae, the Appropriate Technology Development Institute. Technical consulting for the installation and maintenance of this technology has been implemented by ATDI. This is a very important area and a UNIDO Technical Assistance project for going into all aspects of design, manufacture and maintenance has been recommended in this report.

5.5.2.7 Staff

The current staff strength is shown in Table 5.2.

5.5.2.8 Workshop

The Foundation's extensive workshop facilities began as a simple R & D facility through a substantial assortment of infrequently used production machinery. The machines should be utilised for commercial production, though most of them need repairs. A key element will be tool engineering during production and training of skilled artisans.

In the past it has produced work such as wood laminate machinery prototype development for pedal powered food carts and water pump development. Presently, the workshop is involved in drum oven and water pump manufacture.

5.5.2.9 ATDI Liaison and Organisation Strengthening

The Appropriate Technology Development Institute (ATDI) was set up by SPATF and the University of Technology at Lae. Its functions under a Board of Directors largely staffed by University Faculty with ATDI representation.

ATDI needs improved management and direction and should follow a market driven development programme. Its services need to be marketed more effectively.

TABLE 5.2

SPATE - CURRENT STAFF

DIVISION/PROJECT	STAFF POSITION	
MANAGEMENT	Executive Director	1
	Management Advisor	1
FINANCE & ADMIN	Accounts Supervisor	1
	Accounts staff	2
	Secretaries	3
	Driver gen. assist	1
OPERATIONS		
Business Services	Adviser	1
Information & Training	Trainers	1
	Information Marketing	1
	(ATDI Staff in Lee)	1
Small Industries Promotion Centers		
Headquarters:		
Technical R&D (ATDI)	Sr Tech. Off. (Div. Mgr.)	1
	Turner	1
	Welders	2
	Mechanics	1
	Carpenter	1
	Assistant	1
	Industrial Engineer	1
Handicraft	Project Manager	1
	Assistants	3
Scrap Metal	Project Manager	1
	Assistants	3
	Driver	1
Leather Products	Project Manager	1
	Production staff	20
	Trainees	3
Cane weaving	Project Manager	1
	Trainers	3
	Assistants	2
	Trainees (Costs)	15
Wok. Sawmill	Technical Officer	1
Water Supply Technologies	Technical Officer	1
Micro Hydro Extension	Technical Officer	1

TOTAL ALL STAFF		83
SUB TOTAL ADMN STAFF	7	9
SUBTOTAL ADVISORY STAFF	...	1

130

The roles and strategies of both SPATF and ATDI need to be coordinated and made complementary to those of SBDC.

5.6 SPATF/SBDC SPECIAL LINKAGE

5.6.1 While SPATF's main mandate is to essentially provide direct technical services to small industry, SBDC focuses on coordination/provision of business services for the same clientele. The line between business and technical functions, particularly in the small scale sector is indistinct and involves some degree of overlap.

5.6.2 Management of both organisations have to ensure a structured and continuous interaction between the two agencies.

5.6.3 Their interaction can be easily visualised from their principal activities, given below:

SBDC	SPATF
Business Information	Technology Information and Demonstrations
Market/feasibility Studies	Technology Extn. & Training
Business Management Assistance	Tech. Research & Development
Business Registration/Incorporation	Pilot Production Assistance
Financial Assistance	

CHAPTER VI

MANPOWER PLANNING FOR ENGINEERING INDUSTRIES

6.1 The principal objective of manpower planning is to assess the gaps between anticipated demand and supply of various categories of skills and relating their analysis to facilities, present and future, for education and training. In the context of engineering goods, it applies to all technological disciplines involved in manufacture, of all types of goods and their infrastructure such as castings and forgings. There will be an overlap with operation and maintenance of these facilities. In view of the need for technical manpower, in the present and next decade, likely to arise ahead of availability of suitably-trained local personnel, from within national institutions or otherwise, manpower planning would have to be specifically considered under short term and long term measures.

6.2 Inputs to Manpower Planning

6.2.1 Manpower planning for PNG has to take into account its socio-economic setting. Planning for an industrial manpower has additionally to consider the impact of technologies. In both cases, it implies a systematic analysis of available manpower according to skills involved, shortages or surpluses in each at present, additional demand and availability and anticipated gaps between demand and supply. The forward and backward linkages of demand projections will connect them to capacity for commodities, services and infrastructural facilities on the one hand and

capabilities of training and educational institutions on the other. The starting point, of course, is a rational analysis of scientifically-derived demand and supply balance for engineering industries.

6.2.2 Effectiveness of any manpower plan will depend on the data on which it is based - both for future demand as well as present availability. Initial estimates can be made on the basis of relationship between output targets and manpower requirements in other countries. Quite apart from the fact that available data in this area is woefully inadequate, there seems to be hardly any work having been done to relate the crucial factor of productivity and influence on it, of mechanisation, quality control and supervisory and management skills.

6.2.3 In the engineering industries, it is essential to develop relationship between manpower demands at individual project level to those at the national level. Each project in developing countries, almost invariably does (and if not, easily can) make an estimate of quantity and quality of skills required for operation of its facilities. To these, have to be added an estimate of upgrading the manpower requirements by skills, likely to be caused by input of gradually higher levels of technology in the unorganised sector - namely, small scale, for manufacture and maintenance, in rural and urban areas.

6.2.4 In this context, the inputs for manpower are, inter alia,

(i) Future requirements, present availability and gaps in terms

of man hours required and available for different types and grades of skills; and

(ii) Basic education, technical education, vocational training and (iii) experience required and available for each type and grade of skill.

6.2.5 The main disciplines which could, for example, be considered for engineers and managers will be Industrial, Mechanical, Electrical, Electronic and Finance. These could be conceived as specialising in operational branches such as production, design, research, plant management, maintenance, EDP, marketing, materials management, plant engineering, quality control and operations research.

6.2.6 In the case of artisans, highly skilled, skilled or semi-skilled, demand and availability will have to be assessed in terms of processes of manufacture and trades involved eg fitters, machinists, forge and foundrymen, carpenters, welders, etc. Demand for unskilled artisans will be derived from it.

6.2.7 It is important that manpower planning is conceived as a part of an integrated system and dependable, accurate linkages developed to suit different conditions.

6.3 FORMULATING A PLAN

6.3.1 The success or otherwise of a plan will depend on the accuracy of the data used, involvement of relevant agencies including plant designers, national planners for industrial

sector and manpower, their experience and knowledge of skills required for manufacture of engineering goods and their infrastructure and concerned educational and training institutions. A possible framework is to obtain future demands from the industry in terms of codes developed for engineering goods, from existing as well as new units, analyse them and add to them the likely demands of the small scale sector. Valuable data could be obtained from agencies for development of small scale industries from other developing countries, fed to relevant national bodies for education and training to enable them to plan for timely action to cover the gap. It will be necessary to keep the exercise as dynamic, to enable it to take into account changes in plans, priorities, technologies and plant sizes. It will also be necessary to involve agencies connected with analysis and promotion of productivity so that impact of anticipated levels of productivity in the context of gradually-increasing level of complexity of manufacturing technologies on demands for skills can be taken into account. Future demands will also be related to wage systems and working hours and, therefore, will need to be coordinated with national workers' bodies.

6.3.2 Use of Industry Codes for Manpower Planning

6.3.2.1 UNIDO have recommended adoption of a planning process based on classification & codification of capital goods and industries developed by the author of this Report in Turkey (1979-84). The codes evolved in this planning process can be easily linked to quantitative and qualitative requirements of

engineers and workers - and the fact that the methodology can provide arithmetic totals in terms of weights, values and numbers, enables it to be dynamically used either for national planning or regional cooperation in terms of education and training of manpower demands for this sector. It quickly provides the basis of continuous updating and avoids the need (universal in most developing countries) for periodic, fresh demand studies, saving considerable money and manpower.

6.3.2.2 It is felt that UNIDO can play a very important role in assisting PNG in manpower planning by collecting, analysing and disseminating relevant data on relationship between outputs and managerial, engineering and artisan skills, under its socio-economic and environmental conditions in organised and small scale sectors. For example, these could conceivably be done using 8 digit codes for castings and forgings - by adding to them additional digits for codes to represent indices of complexity.

These codes are shown at Annexure VIII, IX & X.

CHAPTER VII

INSTITUTIONAL ISSUES

7.1 Governmental institutions that are directly concerned with the engineering industry are briefly described below.

7.1.1 DEPARTMENT OF TRADE AND INDUSTRY

This is the key agency for formulation, coordination and monitoring of policies. The actual implementation is carried out by various statutory bodies.

7.1.2 INVESTMENT PROMOTION AUTHORITY

This is a major implementing agency of the Government to promote and manage foreign and domestic investments for existing and proposed enterprises. This corporation has taken over the previous activities of NIDA which is being wound up. It aims to provide information to the investors in the country and overseas, encourage and facilitate investment by existing investors, obtain necessary licences, compliances and approvals as well as to facilitate the introduction of investors to each other. The most critical aspect of these activities is going to be dependable and timely databank which will assist the IPA to undertake these activities successfully and efficiently.

7.1.3 INDUSTRY ASSISTANCE BOARD (IAB)

This Board is proposed to be set up to advise the government

on policy instruments. These will include the level of protection to be given to the manufacturing industries including imposition or removal of tariffs on goods imported into PNG.

7.1.4 INDUSTRIAL CENTRES DEVELOPMENT CORPORATION

This is responsible for construction of a 22 hectare industrial centre in Lae. This industrial centre has so far no detailed plans and no priorities have yet been determined either for or other activities that may be located in the centre. No buildings or sheds have come up. In fact it is only at ground levelling stage. A layout plan of the centre is at Annexure XII.

7.1.5 SMALL BUSINESS DEVELOPMENT CORPORATION (SBDC)

This is yet another organisation being set up by the government for advice on policies to promote small businesses and to implement them, besides operating a business information service & providing support services to small businesses. (SBDC has been dealt with in details in Chapter V on Small Scale Industries).

7.1.6 NATIONAL INSTITUTE OF STANDARDS AND INDUSTRIAL TECHNOLOGY (NISIT)

The Government proposes to establish a National Institute of Standards & Industrial Technology i.e. NISIT under an ADB Finance Programme. Its main functions will be to establish and coordinate a standards system, and inter alia, to maintain, improve and disseminate standards, develop and promote implementation of

technical standards, support secondary level laboratories, develop measurement and calibration technology, offer consultancy services and training facilities on metrology, quality control and standardisation, and establish a national information centre for technical information.

7.1.7 COOPERATIVE SOCIETIES

There are 416 registered cooperative organisations in the country but there is no participation by them in engineering industries.

7.1.8 SOUTH PACIFIC APPROPRIATE TECHNOLOGY FOUNDATION (SPATF)

SPATF was established to promote development of appropriate technologies, for viable and sustainable development in the country. The primary objectives of SPATF are to research and develop tools, machines and procedures, collect & disseminate information on appropriate technology, develop delivery and support systems for utilization of appropriate technologies, identify and introduce technologies for import substitution, and commercialize suitable appropriate technologies. It operates on Appropriate Technology Development Institute (ATDI) in Lae. Another functional unit of the organisation is a manufacturing unit called Village Equipment & Supply also based in Lae. SPATF has also been dealt with in detail in Chapter V on Small Scale Industries.

7.1.9 It is recommended that a study should be carried out to :

(i) avoid duplication of effort,

(ii) promote professionalisation of institutions in the context of their aims and objectives,

(iii) ensure cost effectiveness of their operations,

(iv) monitor their effectiveness,

7.2 FINANCIAL INSTITUTIONS

7.2.1 Investment Corporation of PNG

This was set up in 1971 to promote national participation in equity investment in foreign companies operating in PNG through an Investment Corporation Fund. Its role however as development of local industry particularly engineering industry is concerned, has been minimal.

7.2.2 Agricultural Bank of PNG

This is primarily to lend to agricultural sector.

7.2.3 Bank of PNG

This is the country's central bank and performs the normal functions of a central monitoring authority, regulating the activities of commercial banks.

7.2.4 Commercial Banks

There are six banks including the Government owned PNG Corporation, four of which are of Australian origin. One of their objectives is corporate financing but their role in providing both equity capital and working capital to engineering sector has been very limited.

7.2.5 Merchant Banks

There are three merchant banks expected to deal with corporate entities. These are expected to deal in loans, guarantees providing project financing and advisory functions. It appears that they are likely to deal mainly with large business enterprises which are foreign owned and controlled. They have very little role to play at present in the engineering industry.

7.2.6 Finance Companies

There are 5-6 such companies including PNGBC owned Naun Dawan Finance Limited and nationally owned Credit Corporation. There was no evidence of their involvement in engineering industry.

7.2.7 It is felt that it will help the engineering industry considerably if Department of Industry sets up a single window for providing all approvals that are necessary, as well as financial help. It could help entrepreneurs to make loan applications, assist them in getting finance, technology or giving them information available on technology available within the country and also possible technologies which could be imported. They could be advised on sources of imported technology

and also how to operate and manage business. One possible vehicle could be SBDC for small businesses and Investment Corporation of PNG for the medium and large scale business.

It will be for the Government to ensure that set ups for technological and financial services, in these two organisations, are professionally organised. They should be staffed by qualified engineers for dealing with all technological issues and qualified experts for dealing with financial aspects. It would be advisable for them to use a task force approach, so that persons with engineering and finance disciplines, can get together and resolve all problems which may be presented to the institution by the intending entrepreneurs.

7.3 INDUSTRY ASSOCIATIONS

7.3.1 METAL TRADES INDUSTRY ASSOCIATION

7.3.1.1 The Metal Trades Industry Association of PNG was formed in 1988 from a unified group of local businesses actively involved in the metal fabrication, processing and contracting industries.

The Association membership of 14 corporations employs thousands of Papua New Guineans in manufacturing operations throughout the country.

Its objective is to bring together this diverse group of metalworking companies in order to promote and encourage the fabrication of metal products onshore utilising skilled Papua New Guinean labour.

The Association offers a comprehensive range of local support to organisations which may be considering establishment or development of emergency activities in Papua New Guinea.

7.3.2 CHAMBER OF COMMERCE AND INDUSTRY

This is an apex body of trade and industry in the country and professional, as well provincial chambers of commerce and industry are its members. Regional chambers' Presidents and executives of the national body are almost entirely expatriates. The list is at Annexure XI. The Chamber protects the interests of private sector in general and operates a trade information service also.

7.3.3 SOCIETY OF PROFESSIONAL ENGINEERS

The membership of this body is open to all engineers, engineering disciplines -- mechanical, chemical, electrical, civil etc. The academic qualifications acceptable for graduate membership are PNG University Technology Engineering degree or equivalent. It has adopted a code of ethics which is to international standards. The society has now 520 registered members. Its association however with engineering industry is almost nil.

7.3.4 ASSOCIATION OF CONSULTING ENGINEERS

The association is almost entirely made up of civil engineers and has little to do with engineering industry.

7.3.5 LIKBA (LIKLIK BISNIMANMERI ASSOCIATION)

This was inaugurated in 1984 for the purpose of representing small business operators, mostly informal sector, to assist them to overcome business constraints. Its task is to develop skills of entrepreneurs. Its membership is around 73 and its members are mostly involved in retail stores, canteens, running PMVs, fishing, small construction, building and maintenance, trade stores, repair shops and petrol stations. No engineering unit is a member of the association and it appears that there is no effort to promote this vital resource on the national scene by this association. The association will need to develop its professional background if it has to be of any assistance to the small scale engineering sector.

7.4 CONSULTATIONS WITH THE PRIVATE SECTOR

In mid 1990, the Government established a Regulations Advisory Committee which is intended to recommend to the Government, the areas of private sector involvement. The Government is also considering establishment of a National and Industrial Forum to be headed by the Minister of Trade and Industry, to deal with all matters relating to private sector investments. In view of the importance of the engineering sector to national economy, it is suggested that a regular item on its agenda should be the removal of constraints both Governmental and otherwise, coming in the way of setting up new efficient units and expansion of existing ones in the engineering sector.

7.5 INTERNATIONAL COOPERATION

7.5.1 FOREIGN AID PROGRAMMES

At the moment there are various bilateral as well as International Financial Institutions programmes for aiding development of Trade & Industry in PNG. There is a strong case for integration of aid programmes in order to optimise the benefits of resources being spent as well as achieve saving of time. A very small set up in the Department of Trade and Industry could oversee all coordination of all programmes which are meant for trade and industry so that they are complementary in approach and effect.

CHAPTER VIII

RECOMMENDATIONS

1. STRENGTHS OF THE ENGINEERING INDUSTRY WHICH SHOULD BE EXPLOITED
 - 1.1 RELATED TO GOVERNMENT INITIATIVE
 - 1.1.1 A strong macro economic structure.
 - 1.1.2 Market-oriented policies
 - 1.1.3 Availability of good work force through vocational training schemes.
 - 1.2 RELATED TO INDUSTRY INITIATIVE
 - 1.2.1 Availability of basic disciplines for computerisation.
 - 1.2.2 Association with Australian companies for back-up support and technology.
 - 1.2.3 Availability of good equipment for structural and sheet metal work.

2. WEAKNESSES WHICH SHOULD BE REMOVED

2.1 THOSE NEEDING GOVERNMENT INITIATIVE

2.1.1 Lack of attention to important parameters affecting competitiveness of the engineering industry --

(i) High cost wage structure -- Wages to be related to productivity at international levels.

(ii) High cost of infrastructure, both power and telecommunication to be brought down to international levels by improving efficiency.

(iii) High cost of inventories since all raw materials are imported to be brought down by introducing zero tariff and bulking of imported raw material.

(iv) Provincial taxes where applied to be removed.

(v) Excise tax to be removed.

(vi) Exemptions from the normal duty structure to the Government contractors and mining companies which work as disincentive to the engineering industry to be discontinued.

(vii) Small market not amenable to mass production (with exception of meshes, ⁷barbed **147** wire and nails) to be expanded

through exports which can be done only if cost and quality are competitive.

2.1.2 Non-availability of market data which should be collected, collated and disseminated.

2.1.3 Inadequate priority for engineering sector to be remedied by the PNG Government.

2.1.4 Lack of interest in the engineering industry by financial institutions which should be prompted to increase their involvement in this sector.

2.2 THOSE REQUIRING INITIATIVE BY INDUSTRY

2.2.1 Lack of modern industrial culture for competitiveness which should be improved to international standards through technical assistance from UNIDO and other agencies.

(i) Non-application of principles of industrial engineering (work norms, efficient layouts, safety precautions).

(ii) Lack of knowledge of standards, particularly for welding and machining.

(iii) Non-availability of material testing facilities for raw materials and welds. (This may be set up either by MTIA or UNITECH).

(iv) Workshop practices reflected particularly in the quality of welding and machining.

(v) General ignorance of 'Total Quality Management' concepts.

(vi) Lack of application of value analysis.

2.3 THOSE REQUIRING JOINT INITIATIVE BY GOVERNMENT AND INDUSTRY

2.3.1 Non-availability of a Central Tool Room for manufacture of tools, dies, jigs and fixtures. (This may be set up under the auspices of MTIA or SBDC).

2.3.2 Inadequate human resource development

i) Training of local managers which should be undertaken with international technical assistance.

ii) Apprenticeship scheme (More interaction between university and the sponsoring units in the industry is needed).

3. OPPORTUNITIES TO BE GRASPED

3.1 Value added for rich mineral and forest resources through a timebound plan for each sector & sub-sector.

3.2 Castings for operational spares for mining and cement industry by upgrading existing facilities and setting up new ones.

- i) Grinding balls for SAG and ball mills.
- ii) Liners for ball mills.
- iii) Other spares. (Assistance by UNIDO for preparation of a feasibility report for foundry forge units has been recommended).

It has also been recommended that a permanent exhibition of spares required by the mining industry should be set up at Lae or Port Moresby.

3.3 Small hydraulic turbines upto 100 KW. (A new unit may be set up).

3.4 Construction material for the mining industry and housing sector. (Existing units should be encouraged for this).

3.5 Use of UNITECH facilities for :

- i) mass manufacture
- ii) material testing

(A full-fledged material testing laboratory has been recommended).

3.6 Improved utilisation of the Army Workshop at Port Moresby by making all equipment operational providing staff to run them

them and marketing its capacities and capabilities.

3.7 Full utilisation of the existing shipbuilding facilities at Port Moresby by banning off-shore work which can be taken up locally.

3.8 Urgent development of Small Business Development Corporation into an autonomous, efficient professional unit for taking initiatives, e.g.

i) one window assistance for meeting all needs of entrepreneurs.

ii) setting up of small service centres in different locations.

3.9 Increase in refining capacity for gold, silver and copper and downstream processing of copper.

3.10 Setting up small engineering units by SBDC & other related institutions. (Carpentry, smithy and elementary machines at district/large village levels).

3.11 Updating of feasibility studies conducted in 1981 for :

i) builders' hardwares

ii) hand tools

iii) electrical appliances

- iv) fans
- v) cocks, valves & taps
- vi) automotive spares
- vii) domestic utensils (expansion of existing facilities)
- viii) bus and truck bodies (expansion of existing facilities)
- ix) construction materials (sanitary products).

UNIDO's assistance may be sought for this.

4. THREATS WHICH NEED TO BE FACED & REMOVED

4.1 Law and order situation

4.2 Foreign companies on account of

i) application of the duty regime in actual practice which acts as a disincentive to be rationalised.

ii) up-to-date technologies used by neighbouring countries other than Australia to be also used for upgrading technologies in PNG.

5. SMALL BUSINESS DEVELOPMENT CORPORATION

i) The activities of Small Business Development Corporation should be expanded to provide complete assistance in the fields of technology, management and finances.

ii) It should develop specific plans for consultancy, entrepreneurship development as well as marketing assistance to the small-scale industries.

iii) The Government may consider reservation of some items for small-scale industries.

iv) SBDC should also consider institutionalising supply of machinery and plant and raw materials to small-scale industries.

machinery and plant and raw materials to small-scale industries.

6. **SOUTH-PACIFIC APPROPRIATE TECHNOLOGY FOUNDATION (SPATF)**

i) SFATF activities should be expanded and modernised with more professional input for its management as well as to support its design efforts.

ii) Liaison between Appropriate Technology Development Institute (ATDI) and SPATF needs improvement.

iii) Linkage between SPATF and SBDC needs to be crystallised to avoid duplication of efforts and to ensure their complementarity in promoting small-scale industries.

7. **MANPOWER PLANNING**

i) An organised effort is required by the Government with the assistance of industry to develop a specific plan for managerial, supervisory and artisan skills related to anticipated technologies as well as outputs of different branches of the engineering sector. This will obviously require to be coordinated with the requirements of other sectors of the economy.

8. Regular periodic interaction between the Government and MTIA as well as other associations representing the engineering industry is recommended.

9. The institutions meant to assist the engineering industry,

including Investment Promotion Authority, Industrial Assistance Board, Industrial Centres Development Corporation, Small Business Development Corporation, SPATF need to be provided with more professionals with well-defined job descriptions.

10. The Development of Trade and Industry should have a senior person as an adviser to the Ministry to advise it on all policy issues concerning engineering industry including planning & implementing steps to be taken to improve its performance and contribution to the national economy.

11. The financial institutions may be asked by the Government to have a relook at priorities so that they provide both equity capital as well as working capital to the engineering industry.

12. A small cell in the Department of Trade and Industry to oversee coordination of bilateral and international assistance programme for trade and industry is recommended to ensure that they are complementary in approach and effect.

13. It is recommended that UNIDO may provide the following assistance :

(The list is in order of priority)

Item	Anticipated Man/Months	Discipline of Consultant/Adviser
A. Preparation of feasibility reports for		

- | | | | |
|-----|---|---------------|---|
| A.1 | A Foundry Forge
(principally to cater for the requirements of the mining industry) | 3 man-months | Industrial engineer |
| A.2 | A Tool Room Material Testing Laboratory | 3 man-months | Industrial engineer |
| A.3 | Design and manufacturing technologies for micro hydro-electric power projects | 4 man-months | Design Engineer
(1 man-month)
Industrial engineer
(3 man-months) |
| B | Adviser to the Ministry of Trade and Industry to render advice on all policy issues, assist in development of SBDC, implement a plan for development of local management skills, adoption of an industrial culture by the engineering industry. | 24 man-months | Industrial engineer |

- C. Updating of old feasibility reports carried out in 1981 5 man-months Industrial engineer
- D. Preparation of a master plan for engineering industry, including better utilisation of existing assets, setting up of small service units and a manpower plan. 5 man-months Industrial

PROFORMA USED FOR DATA COLLECTION.

NAME OF COMPANY

ADDRESS

NAME OF CHIEF EXECUTIVE

NAME & DESIGNATION OF PERSON FILLING
UP PROFORMA

ANY INFORMATION/DATA CONSIDERED
RELEVANT BUT NOT APPEARING IN
PROFORMAS A & AA

A6	WAGES (AVERAGE)	Direct	Indirect (eg housing, medical facilities)
	Managers	-	
	Supervisors	-	
	Skilled Artisans	-	
	Unskilled	-	

A7 SALES

Local
Export
Total

A8	ITEMS EXPORTED	Qty	Value
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i)

ii)

iii)

A9 Standards followed

National
International

AA. INDUSTRY - SITE CHECKS

- AA 1. Productivity of Labour**
 - Norms of Productivity
 - International comparisons

- AA 2. Maintenance Practices**

- AA 3. Workshop Practices**

- AA 4. TQM and Standardisation**

- AA 5. Basis of Productivity/capacity calculations**

- AA 6. Cost of Raw Material/ Availability**

- AA 7. Availability of spares**

- AA 8. Capital Requirements**

- AA 9. Management system (PPC, Costing, WIP)**

B. ISSUES TO BE DISCUSSED - INDUSTRY

B1 Difficulties in setting up industries/expanding capacity

Licensing
 Financing - foreign exchange
 - local currency
 Technology Data
 Incentives
 Economic Environment.

B2 Difficulties in technology upgradation

Technology data
 Incentives
 Local Skills

B3-1 Usefulness of Government Incentives

	Very Useful	Somewhat Useful	Not Useful	Don't Know
1. Feasibility Contribution Scheme	1	2	3	4
2. Wages Subsidy Scheme	1	2	3	4
3. Least Developed Areas Scheme	1	2	3	4
4. Interest Rate Subsidy	1	2	3	4
5. Credit Guarantee Scheme	1	2	3	4
6. Tax Concession Schemes	1	2	3	4
7. Duty Drawback Scheme	1	2	3	4
8. Others (specify: _____)	1	2	3	4

B3-2 Reasons for Lack of Usefulness:

	Not Readily Available	Too Much Paperwork	Not Well Publicized	Other
1. Feasibility Contribution Scheme	1	2	3	4
2. Wages Subsidy Scheme	1	2	3	4
3. Least Developed Areas Scheme	1	2	3	4
4. Interest Rate Subsidy	1	2	3	4
5. Credit Guarantee Scheme	1	2	3	4
6. Tax Concession Schemes	1	2	3	4
7. Duty Drawback Scheme	1	2	3	4
8. Others (specify: _____)	1	2	3	4

B4 Fiscal & Policy factors affecting performance:

		Positively	No Effect	Negatively	Don't Know	
1.	Input prices	1	2	3	4	_____
2.	Input availability	1	2	3	4	_____
3.	Interest rates	1	2	3	4	_____
4.	Exchange rate	1	2	3	4	_____
5.	Wage Costs	1	2	3	4	_____
6.	Taxes	1	2	3	4	_____
7.	Output Prices	1	2	3	4	_____
8.	Government Price Controls	1	2	3	4	_____
9.	Credit availability	1	2	3	4	_____
10.	Government pronouncements/actions	1	2	3	4	_____
11.	Other regulations (work permits, import licenses, etc)	1	2	3	4	_____
12.	Other (specify): _____	1	2	3	4	_____

B5 Infrastructural Factors affect by efficiency?

	Negative Effect	Positive Effect	No Effect	Not Apply	
1. Access to credit	1	2	3	4	—
2. Access to inputs	1	2	3	4	—
3. Access to land	1	2	3	4	—
4. Access to skilled/ supervisory labour	1	2	3	4	—
5. Access to services (refuse coll., electricity, etc)	1	2	3	4	—
6. Access to water	1	2	3	4	—
7. Access to transport	1	2	3	4	—
8. Price of trans- port	1	2	3	4	—
9. Price of elect- tricity	1	2	3	4	—
10. Reliability of electricity	1	2	3	4	—
11. Availability of communication services (post, tel.)	1	2	3	4	—
12. Quality of communications	1	2	3	4	—
13. Quality of water services	1	2	3	4	—
14. Availability of suitable buildings	1	2	3	4	—
15. Access to suit- able equipment	1	2	3	4	—
16. Access to spare parts	1	2	3	4	—

- B6 Export Promotion Measures**
- B7 Market Data - Foreign/Local (Availability, Timeliness, Quality)**
- B8 Industry Classification**
- B9 Standardisation and TQM**
- B10 Consultancy**
- B11 Promotion of Industry Associations**
- B12 Proforma for data collection by individual units and site discussion**

C. ENGINEERING INDUSTRY - ISSUES TO BE DISCUSSED - GOVERNMENT

1. Definition of small scale industries
2. Technology Planning - Automation
3. HRD Planning
 - Managers
 - Supervisors
 - Skilled Artisans
4. Privatisation of Industry - Role of Public Sector
5. Export Promotion Measures - Incentives
6. Data Management
 - Use of ISIC
 - computerisation
7. Protection of Local Industry
8. Investment Promotion
 - Foreign
 - Local (inc. Differentiation in Import Regions for Trade & Industry)
9. Place of Engg Industries in Industrial Priorities
10. Industries Policy
 - Licensing
 - Import Substitution
 - Import Regimes for Raw Materials
 - Spares
 - Finished Goods
 - (including duties and barred items)
 - small scale industries.
11. Regional Development Plans.
12. Infrastructural Assistance (eg Tool and die shops)
13. Analysis of foreign aided projects if any.
14. Brain Drain
15. Integrating of assistance from international agencies.
16. National Institute of Standard Industries Technology
17. Labour Policy



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

DP/PNG/86/002/11-59

POST TITLE **Engineering industry sub-sector consultant**

DURATION 1.5 m/m

DATE REQUIRED as soon as possible

DUTY STATION Port Moresby, Papua New Guinea (PNG). The mission will include one week in Lae, PNG, and one week in Queensland, Australia, respectively.

PURPOSE OF PROJECT To prepare a profile and assessment of the PNG engineering industry sub-sector and to recommend measures to promote the development of this sub-sector.

For the purpose of this study, the engineering industry sub-sector is defined as activities included in Division 38 of the ISIC.

DUTIES The assignment will be an integrated part of DP/PNG/86/002 and will be financed under this project.

The expert will work under the general guidance of the Chief Technical Advisor (CTA). In his work, the expert will liaise closely with the staff of the Department of Trade and Industry and with the metal trades industry Association.

The specific requirements are as follows:

1. To collect and compile data on key parameters of the engineering industry sub-sector based on official guidelines and information gathered from 10-12 leading firms. Key parameters are to include types of products, value of output, cost structure, value added,

employment, exports, imports, level of technology, skills level of workforce, legislative and regulatory framework and other factors relevant to a comprehensive assessment of the sub-sector.

2. To assess the sub-sector in respect of productivity as well as present and potential international competitiveness.

3. To identify sources of inefficiency and constraints for efficient operations.

4. To identify and analyze Government policies and practices hampering the development of the sub-sector, such as National and Provincial Governments' duty free imports, provincial sales taxes, legislation in respect of manufacturers' excise tax, Government procurement practices etc.

5. To make a preliminary assessment of the potential for exports by the sub-sector to Australia, primarily Queensland.

6. To assess the potential for development of the sub-sector in terms of (i) increased market penetration for existing products in major domestic market segments, viz. the mineral sector, the National and Provincial Government sectors, the construction industry and the private non-mineral sector; (ii) exports to Australia; and (iii) new products.

7. To propose measures to facilitate the capturing of identified potentials for the development of the sub-sector, including areas such as policies, legislation, tariffs, procurement practices and various support schemes.

8. To prepare an end-of-mission report.

QUALIFICATIONS

The candidate should have a university degree in economics, business administration, mechanical engineering or equivalent. At least 15 years experience, primarily from engineering industries in managerial positions, including experience from developing countries is required. Fluency in English is required.

BACKGROUND INFORMATION

The engineering industrial sub-sector accounts for about 15% of the manufacturing value added in PNG, equivalent to about 1.5% of GNP.

Total output amounts to about Kina 100 million (about US\$ 105 million). About 4,000 persons are employed in the sub-sector.

Exports are negligible, whereas imports of fabricated metal products (excluding passenger cars, motor vehicles and aircraft) amount to about Kina 400 million, equivalent to over 30% of total imports.

Fabricated metal products already manufactured in PNG include a variety of goods such as fabricated and welded structural products, steel metal fabrication, aluminium doors and window frames, metal containers, bridges, nuts and bolts/nails, fencing, reinforcing mesh, roofing iron, gabions, trailers etc. Leading firms are located in Port Moresby and Lae. The ten major establishments account for about 60% of the total output of the sub-sector.

Over the last decade the engineering industry sub-sector has been slowly contracting. In spite of the fact that the sub-sector, based on anecdotal evidence, has a potential to perform at a fairly satisfactory level of efficiency, it is generally felt that the operations are hampered by various constraints in the environment. International comparisons also reveal that the sub-sector is less than half the size of what is normally found in countries at the same stage of development as PNG. This indicates, given the appropriate environment, that the engineering industry sub-sector may offer a potential of increased production in excess of Kina 100 million per year and increased employment.

For the above reasons, the Government wishes to carry out the proposed engineering industry sub-sector study.

APPENDIX III

List of Persons Met

Government

Mr. Robert Igara,
Secretary
Department of Trade and Industry

Mr. Moshe Semadar,
Chief Trade Adviser
Department of Trade and Industry

Mr. Taua Magaru
Assistant National Statistician
Economic Statistics Division
National Statistical Office

Mr. Kila L Boto
Superintendent, Purchasing Supply Contract
Department of Works

Mr. David Gole
Architect
First Assitant Secretary (Technical Services),
Department of Works

Mr. Kialou M. Angat,
Executive Director,
National Standards Council

Mr. Alois G. Lavu,
Managing Director,
Small Business Development Corporation

Mr. Taunao Vai,
Project/Investment Analyst
Small Business Development Corporation

Mr. Nigel R. Agonia,
Executive Director
National Investment and Development Authority

Mr. Dennis Ellingson,
Chief Economist/General Manager,
ADS (PNG) Pty. Ltd.

UNDP

Mr. Siba Kumar Das
Resident Representative

Mr. Mikael Brenning,
Senior Industrial Planner,
UNIDO Project for Industrial Promotion Assistance

Mr. Edward J. Chesky,
Chesky Associates International
Economic Consultants

Mr. Jette Jensen,
Area Programme Officer
Department for Programme and Project Development

Mr. Brian Haigh,
Field Security Officer

ADB

Mr. Peter S. Boone,
Senior International Economist,
International Policy Center,
SRI International

Mr. Thomas A. Boyce
Principal Consultant
International Consulting Center,
SRI International

Mr. Hidekazu Tanaka,
Principal Consultant,
Japan Development Institute,
Engineering Consulting Firms Association

Mr. Lionel Chin,
Research Analyst,
SRI International

Industry

Mr. Steve Tuckey
Branch Manager (Lae)
Arcon Engineering Limited

Mr. Alan Fleay
General Manager,
Atlas Steel

Mr. John Cross
Manager
Atlas Steel

Mr. Philip C. Webster
General Manager,
BHP Lysaght Papua New Guinea Pty. Ltd.

Mr. John Shuttleson,
Regional Manager,
BHP Lysaght Papua New Guinea Pty. Ltd.

Mr. John Gerber,
General Manager
BHP Titan Pty. Ltd.

Mr. Zac Crowe,
Branch Manager, Port Moresby
BHP Titan Pty. Ltd.

Mr. A. R. (Ross) Humphries,
Manager/Director,
Barlow Industries Pty. Ltd.

Mr. Barry Sonter,
Manager
Barlow Industries Pty. Ltd.

Mr. Jayant H. Modi,
Accountant
Barlow Industries Pty. Ltd.

Mr. Jim Duncan,
Director Development,
Boulderstone Hornibrook

Mr. Robert Foster
Workshop Manager,
Bishop Brothers Engineering Pty. Ltd.

Mr. Charles Nakau,
Manager
Development Engineering Services Pty. Ltd.

Mr. Justin Bragg,
General Manager,
Fletcher Manufacturing (PNG) Pty Ltd

Mr. Mark Tracy-Inglis,
Regional Manager,
Fletcher Morobe Construction Pty. Ltd

Mr. Joe Booth,
Branch Manager,
Hastings Deering

Mr. David E. C. Lee,
General Manager,
Hornibrook NGI Pty. Ltd.

Mr. Robin Pink,
Area Manager
Hornibrook NGI Pty. Ltd.

Mr. Peter Rees,
Area Manager,
Hornibrook NGI Pty. Ltd.

Mr. Ross L. Bishop,
General Manger/Managing Director,
Huon Industries Pty. Ltd.
Maintenance Plumbing Pty. Ltd.

Mr. Dhiren Mehta,
Manager,
Kai Kai Cookware

Mr. George Sellar,
General Manager,
Lae Builders & Contractors Pty. Ltd.

Mr. Bob Hunter,
Managing Director/Owner
Morobe Engineering Pty. Ltd.

Mr. John Matthews,
Manager,
NC Freighters

Mr. Rob Walsham,
Ove Arup & Partners Pacific Pty. Ltd.

Mr. Ross James,
Master Mechanic, Mobile Mechanical,
Forgera Joint Venture,
Managers Placer (PNG) Pty. Ltd.

Mr. Andrew M Kauleni,
Executive Director,
South Pacific Appropriate Technology Foundation

Mr. Frank McQuoid,
Director,
Steel Industries Pty Ltd

Mr. Colin Weeds,
Branch Manager
TCA

Mr. Greg Anderson,
Executive Officer,
PNG Chamber of Mines and Petroleum

University

Prof. Nirwan Idrus,
Head of Department
Mechanical Engineering
University of Technology

Annexure I

Gross Domestic Product by Industrial Origin at Current Prices, 1983-91

(In Millions of Kina)

	1983	1984	1985	1986	1987	1988	1989	1990	1991 Est.
Agriculture, Forestry, & Fishing	700.0	857.1	818.5	828.0	852.4	924.0	856.6	868.1	933.3
Mining & Quarrying	225.1	139.5	239.2	329.8	490.0	609.5	352.7	409.7	644.3
Manufacturing	217.3	252.0	264.6	256.8	268.9	294.3	336.9	305.3	338.4
Electricity, Gas, & Water	31.4	37.8	38.0	40.0	43.6	46.1	49.0	51.3	57.5
Construction	123.7	111.1	94.1	103.7	101.8	133.2	161.3	159.3	218.8
Trade, Transport & Finance	400.3	423.8	456.8	462.0	495.2	522.4	543.1	522.7	583.0
Community and Social Services	358.2	375.1	408.6	431.1	460.0	484.6	543.4	554.3	578.7
Sub-Total	2056.0	2196.4	2319.8	2450.9	2711.9	3014.1	2843.0	2870.7	3354.0
Plus Import Duties	86.6	97.0	104.1	121.4	142.4	156.0	203.0	187.9	201.0
Gross Domestic Product	2142.6	2293.4	2423.9	2572.3	2854.3	3170.1	3046.0	3058.6	3555.0

Source : Data provided by PNG authorities.

Annexure II

Gross Domestic Product by Industrial Origin at Constant 1983 Prices, 1983-91

(In Millions of Kina)

	1983	1984	1985	1986	1987	1988	1989	1990	1991 Est.
Agriculture, Forestry, & Fishing	700.0	720.9	699.9	710.7	748.7	775.0	785.9	782.1	790.4
Mining & Quarrying	225.1	185.4	274.6	364.5	354.4	363.5	225.8	250.0	412.1
Manufacturing	217.3	235.8	242.4	220.4	222.3	230.9	250.3	213.9	217.1
Electricity, Gas, & Water	31.4	35.2	34.4	34.2	36.0	36.0	36.6	35.9	37.3
Construction	123.7	104.5	87.8	90.3	84.5	105.0	119.1	111.8	138.8
Trade, Transport & Finance	400.3	404.4	410.0	423.3	446.6	447.0	458.7	421.4	443.0
Community and Social Services	358.2	358.5	377.8	377.8	379.0	379.1	395.3	386.8	374.8
Sub-Total	2056.0	2044.7	2126.9	2221.2	2271.5	2336.5	2271.7	2201.9	2413.5
Plus Import Duties	86.6	90.2	93.4	103.3	117.3	121.8	151.7	131.3	131.3
Gross Domestic Product	2142.6	2134.9	2220.3	2324.5	2388.9	2458.4	2423.4	2333.2	2544.9

Source : Data provided by PNG authorities.

Annexure III

Volume of Major Exports by type of Product, 1983-91

(Thousand tonnes) a/

	1983	1984	1985	1986	1987	1988	1989	1990	1991 Est
Copper	181.1	163.3	168.6	181.4	209.7	222.4	208.8	196.5	232.0
Gold (Tonnes)	19.1	19.4	32.0	36.5	34.6	35.4	31.3	32.8	55.1
Coffee	52.5	49.4	40.6	53.1	64.8	44.8	85.0	54.6	50.0
Cocoa	26.3	34.1	30.9	31.9	34.4	37.1	46.6	33.9	34.0
Copra	78.7	93.5	103.5	93.0	84.1	76.8	60.7	55.0	35.0
Copra Oil	36.0	40.7	41.5	41.1	40.2	36.3	34.6	34.8	31.0
Fish Products	2.6	2.9	13.5	1.7	1.4	1.0	1.2	2.0	2.0
Palm Oil	77.9	129.9	123.8	129.0	97.3	102.6	131.7	142.7	165.0
Tea	6.8	7.3	6.6	5.3	5.6	5.8	5.4	5.4	5.8
Logs (000cm)	1019	1278	1141	1299	1450	1348	1293	1300	970
Rubber	2.7	3.4	5.4	5.0	3.7	4.5	3.6	2.3	2.4

Source : Data provided by PNG authorities and staff estimates.

a/ Unless otherwise Indicated.

Annexure IV

Mineral Production, 1984-90

	1984	1985	1986	1987	1988	1989	1990
BCL							
Gold (tonnes)	16	14	16	15	14	7	—
Copper ('000 tonnes)	164	175	179	178	166	69	—
Silver (tonnes)	44	46	50	51	48	21	—
Ok Tedi							
Gold (tonnes)	2	17	18	18	18	16	16
Copper ('000 tonnes)	—	—	—	36	51	132	186
Silver (tonnes)	1	6	6	10	20	30	25
Other							
Gold (tonnes)	—	—	—	—	—	5	17
Silver (tonnes)	—	—	—	—	—	39	81
Total							
Gold (tonnes)	18	31	35	32	32	28	33
Copper ('000 tonnes)	164	175	179	214	217	201	186
Silver (tonnes)	45	52	56	61	68	90	106

Source : Data provided by PNG authorities.



PUBLIC NOTICE

Bank Of Papua New Guinea

FINANCING FACILITY

FOR NATIONALLY OWNED SMALL TO MEDIUM

SIZED BUSINESS ENTERPRISES

On 15 August 1991, the Bank of Papua New Guinea launched a financing facility made available by the European Investment Bank to support the investment and development of nationally owned small to medium sized business enterprises.

The total amount for this facility is about K12 million of which 80 percent is borrowed funds for on-lending and 20 percent for equity financing.

After some initial delays, the facility is now operational and the first loan of K500,000 was advanced on 14 April 1992 to ANZ Banking Group (PNG) Limited for one of its clients.

Eligible business enterprises are encouraged to approach any of the approved financial institutions (see below) to see if they can qualify for funding from the facility.

1. To be eligible to borrow from the facility, beneficiaries must:—

(a) Be small to medium sized business enterprises which are wholly owned or have a minimum of fifty percent (50%) ownership by citizens of Papua New Guinea.

(b) Be involved in agro industry, manufacturing, transport, tourism, and small mining projects and other projects relating to these sectors.

(c) Be either:

- (i) establishing a new enterprise or investment.
- (ii) rehabilitating and/or expanding production capacity of existing businesses/investments.
- (iii) providing permanent working capital. Traditional asset financing (for example, purchase of second hand capital goods) can be allowed.

(d) Have the managerial and technical capacity to implement their project efficiently.

2. The Facility will not provide refinancing for existing debts or take-overs.

3. The Facility will not provide financing for real estate, housing financing, agricultural cultivation and commerce, i.e. wholesale and retail trading.

4. The amount of an advance to a single beneficiary is limited to a minimum of K60,000.00 and a maximum of K500,000.00

5. The duration of a loan is up to 12 years including an optional grace period of up to 3 years for principal repayments. The grace period will be determined by and be at the discretion of the approved participating financial institutions and the nature of the proposed project.

6. Advances by the financial Institutions to the beneficiaries will carry a fixed interest rate currently about 10 percent.

7. Up to 70 percent of the total project cost can be financed under the facility of which up to 50% is made up of borrowed funds and up to 20% is in the form of equity. The remaining 30% must be funded from the approved financial institutions (AFIs) and the borrowers own sources, the later comprising of at least 10% of the total project cost.

8. Eligible beneficiaries have the discretion to use both the borrowed funds and the equity facility together or use only the borrowed funds facility. This should be indicated in the relevant sections of the application forms provided. (see below - item 10).

All enterprises are encouraged to utilise the equity funding which are on highly preferential and concessional terms.

9. To apply for the funds under the facility, eligible beneficiaries should approach any of these approved financial institutions (AFIs).

Papua New Guinea Banking Corporation, Westpac Bank-PNG Ltd, ANZ Banking Group (PNG) Ltd, Bank of South Pacific Ltd, and Indosuez Niugini Bank Ltd, and Credit Corporation (PNG) Ltd, and Resources & Investment Finance Limited (RIFL).

10. Two (2) types of Application Forms have been distributed to these approved financial Institutions (AFIs).

- (i) For investments up to K150,000.00
- (ii) For investments of K150,000.00 and over.

Eligible beneficiaries should approach any of the branches of the approved financial institutions (AFIs) and obtain these application forms.

Eligible beneficiaries should provide all the details required on the appropriate application form (depending on the size of the required loan) and present the applicant forms to the approved financial institutions (AFIs) of his/her choice.

11. The approved financial institutions will appraise and evaluate the details in the Application Forms to assess the viability of the proposed project.

Sir Henry ToRobert, K.B.E.
Governor Bank of Papua New Guinea

The Structure of the Wood, Wood Products Sector by Size

Sector	No. of Est.		No. of Emp.		Wages/Salaries		Gross output		Gross Value		Capital	
	No.	%	No.	%	Value	%	Value	%	Value add	%	value	%
All establishments												
ISIC 3320												
Small establishments												
ISIC 3320												
Large establishments												
ISIC 3320												

Performance Indices in Wood, Wood Products and Plastics by size

Size	Small Establishments						Large Establishments						Total					
Sector	$\frac{GVA}{GO}$	$\frac{GO}{EMP}$	$\frac{K}{EMP}$	$\frac{GVA}{NO}$	$\frac{W}{EMP}$	$\frac{GVA \cdot W}{K}$	$\frac{GVA}{GO}$	$\frac{GO}{EMP}$	$\frac{K}{EMP}$	$\frac{GVA}{NO}$	$\frac{W}{EMP}$	$\frac{GVA \cdot W}{K}$	$\frac{GVA}{GO}$	$\frac{GO}{EMP}$	$\frac{K}{EMP}$	$\frac{GVA}{NO}$	$\frac{W}{EMP}$	$\frac{GVA \cdot W}{K}$
3320																		
3560																		

Classification of Steel Castings

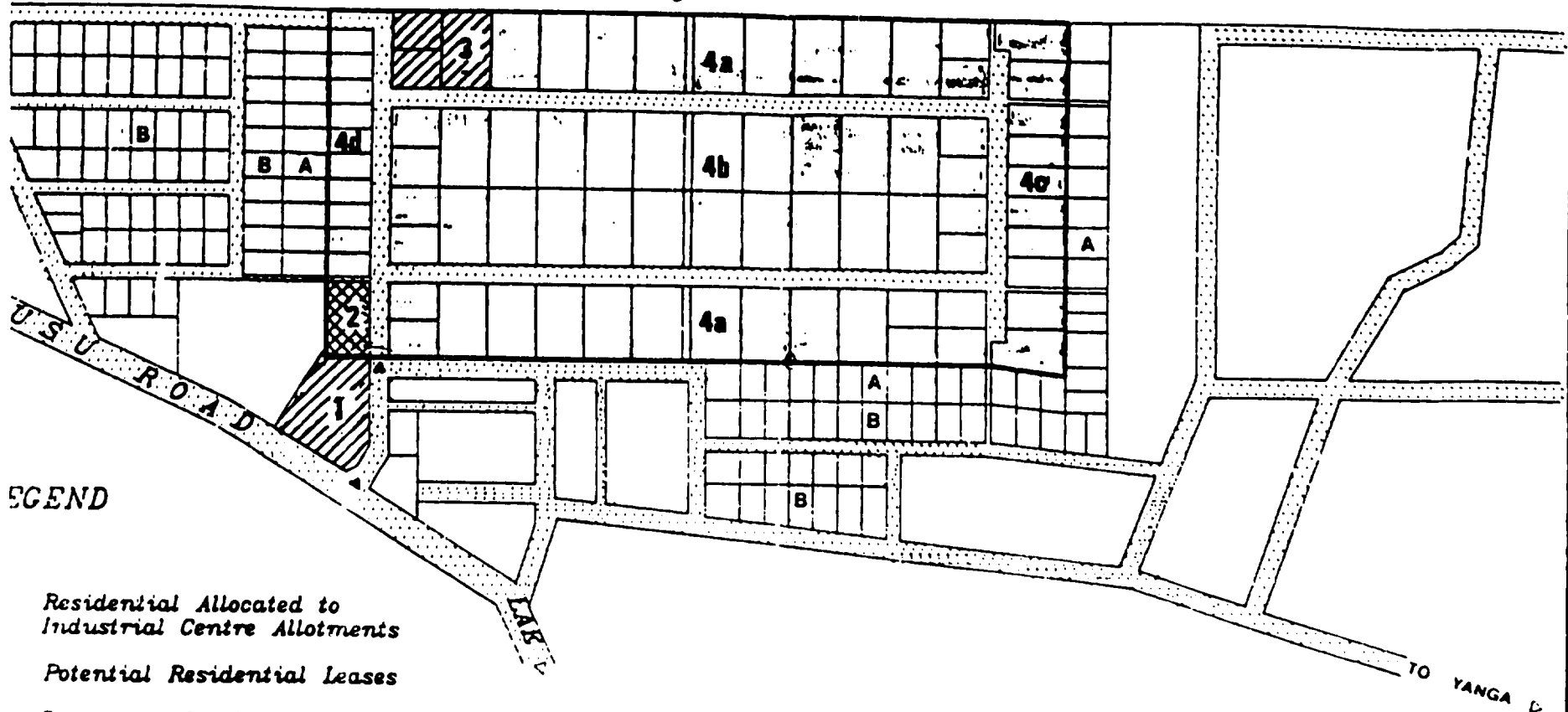
SITC Group	Material		Criteria 1 Weight		Criteria 2 Complexity	
67941	1.	Carbon steels	1.	Less than 3 kg.	1.	Shaped, highly complex
	2.	Alloy steels	2.	3-10 kg	2.	Shaped, medium and low complexity
	3.	High alloy steels	3.	10-40 kg	3.	Centrifugal
			4.	40-100 kg.	4.	Others
			5.	100-500 kg.		
			6.	500-1000 kg.		
			7.	1000-5000 kg.		
			8.	5000-10000 kg.		
			9.	More than 10000 kg.		

Classification of Iron Castings

SITC Group	Material		Criteria 1		Criteria 2	
			Weight		Complexity	
67941	1.	Chilled	1.	Less than 3 kg.	1.	Shaped, highly complex
	2.	Grey Iron	2.	3-10 kg	2.	Shaped, medium and low complexity
	3.	Alloyed Iron	3.	10-40 kg	3.	Centrifugal
	4.	Malleable	4.	40-100 kg.	4.	Others
	5.	Spheroidal	5.	100-500 kg.		
			6.	500-1000 kg.		
			7.	1000-5000 kg.		
			8.	5000-10000 kg.		
			9.	More than 10000 kg.		

Classification of Steel Forgings

SITC Group	Material		Criteria 1 Weight		Criteria 2 Complexity	
67941	1.	Carbon steels	1.	Less than 3 kg.	1.	Open forging
	2.	Alloy steels	2.	3-10 kg	2.	Die forging
	3.	High alloy steels	3.	10-40 kg		
			4.	40-100 kg.		
			5.	100-500 kg.		
			6.	500-1000 kg.		
			7.	1000-5000 kg.		
			8.	5000-10000 kg.		
			9.	More than 10000 kg.		

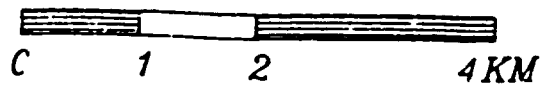


LEGEND

- Residential Allocated to Industrial Centre Allotments*
- Potential Residential Leases*
- Customary Land*
- Management Centre*
- Nursery Units Secured Compound*
- Standard Units - Advanced Floor Space*
- Industrial Allotments of Varying Sizes*

MALAHANG INDUSTRIAL CENTRE PLAN

Scale: 1:5000

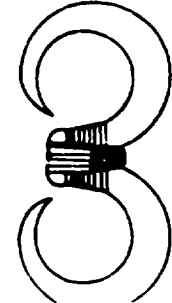


DATE SET ALIGNED	
DATE SET LAYOUT	
JOB NO. 1	
SPR. NO. 2	

PROJECT: MALAHANG INDUSTRIAL CENTRE, LAS
184 PROPOSED MALAHANG INDUSTRIAL CENTRE PLAN
 CLIENT: DEPARTMENT OF TRADE AND INDUSTRY, BANGKOK

KUM-GIT CONSULT

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LIST OF PROJECTS WHICH WAS STUDIED IN
1981 AND HAVE TO BE UPDATED

1. Construction Materials - Structural Components
2. Construction Materials - Sanitary Products
3. Hand Tools
4. Builders' Hardware
5. Electric Appliances
6. Pillar Taps and Cocks
7. Domestic Steel and Aluminium Utensils
8. Dry Cell Batteries