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Indonesia Forest Products Sector and Trade Profile

1985

G. F. Schreuder and R. P. Vlosky

CENTER FOR INTERNATIONAL TRADE IN FOREST PRODUCTS
UNIVERSITY OF WASHINGTON
COLLEGE OF FOREST RESOURCES AR-10
SEATTLE, WASHINGTON 98195

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G. F. Schreuder
R. P. Vlosky

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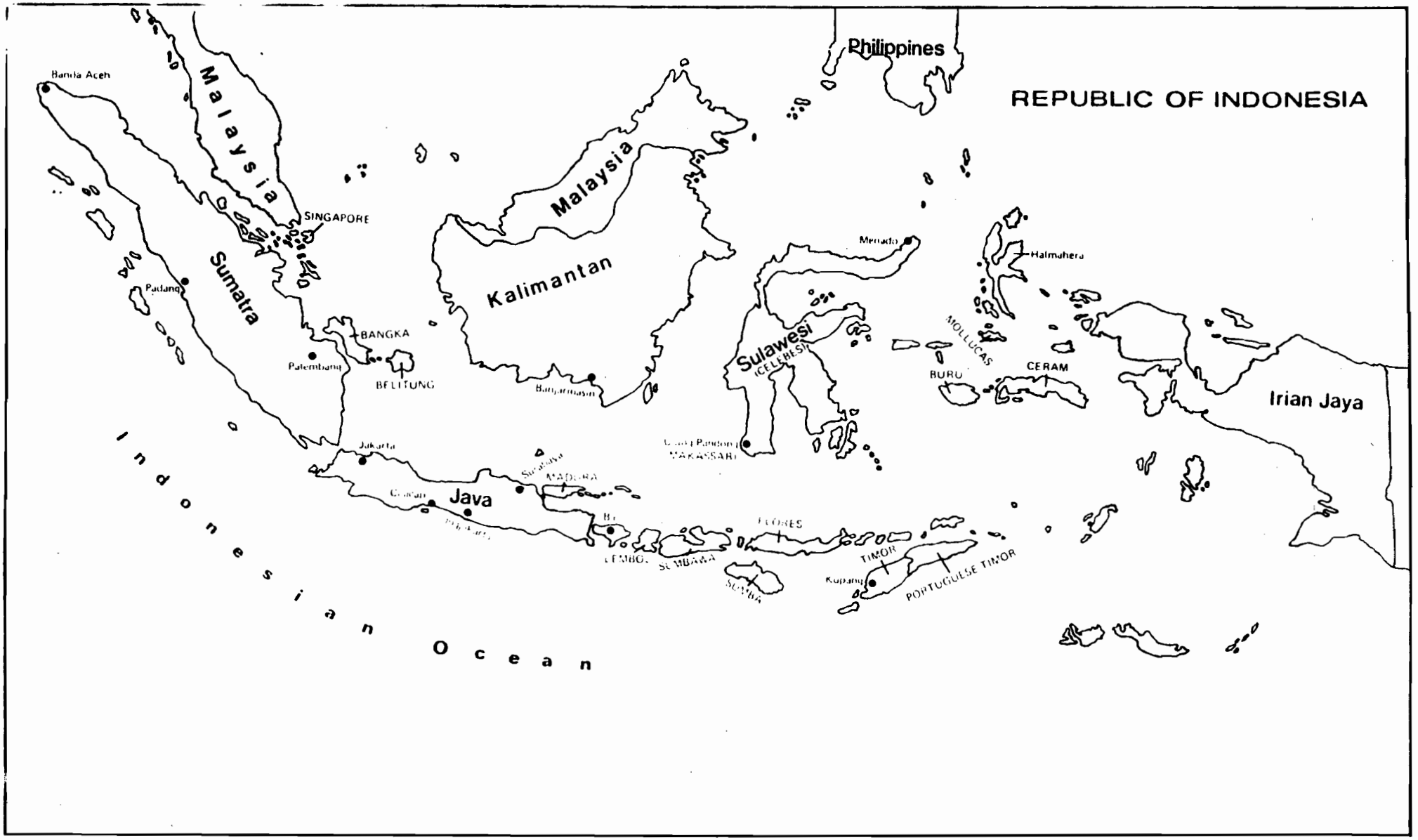
1. INTRODUCTION

Indonesia is one of the most important hardwood producing countries in the world of terms of actual production and future potential. Presently, Indonesia has the largest existing supply of tropical hardwood logs in the world. The country's past role of being the world's largest exporter of hardwood logs was negated in 1980 with the advent of a ban on log exports which has been fully implemented as of January, 1985. Questions have arisen concerning the effects on global forest products trade this policy action will have.

Timber production has gone from being insignificant as an export earner to becoming ranked third after oil and natural gas. From 1971 to 1980, the export of hardwood logs accounted for 72.6 percent of total timber production; lumber accounted for 2.7 percent; plywood and veneer accounted for 0.4 percent (Liang, 1983). Other products such as chips, pulp, fuelwood, and furniture contributed very little to total export earnings.

In conjunction with the log export ban, Indonesia has increased capacity of it's plywood industry at a truly astounding pace. It is questionable whether Indonesia will be able to sustain the planned growth of this industry given its resource base and availability of required capital.

This paper will examine issues such as these and their ramifications on Indonesia's contribution to supply and demand of forest products. Future trends and their impacts on global wood products flows will also be examined.


REPUBLIC OF INDONESIA
Philippines
Malaysia
Malaysia
Banda Aceh
SINGAPORE
Sumatra
Padang
Kalimantan
BANGKA
Palembang
BELITUNG
Banjarmasin
Menado
Halmahera
Sulawesi
(CELEBES)
MOLUCCAS
BURU
CERAM
Irian Jaya
Jakarta
Java
MADURA
FLORES
TIMOR
Kupang
PORTUGUESE TIMOR
SUMBAWA
SUMBA
Indonesian Ocean

2. COUNTRY DATA

2.1 BASIC COUNTRY DATA

Land Area: 1,904,600 km^2

Population: 150 million (mid-1981 estimate)

Population Centers- '000 (1971) census)

Jakarta.....6,503

Surabaja.....1.556

Bandung.....1,202

Semarang..... 646

Medan..... 635

Palembang..... 583

Climate: Tropical

Languages: Bahasa Indonesia; many other languages and dialects

Currency: 1 Rupiah (Rp)=100 sen

Exchange rate (1983) 1 dollar U.S.=978 Rp (now freely fluctuating)

Indonesia consists of 13,667 islands spanning 5,110 km from east to west and 1,888 km from north to south. Of the total land area of nearly 2 million km^2, approximately 143 million hectares are forested (Ross, 1983).

There are more than 64 million hectares of production forest on which forest operations are presently employed. An average of 25 to 30 million m^3 of wood material is harvested annually.

2.2 DEMOGRAPHIC DATA

Indonesia has over 150 million people, making it the fifth most populous nation in the world. The island of Java alone accounts for over

60 percent of the population, although it has only 7 percent of the land area of the country. Java has three cities of over 1 million inhabitants, including the capital, Jakarta, with nearly 7 million. Population has been growing since 1961 at an average annual rate of 2.3%; consistently higher than government demographers' estimates of 2.0% (Quarterly Economic Review of Indonesia, 1982)(see Table 1)(Figure 1).

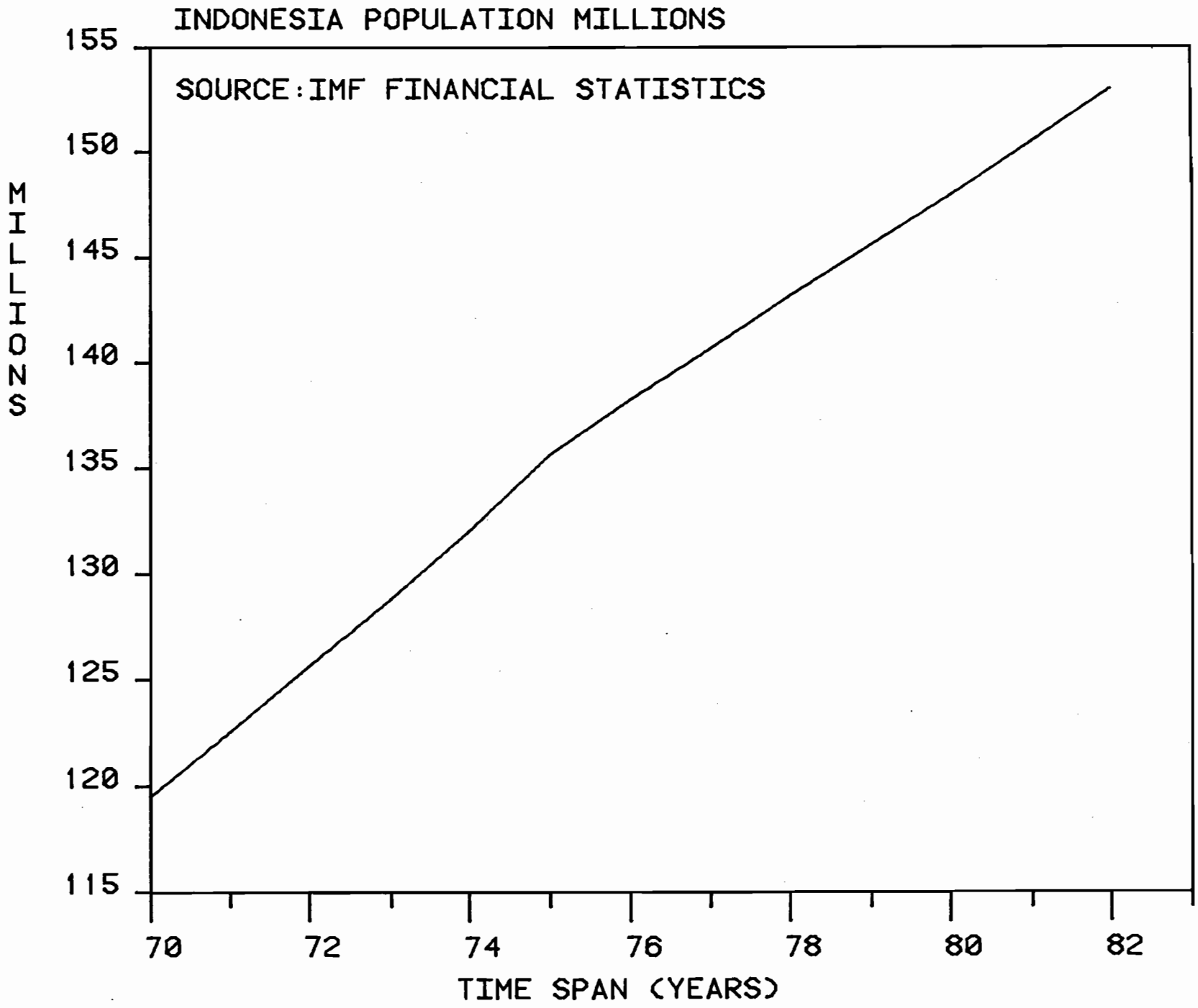
Table 1.

Region	Area ('000 km^2)	Population (millions)	% growth (annual 1971-80)
Java/Madura	132	91.3	2.02
Sumatra	474	28.0	3.32
Sulawesi	189	10.4	2.22
Kalimantan	539	6.7	2.96
Bali	5.6	2.5	1.77
Irian Jaya	422	1.2	2.67
Other Islands	157	7.3	c
Total	1,191	147.4	2.32

Source: Bank Indonesia
c. Figure not comparable

The majority of the population lives in rural areas; for the past 50 years the rural percentage figure has hovered around 90%. The government sponsored transmigration policy has attempted to open up outer islands for resettlement and to provide a basic infrastructure in these areas. During the third five-year-plan an estimated 513,000 people per year are reported to have resettled. This accounted for only 0.6 percent of the 1980 population of Java, which indicates the inadequacy of this policy to alleviate the population pressures on this island (Quarterly Economic Review of Indonesia, Annual Supplement, 1984).

Figure 1


INDONESIA POPULATION MILLIONS
SOURCE:IMF FINANCIAL STATISTICS
MILLIONS
155
150
145
140
135
130
125
120
115
70
72
74
76
78
80
82
TIME SPAN (YEARS)

Gross national Product (GNP) is rising, and Indonesia's per capita income has risen from 27 dollars in 1970 to 377 dollars in 1982 (International Monetary Fund). Official estimates put real gross domestic product (GDP) growth at 3%, while the World Bank puts the figure at 4.5% (very close to Chase's 1984 estimate of 4.4%, and higher than Wharton's 3.8% estimate)(Quarterly Economic Review of Indonesia, No. 1, 1984)(see Figure 2).

2.3 CURRENCY

Until 1966, Indonesia had a complex multiple currency exchange rate system. In 1970, it adopted a unitary exchange rate system and from 1971 until mid-November 1978 the exchange rate was fixed at 415 rupiahs to 1 U.S. dollar. On November 15, 1978 the government devalued the rupiah to 625 rupiahs/U.S. dollar. During the seventies the official monetary policy called for a fixed exchange rate policy which in essence meant that the rupiah was pegged to the dollar. However, in 1981, the rupiah was allowed to depreciate against the dollar. After over a year of public speculation, on March 30, 1983, the government devalued the rupiah by 38%. Since that time exchange rates are adjusted periodically in line with the financial markets (see Figure 3).

2.4 IMPORTS/EXPORTS

Tables 2, 3, and 4 show the origins of GDP, the main exports in 1982, and the main origins of imports in 1982. Noteworthy is that forest products are second in value only to the petroleum and natural gas. Finally, agriculture and forestry account for about 30% of GDP.

Figure 2

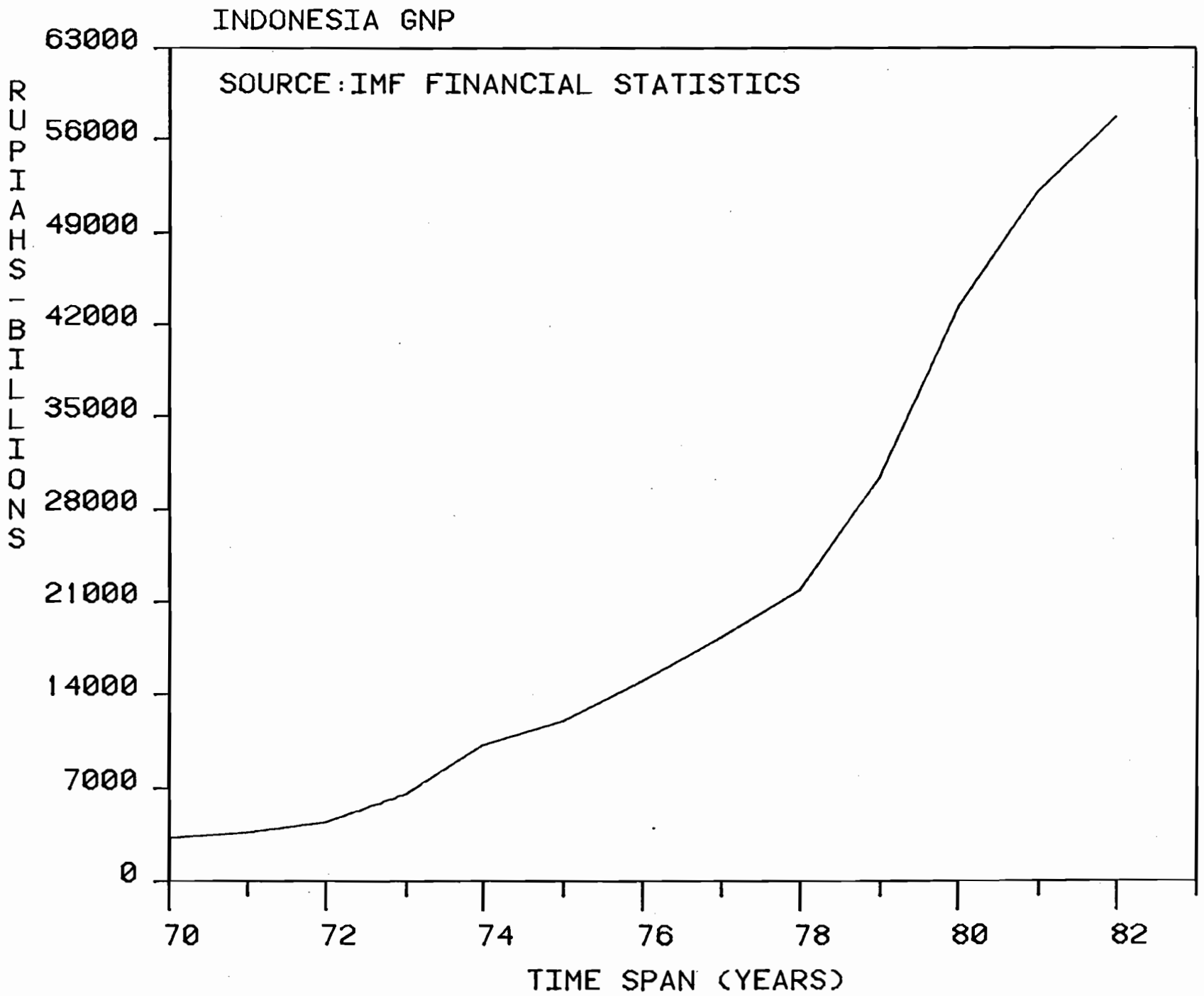

INDONESIA GNP
SOURCE:IMF FINANCIAL STATISTICS
RUPIAHS-BILLIONS
63000
56000
49000
42000
35000
28000
21000
14000
7000
0
70
72
74
76
78
80
82
TIME SPAN (YEARS)

Figure 3

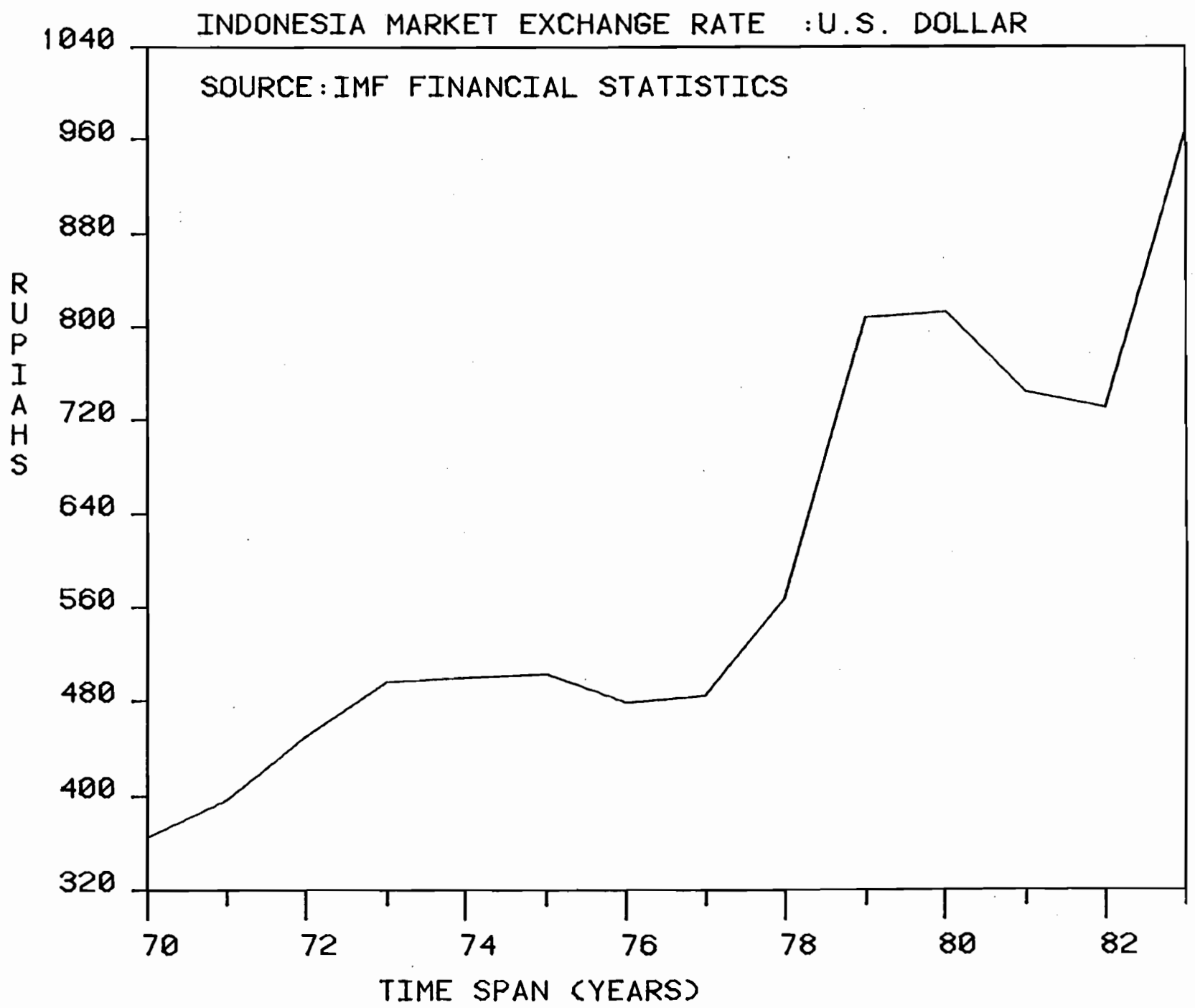

INDONESIA MARKET EXCHANGE RATE :U.S. DOLLAR
SOURCE:IMF FINANCIAL STATISTICS
1040
960
880
800
720
640
560
480
400
320
RUPIAHS
70
72
74
76
78
80
82
TIME SPAN (YEARS)

Table 2. Main Origins of Gross Domestic Products, 1982 (% of total at constant 1973 prices).

Agriculture, Forestry	29.8
Mining	7.6
Manufacturing	15.4
Construction	6.1
Transport & Communications	5.8
Trade, Finance, & other services	26.0
Public Administration & defense	9.3
Total	100.0

Source: Quarterly Economic Review of Indonesia No. 2, 1984.

Table 3. Main Exports, 1982 ($ million)

Crude petroleum & LNG	18,366
Forestry products	966
Rubber	602
Coffee	342
Tin	379
Total, incl. others	22,293

Source: Quarterly Economic Review of Indonesia No. 2, 1984.

Table 4. Main Origins of Imports, 1982 (% of total)

Japan	26
Singapore	17
U.S.A.	14
W. German	7
U.K.	3
Total, incl others	100

Source: Quarterly Economic Review of Indonesia No. 2, 1984.

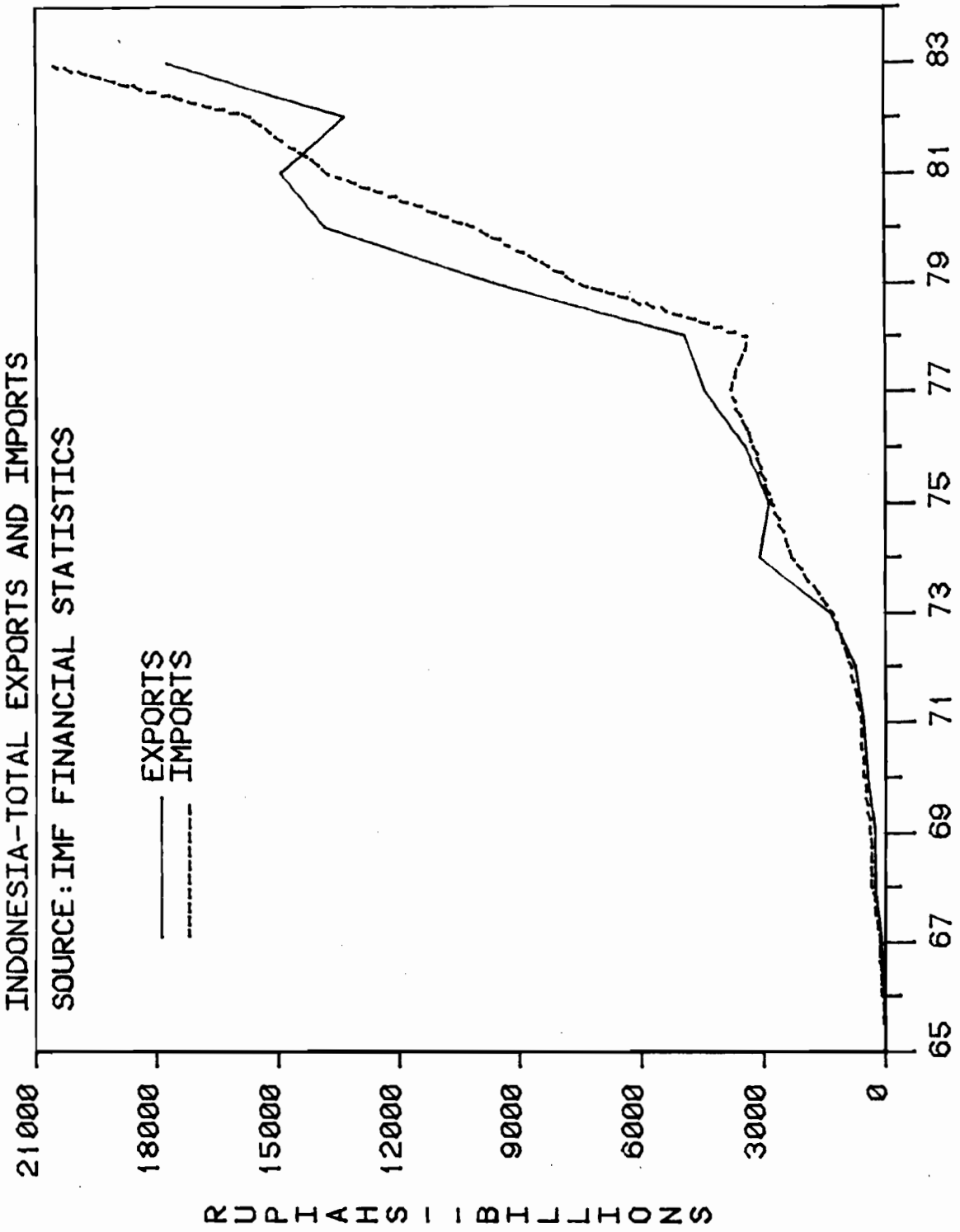

INDONESIA-TOTAL EXPORTS AND IMPORTS
SOURCE:IMF FINANCIAL STATISTICS
EXPORTS
IMPORTS
RUPIAHS - - BILLIONS
21000
18000
15000
12000
9000
6000
3000
0
65
67
69
71
73
75
77
79
81
83
TIME SPAN (YEARS)

Figure 4

Figure 4 shows that Indonesia has run a surplus of exports over imports since 1970, but that since 1981 its positive balance of payments was reversed (International Monetary Fund, Financial Statistics). Its foreign debt (at about 20 billion dollars in 1983) is considered to be small to moderate and Indonesia is generally considered to be a good financial risk as far as default is concerned. (This, of course, does not mean that the foreign investment climate is necessarily favorable.)

In summary, Indonesia has a rapidly increasing population, but its GNP and GDP seem to be outstripping population growth. While its currency has been repeatedly devalued, its overall financial situation is not desperate. Forest products are an important component of the export mix, second only to energy products.

3. INDONESIA'S FOREST RESOURCES

3.1 Forest Base by Region

About 60% of the land area in Indonesia is covered with forests comprising about 113 million hectares. The forests are presently classified into 4 classes, two of which devoted to timber production (permanent and limited production forests)(see Table 5). About 50% of these 2 classes are located in Kalimantan and lower Java (see table 5).

The predominant forest type is rain forest comprising 82.3 million hectares with the remaining areas being peat forest, swamp forest, mangrove forest, and secondary forests (see Table 6).

The existing forest stock of production forest (available for commercial harvesting) ranges from 50 to 150 m^3 per hectare for all commercial species combined. On the basis of a 35 year cutting cycle and

Table 5. Function classification of Indonesian forest by province.

No.	Province	Total Land (ha)	Production Forest (ha)	Wild Life and Nature Conservation (ha)	Limited Production Forest (ha)	Definite Production Forest (ha)	Total Definite Forest		Conversion Forest and Other Function	
							Area (ha)	Percent of Total Land	Area (ha)	Percent of Total Land
1	Aceh*	5539000	1051406	666800	1375704	188350	3282260	59.26	2256740	40.74
2	North Sumatera*	7168068	1391129.25	253884.62	1349886.15	531548	3526448.02	49.20	3641519.98	50.80
3	Riau	9456160	741842	267160	2764170	2772890	6546062	69.22	2910098	30.78
4	West Sumatera*	4229730	1206624	599694	539707	596844	2942869	69.58	1286861	30.42
5	Jambi*	5100000	1147500	493000	974000	--	2614500	51.--	248500	49.--
6	South Sumatera*	10925400	732000	728000	298000	2421000	4179000	38.30	6746400	61.70
7	Bengkulu	1978870	513747	264180	265990	23048	1066965	53.92	911905	46.08
8	Lampung*	32000000	315000	356000	--	573000	1244000	38.90	1956000	61.10
9	West Kalimantan*	14680700	2047125	13366750	2988750	1323000	7695625	52.43	6985075	47.57
10	Central Kalimantan*	15300000	800000	729419	3400000	6068000	10997419	71.88	4302581	28.12
11	East Kalimantan*	21144000	3643860	1968600	4826100	513060	15951620	75.44	5192380	24.56
12	South Kalimantan*	3700000	432736	66015	200625	1330424	2029800	54.85	1670200	45.15
13	West Nusa Tenggara*	2015315	481681.80	134759.20	222711.50	224120.70	106327.20	52.76	952041.80	47.24
14	East Nusa Tenggara*	4738920	677601	131890	398954	278147	1486592	31.37	2352328	68.63
15	North Sulawesi	2578600	283765	386168	664045	303869	1617847	62.74	960753	37.26
16	Central Sulawesi	6803300	1156920	616740	1364140	1028000	4165800	61.20	2637500	38.80
17	South Sulawesi*	6292650	2004070	189639	993082	164998	3351789	53.27	2940861	46.73
18	South Sulawesi*	3814000	420795	273359.20	827115	668890.80	2190160	57.42	1623840	42.58
19	Maluku	8572800	1550356	440995.76	2075642.44	1029929	5096923.20	59.45	3475876.80	40.55
20	Irian Jaya*	41066000	8648510	8311820	4732350	7123480	28816160	70.17	12249840	29.83
21	East Timor*	1460937.50	435277	38850	170484	45211	689822	47.22	771115.50	52.78
22	Jakarta	59000	--	--	--	1000	1000	1.69	58000	98.30
23	West Java	4630000	299000	213000	--	--	512000	11.05	4118000	88.95
24	Yogyakarta	317000	--	--	--	15000	15000	4.74	302000	95.26
25	Central Java	3421000	21000	3000	--	600000	624000	18.25	2797000	81.75
26	East Java	4792000	259000	178000	--	807000	1244000	25.96	3548000	74.04
27	Bali*	563286	84029.30	31951	5650.44	3853.06	125513.80	22.28	437772.20	77.72
	Indonesia	193546736.50	30345004.35	18679674.78	30417106.53	33634662.56	113076448.22	58.42	80470288.28	41.58

Source: Directorate General of Forestry - 1981
Note: Based on committed forest utilization
* committed

Table 6. Area and percentage of forest by type (1984)

	Million hectares	% of total
Mangrove	927	0.8
Swamp	12,032	10.6
Coastal	927	0.8
Peat	1,391	1.2
Rain	82,320	72.8
Deciduous	927	0.8
Secondary/Idle	14,553	12.9
Total	113,077	100.0

Source: Directorate General of Forestry

average increment of 1 m^3/ha/yr, total available production averages 61 million m^3/year (Liang, 1983).

Table 7 portrays the dominant importance of Indonesia in the South Sea wood production. It has about 7 to 8 times as large an area of the important Dipterocarp forest as the Philippines or Malaysia and its actual wood production dominates.

Presently, Kalimantan is the most important province in Indonesia in terms of forest production. However, the resource base in this region is being depleted at a rapid rate; the same is true for Sumatra. This leaves Irian Jaya as Indonesia's principal area for potential development of forest resources (World Wood, Oct. 1983).

Meranti is the most important hardwood timber species found in Indonesia because of its great demand in world markets and its abundance and accessibility (see Table 8). About 60-70 percent of the growing stock of commercial timber species in Indonesia is of the genus Shorea, of which meranti is a dominant species. This is the case for Kalimantan, Sumatra, and Maluku whereas the predominant species in Sulawesi are Hopea and Vatica, and the most frequently found species in Irian Jaya are non-Dipterocarps including Intsia spp. and Eugenia spp.

Table 7. The Estimated Production of South Sea Logs (Indonesia, Malaysia and Philippines)

COUNTRIES	TOTAL FOREST AREA	TROPICAL RAIN FOREST & MONSOON FOREST TYPES		PRODUCTION FOREST (Dipterocarp Dominant)		AVERAGE STANDING STOCK	ANNUAL ALLOWABLE CUT	ANNUAL[x)] PRODUCTION
	(million ha)	(million ha)	%total forest	(million ha)	%total	m^3/ha	(million m^3)	(million m^3)
Indonesia	113.0	90.0	79.6	64.0	56.6	80	61	26.0
Philippines	14.0	12.0	85.7	8.0	57.1	90-150	16.8	10.0
Malaysia	23.5	20.5	87.2	9.3	39.6	NA	23.5	20.0
TOTAL:	150.5	122.5	81.4	81.3	54.0	--	101.3	56.0

Remarks: x) Based on actual production in 1973. During 1970-1980 period the production of Indonesia and Malaysia is around this figure. After 1975 the actual production of the Philippines decreased considerably, and by 1980 the production achieved is 6.4 million m^3.

Source:
1. Directorate General of Forestry - Indonesia (1981)
2. Tekjokoesoemo, R.H. et. al. (1974). Symposium on Research and Marketing of Southeast Asian Timber and Timber Products.
3. Ismail, H.A. (1974). , pp. 15-21. ---------- do ----------
4. Viado, J., et. al., (1974). , pp. 24-37 ---------- do ----------
5. Vademecum Kahutanan Indonesia (1976).

Table 8. Timber Export by Species (1971; 1977-79)

Species	1971	1977	1978	1979*
1. Meranti	6,749	10,725	13,251	5,589
2. Ramin	1,120	861	541	--
3. Agathis	310	377	256	198
4. Teak	35	35	30	--
5. Pulai Group	26	986	549	157
6. Kapur/Keruing	92	1,703	2,133	1,216
7. Others	2,429	3,247	2,298	1,733
Total	10,761	17,934	19,058	8,893

* January to June 1979 (estimates only)

Source: Directorate General of Forestry and Central Bureau of Statistics

The present situation concerning teak production requires additional comment. Only three countries in the world - Indonesia, Thailand and Burma - produce teak in any measurable quantity. Teak wood's international popularity as construction and furniture manufacturing material has created a large and constant demand in Indonesia for export of this beautiful hardwood. But teak sawn timber is also greatly in demand domestically in Indonesia, so much so in fact that only ten percent of the country's annual production of 500,000 cubic meters (m3) was exported in 1980. Of this amount nearly half is exported to Europe, but the percentage declines annually.

Efforts by manufacturers to employ substitutes for teak have not been widely accepted and most teak importers harbor suspicion about newer, untested woods. In an effort to keep up with high demand, logging companies on Java (Indonesia's largest source of teak) have relentlessly felled trees and paid little heed to the conservation standards recommended by the Indonesian government. As a result, the already critical teak situation on Java continues to worsen. The State-owned forestry corporation Perhutani is in charge of Indonesia's 850,000 hectares of teak plantations in Java. One of their responsibilities is to ensure that the teak reserves are protected from over-cutting by other logging companies or the local populace.

Softwoods are produced in Indonesia but on a much smaller scale than hardwoods. The main commercial species is Agathis which is found actually inter-mixed with hardwoods or (rarely) in pure stands on Kalimantan, Sulawesi, and Irian Jaya; the other important softwood is Pinus merkusii, found primarily in Sumatra.

3.2 FUTURE TIMBER RESOURCE SUPPLY

3.2.1 Present Yields

The Indonesian forest industry currently relies upon natural regeneration of the forest after harvesting for future resource supplies. There are no true silvicultural treatments applied to the natural forest before, during or after harvesting operations. In essence, the harvesting system employes a diameter limited cut, ( ) 50 cm d.b.R. Generally, a cutting cycle of 35 years is used; this is considered to be ample time for the natural forest to regenerate. The goal is to attain a sustained yield through natural regeneration/cutting cycles (Ross, 1983).

Some present concerns related to harvesting are the typically low yields that result from the current system, the utilization of so few of the thousands of available species of timber, and the high percentage of waste associated with the logging process.

Tables 8 and 9 show government projections of log supply to industry (Apkindo, 1984).

3.2.2 Yield Improvement

Ross (1983) has identified five primary ways to improve forest productivity in Indonesia. They are:

a. Reduce logging damage.

b. Control logging to increase number of species harvested

c. Increase utilization of forest residues

d. Silvicultural treatment application to encourage growth and species selection

e. Reduction of cutting cycles length to increase canopy opening to stimulate growth.

The first three of these will be examined in more detail:

Table 9. The annually potential harvest can be broken down according to the wood species and areas outside Java as follows:

THE ANNUALLY POTENTIAL HARVEST OF LOGS

Islands	Forest Area (ha)	ANNUALLY POTENTIAL HARVEST (x 1.000 m^3)						
		Carp.	Non Dip.	Agathis	Ramin	Bakau	Others	Total
Sumatera	13,438,000	10,500	5,587	295	163	396	575	17.565
Kalimantan	10,365,150	31,500	7,314	286	1,494	368	965	41,927
Sulawesi	4,267,000	629	3,394	409	--	--	141	4,527
Eastern Indonesia	13,157,500	3,438	8,638	283	--	479	198	13,036
Total	41,227,750	46,067	24,933	1,273	1,657	1,243	1,879	77,100

Table 10. The actual supply of logs which is relevant to the expected growth of the sawmilling and plywood industry therefore is projected in the following table.

PROJECTION OF LOGS SUPPLY FOR THE INDUSTRY

YEAR	TO SAWMILLS	TO PLYWOOD MILLS	FOR EXPORT	TOTAL
1981/1982	13,600	4,140	5,600	23,340
1982/1983	15,000	4,140	4,500	23,640
1983/1984	16,400	5,980	3,000	25,380
1984/1985	18,400	8,970	1,500	28,870
1985/1986	20,400	11,500	--	31,900
1986/1987	22,400	12,880	--	35,280
1987/1988	24,400	12,880	--	37,280
1988/1989	26,400	12,880	--	39,280

Note: Logs supply calculated 80% optimal capacity
Source: Coordinating Team for Forest Product Industry 1982

a. Logging Damage

Damage due to logging methods is considerable; in one study damage was estimated to be inflicted on over 43% of the residual trees (see Table 11).

Table 11. Logging Damage to Residual Trees

Type of Damage	Percentage of Trees Damaged
a. crown damage	8.1
b. bark and crown damage	1.7
c. fallen or broken trees	31.6
d. bark damage (10%)	1.7
Total Damage	43.1

Source: UK Tikal et al 1974

These figures may be high for a national average as different levels of harvesting efficiency are exhibited by loggers and concessionnaires throughout the country.

b. Increase Number of species Harvested

Approximately 4000 wood species are found in Indonesian forests of which only 120 are currently used commercially (APKINDO, 1984).

Table 12 shows the names of the 45 most used commercial species along with some data regarding their characteristics.

Definitions of durability class, strength classes are in Tables 13 and 14.

The government of Indonesia has indicated in its newest five-year plan to begin the harvesting of the lesser known species as a hedge against depletion of the forest resource supply.

c. Increase utilization of forest residues

Huge amounts of waste are generated from logging operations as well as from the industrial waste generated from products industries. De Beijer suggests that 88% of all wood is considered waste (see Table 26, Section 4.6).

The government breakdown predicts that in 1988 over 32 million cubic meters of wood material will be lost, nearly a doubling of the figure for 1982 (see Table 15).

Much of the residue from logging are the defective trees left standing either of commercial or lesser known species (Ross, 1983). The trees are not felled by concessionaires for fear of being charged a royalty and other fees. Only if the government relaxes royalty fee schedules to take into account these defective trees will forest residue waste be effectively decreased.

Table 12. Properties of Indonesian Commercial Wood Species

	Wood Species	Botanic Name	Specific gravity	Durability Class	Strength Class	Uses
I.	Meranti group:					
	1. Meranti merah	Shorea spp.	0.55	III-IV	II-VI	1. a,b,c,d,e,h,o
	2. Meranti putih	Parashorea spp.	0.54	III-IV	II-IV	2. a,b,c,d,e,h,o
	3. Mersawa	Anisoptera spp.	0.46	IV	II-III	3. a,b,d,e,k
	4. Merbau	Intsia spp.	0.80	I-II	I-II	4. a,d,e,f,j,k,
	5. Nyatoh	Palaquium spp.	0.67	II-III	II-(1-II)	5. a,b,d,e,g,i,k
	6. Pinang, K	Pentace triptera M	0.66	III-IV	II-III	6. a,b,c,d,e,g,k,t
II.	Kapur group:					
	7. Kapur	Dryobalanops spp.	0.81	II-III	II-I	7. a,b,c,d,e,f,g,k
	8. Matoa	Pomatia spp.	0.77	III	II	8. a,c,d,g,k
	9. Keruing	Dipterocarpus spp.	0.79	III	I-II	9. a,b,d,e,f,k
	10. Merawan	Hopea spp.	0.70	II-III	II-III	10. a,b,c,d,e,g,i,k
	11. Kulim	Soorodocarpus borneensis	0.94	I-II	I	11. a,b,d,f,j,k
III.	Jelutung group:					
	12. Jelutung	Dyera costulata	0.40	V	III-V	12. b,h,1.p.g.t
	13. Mentibu	Dactylocladus stenostacys	0.53	IV/V	III	13. a,b,g,h
	14. Teraling	Terrietia spp.	0.75	II-IV	II	14. a,b,c,d,e,g,i
IV.	Pulai group:					
	15. Pulai	Alstonia spp.	0.46	III-V	IV-V	15. b,h,1,n,o,p,t
	16. Jabon	Anthocephalus cadamba	0.42	V	III-V	16. b,h,n,o
V.	Sinkers group:					
	17. Bangkirai	Shorea laevifolia	0.91	I-III	I-II	17. a,b,c,d,f,k
	18. Kempas	Koompasia malaccensis	0.95	III-IV	I-II	18. a,b,d,f
	19. Kenari	Canarium spp.	0.55	IV	III	19. a,b,d,e,g
	20. Rasamala	Altingia excelsa.	0.81	II-III	II	20. a,d,e,g,j,k
	21. Punak	Tetramerista spp.	0.76	III-IV	II	21. a,b,c,d,e,g,k,t
VI.	Bintangur group:					
	22. Bintangur	Calophyllum spp.	0.78	III	II-III	22. a,b,c,d,e,f,k

Table 12. Cont'd.

Wood Species	Botanic Name	Specific gravity	Durability Class	Strength Class	Uses
23. Sendok-senkok	Endospermum spp.	0.45	V	III-II	23. b,e,h,l,n,o,t
24. Bayur	Pterospermum spp.	0.52	IV	II-III	24. a,b,c,g,k,l
25. Durian	Durio spp.	0.64	IV-V	II-III	25. a,b,h
26. Gerunggang	Cratoxylon spp.	0.47	IV	III-IV	26. a,b,h
27. Jeuning	Albizia Falkata	0.33	IV/V	V	27. a,b,h,n,o
28. Jankang	Xylopia malayana	0.63	IV-V	III-II	28. b,e,g,h,l,t
29. Surian	Toona sureni	0.44	III-V	III-II	29. a,b,c,e,g,h,k,l,q,t
30. Perupuk	Lophopetalum spp.	0.56	IV/V	II-III	30. a,b,c,h,l,n,o
31. Terentang	Campnosperma auriculata	0.40	IV	III-VI	31. b,h,n,o
32. Kenanga	Cananga odorata Hook	0.33	V	IV-V	32. b,h,l,n,o,t
33. Puspa	Puspa spp.	0.67	III	II	33. a,b,d,e,j,k,r
VII. L.M.S.H. group:					
34. Mahang	Macaranga spp.	0.43	IV-V	II-VI	34. a,b,e,g,h,n,o,t
35. Tarap	Artocarpus spp.	0.44	III-V	III-V	35. a,b,e,h,k,
36. Ketapang	Terminalia spp.	0.63	III-V	II-III	36. a,b,c,d,e,g,h,k,n,t
37. Kapuk hatan	Gossampinus malabarica	0.30	V	VI/V	37. b,h,n,o,t
38. Kedemba	Mitragyna speciosa	0.48	IV	III	38. a,b,c,d,e,g,t
39. Jati	Tectona grandis L.f	0.70	I-(II)	II	39. a,c,d,e,f,j,k,l,m
40. Ebony	Dyospyros spp.	1.05	I	I	40. c,l,m
41. Sonokeling	Dalbergia latifolia	0.90	I	II	41. c,d,e,i,l,m
42. Mahoni	Swietenia spp.	0.64	III	II-III	42. a,b,c,d,e,g,k,l
43. Ramin	Gonystylus bancanus	0.63	IV	II-III	43. a,b,c,d,e,g,t
44. Rengas	Gluta spp.	0.69	II	II	44. c,d,e,f,l,m
45. Sawokecik	Manikara Kauki	1.03	I	I	45. c,d,e,i,l,m,t
46. Pasang	Quercus spp.	0.90	II-IV	II-III	46. a,b,c,d,e,f,k,m,r
47. Kuku	Pericopsis spp.	0.90	II	II	47. c,d,e,k,m
48. Sonokembang	Pterocarpus indicus Wild	0.65	II	II	48, a,c,d,e,l,m

Source: Forest Prod. Research Institute, Indonesia

Table 13.

Durability Class	I	II	III	VI	V
1. In continuous contact with moist ground	8 years	5 years	very short	very short	
2. Exposed to weather but kept from getting soaked in water and properly ventilated	20 years	15 years	10 years	several years	very short
3. Under roof, not in contact with moist ground and	indefinitely long	indefinitely long	very long	several years	short
4. As above but properly maintained and regularly painted	indefinitely	indefinitely	indefinitely	20 years	20 years
5. Attack of termites	none	rare	rapid	very rapid	very rapid
6. Attack of powder post beetles	none	none	almost none	not serious	rapid

Source: Forest Prod. Research Institute, Indonesia.

Table 14. The strength is grouped into five classes based on the specific gravity, absolute bending and compression strength as follows:

Strength Class	Specific Gravity	Absolute Bending Strength (Kg/Cm2)	Absolute Compression Strength (Kg/Cm2)
I	Over 0.90	Over 1100	Over 650
II	0.60-0.90	726-1100	425-650
III	0.40-0.60	500-725	300-425
IV	0.30-0.40	Over 300-500	215-300
V	Under 0.30	Under 300	Under 215

4. Uses

The key to indicate the possible uses of the wood is as follows:

a. Construction
b. Plywood
c. Furniture
d. Flooring
e. Panelling
f. Sleepers
g. Door and Window frames
h. Packing material
i. Sporting goods and music instruments
u. Power and telephone poles
k. Shipbuilding
l. Carvings and handicrafts
m. Fancy veneer
n. Matches
o. Pulp
p. Drafting instruments
q. Pencils
r. Charcoal
s. Medicine
t. Moulding

Table 15. Assumed Extent of Wood-waste

Year	Logging Waste	Industrial		Total Waste
		Sawmill Waste	Plywood Waste	
1982	7,100	7,500	2,300	16,900
1983	8,600	8,200	3,300	19,100
1984	8,700	9,200	4,900	22,800
1985	10,200	10,200	7,100	26,700
1986	10,600	10,200	7,100	27,900
1987	11,200	12,200	7,100	30,500
1988	11,800	13,200	7,100	32,100

Source: Indonesia Directorate of Forestry

3.3 REFORESTATION EFFORTS AND PROBLEMS

Reforestation

Reforestation efforts in Indonesia have advanced steadily over the past 10 years. Afforestation has also increased dramatically. Table 16 shows how both reforestation and afforestation have advanced since the early 1970s. Currently approximately 1 million hectares are being planted or reforested each year. This level is to be sustained under the government's Fourth Development Plan (1984-1988).

Reforestation

It is questionable whether the previously mentioned proposed reforestation/afforestation projects and diameter limited cuts will be sufficient to offset the rapid depletion of Indonesia's timber resources. According to a recent United Nations Environmental Program (UNEP) situation report, 5,000 hectares of forest area is lost permanently daily due to logging activities. Whether this estimate is true or not, there is little doubt that future supplies will decrease unless stricter controls are implemented. The situation also exists in neighboring Thailand and Malaysia, but Indonesia has been singled out as having the greatest deforestation rate of 500,000 hectares/year.

A measure that could potentially be employed to maintain supplies is to harvest lesser known species that are presently left standing or are left as forest residues. Only about a quarter of the potentially usable species found in Indonesia are being exploited commercially. The government has dictated in its most recent development plan to explore the potential utiization of the remaining 75 percent to allow for a more rational and economically productive use of the forest resource.

Table 16. INDONESIA - Reforestation and Newly Planted Forests

1971/1972 - 1980/1981

(HA)

Year[1]	Reforestation	Newly Planted	Total
1971-1972	22,054	80,900	102,954
1972-1973	82,700	42,300	125,000
1973-1974	78,800	40,000	118,800
1974-1975	84,300	57,000	141,300
1975-1976	25,300	37,800	63,100
1976-1977	162,800	302,600	465,400
1977-1978	149,447	511,550	660,997
1978-1979	292,633	651,854	944,487
1979-1980	301,340	680,092	981,432
1980-1981	238,938	679,345	918,283

[1] April 1-March 31

Source: Directorate General of Forestry

Also, more efficient harvesting techniques and production technology would help in utilization of the forest resource. Presently, 88 percent of all wood material generated from all phases of timber production is considered to be waste. The potential for increased utilization for this material in the manufacture of other forest products will be discussed.

3.4 Dominant Commercial Species

3.4.1 *Shorea* spp.

Light Red Meranti-Light Red Lauan group

Family: Dipterocarpaceae

Other Common Names: Saya (Thailand), Red Seraya (Sabah), Meranti Merah (Indonesia), White Lauan (S. almon and some species of Parashorea and Pentacme), Almon, Mayapis (Philipines).

Distribution: Malay Peninsula, Indonesia, the Philippines, as well as Sabah and Sarawak, usually at low altitudes on well-drained soils.

A large tree reaching a height of 150 to 200 ft. well-shaped boles clear to 90 ft and more; trunk diameters 3 to 6 ft; sometimes buttressed.

General Characteristics: Heartwood variable from almost white to pale pink to dark red, or pale brown to deep brown; sapwood lighter usually with a grayish tinge, distinct. Grain usually interlocked, sometimes somewhat straight; texture coarse; slightly lustrous; usually without characteristic odor or taste.

Weight: Basic specific gravity (ovendry weight/green volume) sorted to range from 0.33 to 0.52, averaging about 0.40; air-dry density 25 to 40 pcf, averaging 32.

Mechanical Properties: (First two sets of data based on the 2-in. standard; the third set on the 2-cm standard.)

Drying and Shrinkage: Seasons well with little or no degrade; there is, though, a tendency to warp, particularly in thin stock. Kiln schedule T6-D4 is suggested for 4/4 stock and T3-D3 for 8/4. Shrinkage green to ovendry: radial 4.6%; tangential 8.5%; volumetric 14.3%. Movement in service is rated as small.

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (34)	7,350	1,340	3,720
12%	11,100	1,630	5,500
Green (37)	7,710	1,650	4,200
14%	10,830	1,970	6,000
Green (35)	9,150	1,400	4,600
12%	12,750	1,520	7,250

Janka side hardness 570 to 665 lb for dry material. Forest Products Laboratory toughness 270 in.-lb for green and 216 in.-lb for dry material (2-cm specimen).

Working Properties: Easy to work with both hand and machine tools; nailing and gluing are staisfactory; takes a good finish, resin and oil exudation is not a problem.

Durability: Heartwood generally rated as nondurable in ground contact and is susceptible to dry-wood and subterranean termite attack; sapwood liable to powder-post beetle attack.

Preservation: Heartwood varies from resistant to very resistant to preservative treatments: sapwood usually moderately resistant.

Uses: Light structural work, furniture components, joinery, plywood, cabinetwork, flooring, concrete form work, and general utility wood.

Shorea spp.

Dark Red Meranti-Red Lauan group

Family: Dipterocarpaceae

Other Common Names: Red lauan, Tangile (Philippines), Dark red seraya, Obar suluk (Sabah), Saya (Thailand), Meranti ketuko (Indonesia), Nemesu (Malaya), Alan (Sarawak).

Distribution: Malaysia, Indonesia, and the Philippines.

A large tree reaching a height of 200 ft and more with a straight cylindrical bole; trunk diameters 5 to 6 ft over moderately large and high buttresses.

General Characteristics: Heartwood dark brown, medium to deep red, sometimes with a purplish tinge, commonly with white dammar or resin streaks; sapwood pinkish, rather poorly defined. Texture rather coars;

grain interlocked, sometimes straight; luster low, without characteristic odor or taste.

Weight: Basic specific gravity (ovendry weight/green volume) averages about 0.55; air-dry density 42 pcf. In Sabah, this grouping of Shorea requires an air-dry weight over 40 pcf.

Mechanical Properties: (First set of data based on the 2-cm standard; second and third sets on the 2-in. standard.)

Drying and Shrinkage: Moderately slow drying with a tendency to warp, thick material may check and end split. Kiln schedule T6-D4 is suggested for 4/4 stock and T3-D3 for 8/4. Shrinkage green to ovendry: ratio 3.8%; tangential 7.9%; volumetric 13.3%. Movement in service is rated as small.

Working Properties: Easy to work with hand and machine tools, dresses to a smooth finish, some tearing of interlocked grain; good gluing and nailing properties; takes a good finish.

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (17)	9,900	1,400	4,920
12%	13,300	1,650	7,670
Green (37)	8,420	1,640	4,350
17%	11,130	1,750	5,740
Green (34)	7,800	1,430	3,880
12%	11,500	1,690	6,000

Janka side hardness 780 to 825 lb air dry. Forest Products Laboratory toughness 292 in.-lb green (2-cm specimen).

Durability: Heartwood is rated as only moderately durable and should not be used in high hazard areas; sapwood liable to attack by powder-post beetles. Not resistent to marine borers.

Preservation: Generally rated as resistent to preservative treatments; sapwood reported to be moderately resistent to permeable, varying with species.

Uses: Veneer and plywood, joinery, flooring, furniture and cabinetwork, general construction, boatbuilding.

3.4.2 *Agathis* spp.

Kauri

Family: Araucariaceae

Other Common Names: Dakua makadre (Fiji), Kauri pine (New Zealand), Bindang (Sarawak), Menghilan (Sabah), Damar minyak (Malaya), Tolong (Brunei), Almacia (Philippines).

Distribution: Widely distributed in Indochina, Malaysia, Indonesia, Philipines, and extending to New Guinea, New Zealand, and Fiji. Found from sea level to high altitudes.

Varies with species but may reach a height of 200 ft with trunk diameters of 5 to 7 ft, sometimes reaching 10 ft and more. Boles are straight, cylindrical, without buttresses, and clear for long lengths.

General Characteristics: Heartwood pale cream, golden brown, to dark reddish or yellowish brown if resinous; usually not distinct from the sapwood. Lustrous; grain mainly straight; texture fine and uniform; generally without distinctive odor or tastes (A. australis has a faint pleasant odor).

Weight: Basic specific gravity (ovendry weight/green volume) 0.41 to 0.47; air-dry density 30 to 36 pcf.

Mechanical Properties: (First two sets of data based on the 2-in standard, the third set on the 2-cm standard.)

Drying and Shrinkage: The timber is reported to season well with little or no degrade. Kiln schedule T7-B3 is suggested for 4/4 stock (A. alba) and kiln schedule T10-D5S for 4/4 stock (A. australis and A. vitiensis). Shrinkage green to ovendry: radial 4.2%; tangential 6.0% (A. alba).

Working Properties: The timber works easily with hand and machine tools, finishes with a clean smooth surface; good nailing and screwing properties; good veneer peeling characteristics; paints and polishes well; easy to glue.

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (34)	6,600	1,330	2,840
12%	11,750	1,650	5,900
Green (15)	7,790	1,570	3,370
12%	13,070	1,890	5,600
Green (35)	8,570	1,400	4,040
12%	13,600	1,600	6,900

Side hardness 480 to 760 lb for green material and 700 to 870 lb at 12% moisture content.

Durability: Generally reported to be nondurable and vulnerable to termite attack; prone to blue stain. Heartwood of A. australis is moderately durable in ground contact.

Preservation: Usually treatable by standard preservation techniques.

Uses: Vats and tanks, patternmaking, millwork, boatbuilding, furniture components, face veneers, shingles, pencil slats. Trees are tapped for its copal used in varnishes and lacquers (A. alba).

3.4.3 Teak

Tectona grandis

Family: Verbenaceae

Other Common Names: Kyun (Burma), Teck (French), Teca (Spanish).

Distribution: Native to India, Burma, Thailand, Indochina, including Indonesia, particularly Java. Extensively cultivated in plantations within its natural range as well as in tropical areas of Africa and Latin America.

On favorable sites, may reach 130 to 150 ft in height with clear boles to 80 to 90 ft; trunk diameters usually 3 to 5 ft; older trees fluted and buttressed.

General Characteristics: Heartwood dark golden yellow, turning a dark brown with exposure, often very variable in color when freshly machined showing blotches and streaks of various shades; sapwood pale yellowish, sharply demarcated. Grain straight, sometimes wavy; texture coars, uneven (ring porous); dull with an oily feel; scented when freshly cut. Dust may cause skin irritations. Silica content variable, up to 1.4% is reported.

Weight: Basic specific gravity (ovendry weight/green volume) 0.55; air-dry density 40 pcf.

Mechanical Properties: (First set of data based on the 2-cm standard; second and third sets on the 2-in. standard; third set plantation-grown in Honduras.)

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (17)	12,200	1,280	6,210
11%	15,400	1,450	8,760
Green (38)	10,770	1,570	5,470
14%	12,300	1,710	6,830
Green (81)	9,940	1,350	4,780
13%	13,310	1,390	6,770

Janka side hardness 1,000 to 1,155 lb for dry material. Forest Products Laboratory toughness 116 in.-lb average for green and dry wood (5/8-in. speciment).

Drying and Shrinkage: Seasons slowly but with little or no degrade, large variations in drying rates reported. Kiln schedule T10-D4S is suggested for 4/4 stock and T8-D3S for 8/4. Shrinkage green to ovendry: radial 2.5%; tangential 5.8%; volumetric 7.0%. Movement in service is rated as small. High resistance to water absorption.

Working Properties: Easily worked with both hand and machine tools and dresses to a very smooth finish if tools are kept sharp; glues moderately well despite its oily nature. Blunting of cutters can be rather severe. As noted, may cause dermatitis in some individuals.

Durability: Heartwood is rated as very durable with respect to decay fungi and termites; not immune to marine borers.

Preservation: Heartwood extremely resistant to preservative treatments, sapwood also of low permeability.

Uses: Shipbuilding joinery, furniture, flooring, carving, cabinetwork, panelling, turnery, tanks and vats, fixtures requiring high resistance to acids.

3.4.4 Ramin

Gonystylus spp.

principally *G. bancanus*

Family: Gonystylaceae

Other Common Names: Melawis (Malaya), Garu Buaja (Indonesia), Lanutan-Bagio (Phillipines).

Distribution: Found in peat swamp forests of Malaya through parts of Sumatra, west coast of Borneo, and the Philippines.

A tall tree free of branches to 50 to 60 ft, bole straight, cylindrical, sometimes fluted at the base; trunk diameter commonly to 2 ft.

General Characteristics: Heartwood and sapwood creamy white to pale straw, not differentiated. Grain generally straight or shallowly interlocked; texture farily fine and even; low in luster. The wood has an unpleasant odor when freshly cut and this may return if dried wood becomes wet. It is suggested that this occurs only in pond-stored logs.

Weight: Basic specific gravity (ovendry weight/green volume) 0.52; air-dry density 41 pcf.

Mechanical Properties: (First set of data based on the 2-cm standard; second set on the 2-in. standard.)

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (35)	10,300	1,470	5,620
12%	19,400	2,030	10,500
12% (52)	17,700	2,170	8,650

Janka side hardness 640 lb for green material and 1,300 lb for dry. Amsler toughness 193 in.-lb at 12% moisture content (2-cm specimen).

Drying and Shrinage: Dries readily with little warp but with a marked tendency to end splitting and surface checking, end coating of boards is suggested. Kiln schedule T3-C2 is suggested for 4/4 stock and T2-C1 for 8/4. Shrinkage green to ovendry: radial 4.3%; tangential 8.7%; volumetric 13.4%. Movement in service is rated as large.

Working Properties: The timber is easy to saw and machine, dresses smoothly, glues and finishes satisfactorily. The wood has a marked tendency to split on nailing.

Durability: The wood is highly susceptible to attack by decay fungi, prone to blue stain; not resistant to termite attack. Freshly felled logs are liable to immediate attack by ambrosia bettles.

Preservation: The wood is easily treated using either open tank or pressure-vacuum systems; absorptions are over 25 pcf (creosote).

Uses: Furniture, joinery, moldings, paneling, flooring, turnery, plywood, nonstriking handles (brooms), dowels, picture frames, a general utility wood.

3.4.5 Keruing
Apitong
Dipterocarpus spp.

Family: Dipterocarpaceae

Other Common Names: Eng, In (Burma), Yang, Heng (Thailand), Lagan, Keroeing (Indonesia), Dau (Vietnam, Cambodia), Gurjin (India).

Distribution: Widely scattered throughout the Indo-Malayan region. More than 70 species make up this group, and they are marketed collectively. Timbers from Malaysia contain a large number of species and are mot variable in properties.

Varies with species but commonly reach heights of 100 to 200 ft with clear, cylindrical boles 70 ft long; truck diameters 3 to 6 ft., commonly with a small buttressed base.

General Characteristics: Heartwood varies from light to dark red brown or brown to dark brown, sometimes with a purple tint; usually well defined from the gray or buff sapwood. Texture moderately coarse; grain straight or shallowly interlocked; luster low; strong resinous odor when freshly cut, without taste. Resin exudation may be troublesome. Silica content variable, generally less than 0.5%.

Weight: Basic specific gravity (ovendry weight/green volume) mostly 0.57 to 0.65; air-dry density 45 to 50 pcf.

Mechanical Properties: (2-in. standard)

Drying and Srhinkage: Dries showly often with considerable degrade due to checking and warp and sometimes collapse. Resin exudation is common, particularly at high temperatures. Kiln schedule T3-D2 is suggested for 4/4 stock and T3-D1 for 8/4. Srhinkage green to air dry: radial 2.5 to 5.5%; tangential 7.5 to 11.5%. Movement in service medium to large.

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (34)	8,500	1,750	4,050
12%	16,700	2,510	8,600
Green (9)	11,900	1,710	5,690
12%	19,900	2,080	10,500

Janka side hardness about 1,520 lb for dry material. Forest Products Laboratory toughness 240 in.-lb for green material (2-cm specimen).

Working Properties: Generally saws and machines well, particularly when green. Blunting of cutters moderate to severe due to silica content. Sometimes difficult to glue. Resin adhering to machinery and tools may be troublesome. Resin may also interfere with finishes.

Durability: Durability varies with species, generally classified as moderately durable, but heartwood is susceptible to termite attack. Though

silica content may be high, resistance to marine borers is erratic.

Preservation: Sapwood and heartwood are both rated as moderately resistant to preservative treatments using either open tank or pressure systems.

Uses: General construction work, framework for boats, flooring, pallets, chemical processing equipment, veneer and plywood, suggested for railroad crossties if treated.

3.4.6 Kapur

Kryobalanops spp.

Family: Dipterocarpaceae

Other Common Names: Keladan, Kapur (Malaya), Kapoer (Indonesia), Borneo camphorwood (Great Britain).

Distribution: Malaya, Sumatra, and Borneo including Sabah and Sarawak; mostly on well-drained soils, often grows gregariously.

Very large trees to a height of 200 to 250 ft with straight clear boles 90 to 100 ft in length above well-developed buttresses; trunk diameters often 3 to 5 ft and may reach 11 ft.

General Characteristics: Heartwood reddish brown; clearly demarcated from the whitish- to yellowish-brown sapwood, rather narrow. Texture moderately coarse; grain straight to shallowly interlocked; luster high; without distinctive taste, but with a strong camphor-like smell when freshly cut which is lost after exposure; contains resin ducts that normally do not

exude over wood surfaces. Silica content 0.12 to 0.91 is reported.

Weight: Basic specific gravity (ovendry weight/green volume) usually 0.57 to 0.65; air-dry density 45 to 50 pcf.

Mechanical Properties: (First set of data based on the 2-cm standard; second set on the 2-in. standard.)

Drying and Shrinkage: Dries rather slowly and with only slight cup and some shake. Kiln schedule T10-D4S is suggested for 4/4 stock and T8-D3S for 8/4 (D. lanceolata). Shrinkage green to ovendry: radial 4.6%; tangential 10.2%. Movement in service is rated as medium.

Working Properties: The wood works fairly well with hand and machine tools, blunting of cutters may be severe particularly when machining dry wood because of silica content. Slight gumming may take place during sawing. Nails and screws well. Wet wood will stain in presence of iron. Glue lines reported not durable in exterior plywood bonded with phenolic adhesives.

Moisture content	Bending strength	Modulus of elasticity	Maximum crushing strength
	Psi	10,000 psi	Psi
Green (35)	11,700	1,580	5,980
12%	16,900	1,930	9,630
Green (9)	12,150	2,305	6,740
15%	16,480	2,710	8,940

Janka side hardness 1,230 lb for dry material.

Durability: Heartwood is rated resistant to attack by decay fungi but is reported to be vulnerable to termites; sapwood liable topowder-post beetle attack.

Preservation: Heartwood is extremely resistant to preservative treatments; sapwood is rated permeable.

Uses: Heavy construction work, furniture components, flooring, cores and backs of plywood (glues well with urea formaldehyde), boat framing, joinery.

4. PRODUCTION AND EXPORT OF INDONESIAN FOREST PRODUCTS

4.1 Log production and export

In the decade of the seventies, Indonesia and Malaysia were the largest exporters of hardwood logs accounting in 1979 for 41% and 34% of the world hardwood log exports respectively (Liang 1983). Hardwood log exports reached a peak in volume terms in Indonesia in 1978 and a peak in value terms in 1980 (see Table 17). In Indonesia in this decade export logs accounted for up to 73% of total timber production.

This position of hardwood log export dominance was altered radically in 1980 when Indonesia began to phase in a ban on all log exports, to be

Table 17. INDONESIA - Exports of Logs and Plywood 1977-1983
Quantity (1000 cu meters)
Value (million U.S. $)

	Logs		Plywood	
	Quantity	Value	Quantity	Value
1977	18,532.8	8,991.0	8.9	2.4
1978	19,060.1	906.7	29.3	8.7
1979	17,809.4	1,548.2	125.3	31.7
1980	14,184.8	1,553.9	245.0	55.4
1981	6,451.5	663.4	599.4	142.1
1982	1,706.4	171.8	1,016.6	247.3

Source: Central Bureau of Statistics

fully effective by Jan. 1, 1985. The purpose of the ban was to stimulate the development of secondary wood product exports. That this ban has had an impact on exports can be seen in Table 15. Already in 1982 log exports had decreased considerably. In fact, many foreign companies have been surprised and some foreign assistance organizations have been impressed by the effectiveness of the ban on log exports.

The prohibition of log exports will cause severe short and long term repercussions in countries that have historically been dependent upon Indonesian hardwood log supply. Trade patterns will also be affected as new suppliers will be required. For example, Malaysia has taken over the position of being Asia's number one exporter of South Sea logs usurping Indonesia's previous dominant position, and in 1982 accounted for 2/3 of all South Sea log supplies (Liang 1983). In the future this may also change as it is speculated that Malaysia will follow Indonesia's lead in the banning of log exports and, moreover, does not have its long term supply potential. In Peninsular Malaysia the policy of banning log exports was established in 1972 on sixteen species. This ban was relaxed to some degree in the mid seventies but presently log exports are nil. In fact, this region is now a net importer of logs (Takeuchi 1983, World Trade Proceedings).

The immediate effects of this abrupt change in supply on some importing countries has been felt. For example, Japan, which accounted for 55 percent of the total South Sea log demand in 1982 has shifted to Malaysia as its main supplier of hardwood logs. Japan has suffered a substantial recession in its plywood manufacturing industries. Many of the smaller plywood facilities have been closed parly due to the lack of adequate supply. There is presently a thrust towards substitution away from hardwoods

and toward softwoods in the plywood industry in Japan. This has been termed "deluanization" or "demerantization". Plywood manufacturing and efficiency tests are currently being conducted on potentially usable domestic and imported species substitutes including Guigue (Chilean Beech), Chilean radiata pine, camarere, and Japanese larch, and western hemlock. Many other species are planned to be tested for substitutability in ply form construction.

This trend will be facilitated by the fact that a high percentage of Japan's plywood capacity is old and mostly depreciated, having been built right after World War II. This is good news for the U.S. and other softwood producers looking for markets abroad. Another very important impetus for the switch to softwoods is a revision in the Japanese Agricultural Standards which now allows softwood plywoods to be used in prefabricated housing (World Wood News, Aug. 1983). (However, it has to be remembered that Japan's own forests, decimated during the war, are reaching harvestable age.)

Other South Sea log importing countries such as Korea and Taiwan, which have limited domestic supplies, will be harder hit by Indonesia's log export ban. This is because their plywood mills which are geared to hardwood materials were installed later than those of Japan making it more difficult to write off the capital investment required and to alter production. As previously stated, Malaysia has taken up the slack as far as supply is concerned, but this is not a long term stable source. Ultimately, Korea and Taiwan will be forced to make large capital investments to convert their plywood mills to softwoods, which appears at present to be a more consistent and stable source of supply. Taiwan production has been curtailed sharply and in 1982 Korean bankruptcies

increased as capacity decreased 42% (World Wood, Sept. 1983: "Asian timber industry had a difficult 1982"). General economic conditions in these countries have also contributed to this situation.

Shortages of logs for the domestic Indonesia industry have cropped up in the early eighties, necessitating even some (minor) log imports from Malaysia. These shortages are only partly the results of the tremendous growth in plywood manufacturing capacity. A number of foreign concessionaires have left rather than build manufacturing capacity. They tended to be the more efficient and larger of the log producers. Many small, local harvesting operators with or without concessions have been forced out of business. The large 1982/1983 fires in East Kalimantan may have had a more significant impact than is commonly believed. And finally, the easily accessible and richest forests have been cut. In this light, there is some question whether the present 1984-1989 5 year plan, which calls for an increase in log production from 29 million m^3 to 44 million m^3 (an annual increase of 10%) can be met.

Another major problem associated with the log export ban and switch to domestic log processing has been a great economic dislocation of the workforce. Approximately 50,000 people have lost their jobs associated with the logging industry (World Wood, Nov. 1984). Only as secondary product manufacturing continues to develop, and only if these displaced workers can and are retrained will they be reabsorbed in the work force.

Concerning actual production levels of logs to fuel the secondary products industries, the five year development plan covering 1984-85 calls for increases in log production from 29.24 million m^3 to 43.46 million m^3 by 1988-89 representing a growth of 10 percent annually. Existing or proposed processing facilities are expected to process all logs produced (World Wood, Nov. 1984).

What has actually happened, however, has been a shortage of logs for industry, particularly sawmills. The government policy to stem deforestation, coupled with the ban on exports of logs has induced a limit on the number of logging concessions. Many smaller operations without logging concessions have been forced out of the industry, but government sources claim it is for the best interest of the industry and country in the long run.

4.2 Lumber production and exports

Indonesia's sawmilling industry has been growing steadily although at a slow rate in comparison to the plywood industry. Lumber output rose to 9.2 million m^3 in 1984, compared to only 1-2 million m^3 annually in the 1970s. Of the 9.2 million, m^3 about 3 million m^3 were exported in 1984 (about 33%) compared to 20% of output exported 10 years earlier (see Table 18).

Because of the major thrust in plywood production, many smaller sawmills were forced out of business. By the end of 1981 there were 239 concession sawmills in operation with a total intake capacity of 7.1 million m^3 and 30 more were under construction (Liang 1983). But during this year over 100 closures occurred (World Wood, April 1982). Most of these were small concession holders engaged in seasonal logging. Even though the number of sawmills decreased, 1982 output was up by 10% to 5.75 million m^3 from 1981 and exports of lumber rose by 9% to 1.4 million m^3 in the same period (World Wood, April 1983). The point is that because many sawmills are being forced out of business or are being forced to establish plywood processing plants (with higher export values), the lumber producing industry has been limited in its growth even though actual production within the industry continues to grow.

Table 18. Indonesia's Export Trends of Logs, Sawntimber and Plywood

Year	Logs	Sawntimber	Plywood
1970	7,800	56	--
1971	10,760	80	--
1972	13,590	132	--
1973	19,433	338	1.5
1974	18,083	354	--
1975	13,921	410	2
1976	18,521	644	10
1977	18,634	594	15
1978	18,904	724	68
1979	18,106	1,270	140
1980	12,800	1,130	282
1981	6,000	1,206	765
1982	4,500	2,000	1,150
1983	3,000	2,500	2,100
1984	1,500	3,000	2,700
1985	0	3,500	3,000

Figures given in 1000 m^3. Source: Indonesian Wood Panel Association.

The established sawmill industry is designed to produce air dried rough-sawn wood. The manufacturing standards are generally low as are the level of quality control standards. Hence, the industry caters to a lower price market and in fact, the prices historically received by Indonesian sawmillers have been lower than that of its Asian neighbors. Much of the exports of sawnwood (which constitute 20% of production) go to countries such as Singapore and Taiwan for reprocessing and reexport (UN Dev. Program 1982). Indonesia should capture this price differential by tightening up its export quality standards.

The bulk of sawn timber is ramin which accounts for 75% with the remaining species being teak, kapur, meranti, among other hardwood species (see Table 19). Depleted resources of ramin caused nearly 50% of the sawmills in Kalimantan to cease operations during the 70s. To prevent a further reduction in production, a shift to multi-species utilization is required. This has been included in the 4th 5-year plan (1984-1989). Also, the plan includes a drive to improve product quality to raise the export price.

Indonesia has been able to hold its own and in fact increase consumption and export of lumber by reducing its prices. (Sometimes, dramatically as in 1983). The long term outlook for its lumber products is tenuous at best. The U.S.A. and Europe, two important markets, do not expect housing (and related uses such as furniture, fixtures, etc.) to rebound to the peaks reached in the seventies (partly because of high interest rates, partly because of the disappearing bulge of the post world war baby boom). Housing is the major consumer of softwood lumber, while furniture and fixtures are the most important hardwood consumers. The

Table 19. Sawn Timber Exports by Species

Air-dried sawn timber: species	1979 (m^3)	1980 (m^3)	1981 (m^3)	1982 (m^3)
Agathis	746	8,221	12,668	19.546
Meranti	276,698	286,664	291,411	279,236
Ramin	761,800	655,916	570,758	500,612
Pulai group	7,259	5,046	1,248	11,822
Kapur	1,971	2,241	14,248	20,810
Keruing	36,772	40,410	33,224	70,426
Jati	32,346	19,900	20,385	20,489
Lain-lain	213,629	161,209	312,883	408,458
Total	1,331,221	1,179,607	1,256,825	1,331,399
Kiln-dried sawn timber	2,606	4,921	39,928	100,227
Sleepers	9,087	33,577	44,903	30,596
GRAND TOTAL	1,342,914	1,218,105	1,341,656	1,462,222

* From Asian timber Nov./Dec. 1983 (2)

predictions are that lumber consumption (both hard and softwood lumber) in these 2 markets will be flat over the next 1 or 2 decades (see tables 20, 21, 22). Perhaps Indonesia's domestic lumber consumption appears to be the most promising, given its rate of population increase. But will its purchasing power increase concomitantly?

Table 20. PRODUCTION TARGETS OF PLYWOOD AND SAWNTIMBER

x 1000 m^3

Year	Sawntimber			Plywood		
	Domestic use	Export	Total	Domestic use	Export	Total
1981	5,900	1,600	7,500	889	665	1,544
1982	6,500	2,000	8,500	1,200	1,150	2,350
1983	7,100	2,500	9,600	1,250	2,100	3,350
1984	7,700	3,000	10,700	2,375	2,700	5,075
1985	7,900	3,100	11,000	2,945	3,000	5,945

From: Indonesian Wood Panel Association

Table 21.

Exports of Sawn-timber and Wood Product
and its Share in Total Exports of Forest Product

No.	Year	Exports of Forest Products Value	Exports of sawntimber and wood products	
			Value	Share (%)
1.	1979	1,932,371	255,595	13.2%
2.	1980	2,020,435	264,242	13.1%
3.	1981	1,157,903	237,144	20.5%
4.	1982	950,700	251,604	26.5%
5.	1983*	1,053,917	251,964	23.9%

Note: * Estimation of ISA (Indonesia Sawmillers Association)
Value in US $ 1,000

Table 22.

Production and Export's Projection During
IVTH Five Years Development Plan

No.	Year	Production of sawn-timber	Export of sawn-timber
1.	1984	9,200	3,200
2.	1985	10,200	3,600
3.	1986	11,200	4,000
4.	1987	12,200	4,400
5.	1988	13,200	4,800

Source: Dept. of Forestry.
Note: Production and Export in 1,000 Cum.

4.3 Plywood production and export

In forest product manufacturing, Indonesia has placed the highest emphasis on plywood production. Its plywood productive capacity growth in the last 5-10 years has been truly phenomenal. As Table 23 shows, plywood production has increased from 9000 m^3 in 1973 to almost 6 million m^3 in 1985. In 1982 Indonesia was the third largest plywood producer in the world, right after the U.S. and Japan, ahead of the U.S.S.R. and Canada (see Table 24). In June, 1984, 86 mills existed in Indonesia with a capacity of 4.86 million m^3/year. An additional 38 mills were under construction. Of the existing 58 mills in 1983, 50 were domestically owned, while 8 were joint ventures; of the mills under construction at that time 31 were domestically owned and 9 were joint ventures. Most of the existing and the large majority of the new mills are located in Kalimantan. Finally licenses for another 32 mills have been approved (World Wood, February 1983).

While initially most of the plywood production went to the domestic market, over time more and more went into export (up to 63% of total production in 1983). Most of this export presently is ending up in the U.S. (between 20 and 25% of total exports or about 20% of total production); other very important markets are the Middle East, Singapore and Hong Kong. Some of this export growth has been obtained and can be maintained only through ferocious price cutting even selling at prices below cost (which has raised the possibility of dumping charges from some quarters). World Wood (Dec. 1984) reports a plan to form marketing groups to which plywood mills must belong. These groups are meant to act in cartellike fashion, to prop up prices and to improve sales. Only these marketing groups will be given export licenses by the government. History has shown these arrangements to be singularly unsuccessful.

Quite apart from the above pricing question, the main questions for the future appear to be:

1) Can Indonesia achieve and maintain the quality control standards required by the international markets, especially as it has to utilize smaller and lower grade logs
2) Is the installed plywood production capacity in equilibrium with its sustained forest yield capacity
3) Will the installed plywood capacity handle the inevitable shift to lower grade and smaller logs.

Table 23. Trend of Production and Trade Flow of Indonesian Plywood

	Production		Domestic Sale			Export			Import
Year	1000 m^3	% of Growth	1000 m^3	% of Prod.	% of Growth	1000 m^3	% of Prod.	% of Growth	1000 m^3
1973	9	100.0	7.5	83.3	100.0	1.5	16.7	100.0	14
1974	24	166.6	24	100.0	220.0	--	--	--	10
1975	107	345.8	105	98.1	337.5	2	1.9	33.3	7
1976	214	100.0	204	95.3	94.3	10	4.7	400.0	5
1977	279	30.3	261	93.7	28.2	17	6.3	70.0	4
1978	424	52.0	341	80.4	30.4	83	19.06	374.3	3
1979	624	47.2	498	79.8	46.0	126	20.2	51.8	843
1980	1,011	62.0	728	67.6	46.1	283	32.4	124.6	--
1981	1,552	53.5	778	50.1	6.8	774	49.8	173.4	--
1982	2,359	52.0	1,209	50.8	54.2	1,150	48.7	48.5	--
1983	3,330	41.2	1,230	36.9	25.0	2,100	63.0	82.6	--
1984	5,075	52.2	2.375	46.8	20.0	2,700	53.2	28.5	--
1985	5.945	17.1	2,945	49.5	33.3	3,000	50.4	11.1	--

Source: Indonesian Wood Panel Association

Table 24. Plywood Production (1982)

Country	000 m^3	Country	000 m^3
1. USA (1 in 1981)	13,300	36. Ger. Dem. Rep.	41*
2. Japan (2)	6,740	37. Ghana	40*
3. Indonesia (6)	2,487	38. Peru	37
4. U.S.S.R. (4)	1,952	39. Turkey	34
5. Canada (3)	1,682*	40. Costa Rica	33
6. China/Taiwan (7)	1,673*	41. Denmark	30*
7. South Korea (5)	1,423*	42. Kenya	23*
8. Brazil (8)	902*	43. Portugal	22
9. Malaysia (12)	787	44. Switzerland	21
10. Finland (9)	596*	45. Netherlands	20
11. Singapore (13)	482*	46. Surinam	20*
12. France (10)	477	47. Vietnam	18*
13. Philippines (14)	465	48. Ivory Coast	16
14. Italy (11)	462	49. United Kingdom	16*
15. Fed. Rep. Ger.(15)	331	50. Burma	15*
16. Mexico (16)	313	51. Hungary	14
17. Czechoslovakia (18)	272	52. Nicaragua	14*
18. Yugoslavia (21)	181*	53. South Africa	13*
19. India (20)	180*	54. Hong Kong	12*
20. Poland (19)	145	55. Zaire	12*
21. Sweden	112	56. Cameroon	10
22. Thailand	95	57. Chile	10
23. Spain	90	58. Norway	10
24. Australia	89	59. Sri Lanka	10*
25. Israel	71	60. Papua New Guinea	9*
26. Belgium/ Luxembourg	68	61. Honduras	8*
		62. Uruguay	7*
27. Ecuador	65	63. Bolivia	6*
28. Nigeria	65	64. Austria	4
29. New Zealand	59	65. Congo	4*
30. Bulgaria	57	66. Figi	4*
31. Morocco	50	67. Malawi	4*
32. Venezuela	50	68. Paraguay	4*
33. Colombia	48	69. Zambia	4*
34. Greece	47	70. Pakistan	3*
35. Argentina	45		

* FAO estimate

The shift to export sales of finished products has aided Indonesia's trade balance. In 1979, exports of plywood (and lumber) accounted for 14% of Indonesia's wood export earnings. That figure has risen to about 50% in 1983 and is expected to rise. The government expects Indonesia will supply fully 40% of the world's plywood trade by 1988 (World Wood, April 1983).

Before this major increase in plywood production, Indonesia consumption of veneer accounted for 90% of production and exports only 10%. Of course, consumption will not grow at a rate approaching the dramatic increase in supply, and this will result in a strong push to penetrate export markets.

There are some problems that must be solved for the plywood industry to operate efficiently and export on the level planned for. Skepticism exists as to the abilities of the plywood industry at large to produce material within specific tolerances and specifications, although some producers in Kalimantan and Sumatra now produce plywood to more exacting standards than either South Korea or Taiwan. This is partly due to the great distances and associated communication problems between individual mills, as well as inexperience of production crews in plywood manufacturing methods. Existing plywood producers have employed trained personnel and techniques from Philippines, Korea, Singapore and recently Taiwan, but it remains to be seen whether new plants will be able to do this. If so, will they have the marketing expertise to penetrate existing export sales markets?

Another problem that will be faced is the annual requirement of 88.6 million m^3 of logs to allow for utilization of plant capacity. With the present levels of cut and lack of adequate reforestation it is doubtful

whether this installed capacity can be fully utilized (Japan Lumber Journal, April 1982).

Investment requirements for purchase of equipment and machinery is another concern as huge amounts of money will be required for the plants themselves as well as for logging operations. One possible solution is to encourage more foreign investment through joint venture operations. This has been occurring to some degree as shown by the 9 joint ventures proposed in 1983. In any event, to encourage the export of such volumes of material, the government may have to alleviate existing export duties to achieve export targets.

4.4 Pulp and Paper Production and Imports

Domestic paper consumption in Indonesia in absolute (total) terms has been growing steadily at well over 10% per year, fueled by an increase in the population and in GNP (Asian Timber, April 1983). Consumption is still low by world standards: 4-10 kg per year per capita from 1977 to 1984, compared with about 250-300 kg for the U.S. (Soetikno 1984 and Statistical Abstract of the U.S. 1984). There is some evidence that per capita consumption actually has leveled off and shifted to a course similar to an average world trend. The relative absence of long fibered species in Indonesia and heavy capital requirements for a pulp and paper mill has forced Indonesia to continue to rely on imports to meet its needs, even though the government in successive 5 year plans continues to strive for self sufficiency. In 1975 Indonesia was 17% self sufficient, in 1980, it was 31% self sufficient (see Table 25). By 1982 its self sufficiency percentage had remained at about 31%. It should be noted that the percentages overstate the self sufficiency because most of the mills use

also imported pulp. In 1978, imported pulp contributed 2/3 of the total used in paper manufacture (FAO. Demand for long fibre pulp is currently some 170,000 metric tons per year with imports totalling 40,000 metric tons per year. Demand for short paper pulp is some 230,000 metric tons per year, with imports totalling 150,000 meters tons per year (World News, 1984).

Plant Technology

The existing industrial plants, and those under construction, can be grouped in three categories according to the levelof technology employed.

(i) Non-integrated Paper Mills: These are the simplest mills, comprised of one or more paper machines. Fiber for the paper machines, consisting of pulp and waste paper, is purchased externally.

(ii) Integrated Paper Mills without Chemical Recovery: At present, the existing mills in this category are all pulping rice-straw. Chemical recovery processes are feasible but complicated and would be of doubtful economic worth in view of the small plant sizes.

(iii) Integrated Pulp and Paper Mills with Chemical Recovery: The Basuki Rachmat and Gowa Mills are fully integrated sulphate pulp mills with chemical recovery systems. Although the basic process design is similar to modern pulp and paper mills throughout the world, their capacity is about one-fifth of what might be

considered the minimum economic size for this type of plant and the costs of production are therefore excessively high.

Although the basic processes in the pulp and paper industry have not changed much over the past 20 years, certain improvements have led to larger yields, better product quality, and lower production costs. The paper industry of Indonesia is plagued by the higher prices for many chemicals and other imported raw materials due to high transportation costs and surcharges on the relatively small volumes involved. Existing Indonesian pulp and paper mills suffer a basic cost disadvantage due to equipment size, the lack of equipment sophistication, and their location. No matter how efficiently these plants may be operated, they suffer a substantial cost disadvantage by comparison with economically sized plants in other regions. According to industrial sources, most of the plants now under construction in the country will suffer a similar disadvantage (U.S. State Dept., 1980).

Raw Materials

Most paper mills are located on the island of Java and rice straw is consequently the most obvious raw material for paper production here. Roughly 4,800,000 hectares on this island are planted with rice, but the problem lies in collecting the rice straw and transporting it to the mill. Intra-island transportation improves each year but is still far from adequate. Any paper or paper carton mill on Java with daily capacity greater than fifty tons would face great problems in maintaining an uninterrupted flow of rice straw feedstock.

A paper mill depending on bamboo as its raw material must be supported by special bamboo plantation. The Basuki Rachmat mill in East Java could

not maintain a sufficient supply and suffered heavy losses when the plant had to be re-tooled for pine and tropical hardwood raw materials. Both plants are originally Japanese turnkey projects that were part of a war reparations program.

Nearly two million tons of waste sugar cane pulp (bagasse) are available annually in East Java, where 33 of Indonesia's 56 sugar cane mills are located. The third expansion of the P.N. Kertas Letjes paper mill in East Java will make it the first Indonesian pulp and paper mill using bagasse as its principal raw material. An annual capacity of 54,000 tons of paper pulp is anticipated and if the project is successful, this will open new investment opportunities in the use of bagasse for paper production in East and Central Java.

The largest softwood reserves in Indonesia are located in the northern area of Sumatra. Pine forests in Central Aceh cover area of 149,000 hectares and have a standing stock of 50 to 140 cubic meters per hectare. Infrabuilding would be needed to make these remote forests accessible. A second large pine reserve area of approximately 48,000 hectares is located in North Tapanuli in the province of North Sumatra. Half of this area is state-owned.

The Cilacap region of Central Java boasts an 80,000 hectare area of pine reserves and an Indonesian company, P.T. Anem Kosong Anem, has obtained a permit from the national Capital Investment Board (BKPM) to build a 60,000 tons/year newsprint mill in Cilacap but this project is still in theoretical stages. Obstacles at this point include the US $80 million capital investment for the mill and the undetermined cost of the necessary infrastructure which must be part of the project (U.S. State Dept., 1980).

In 1976, 91% of all domestic paper was produced by 5 state owned corporations. In 1980 this fell to about 66%. In 1980, 5 new mills were planned at a cost of over $1. billion dollars. In 1980 most of the existing paper mills were located in Java, using rice straw, bamboo, waste paper and imported pulp as raw materials. The 5 new mills were to be located in North Sumatra (using Pinus merkusii), Central Java (also using pines) and three of them in Kalimantan (using primary hardwoods).

Table 25. Indonesia: Paper Production, Consumption, and Imports (thousands of tons)

Year	Production	Consumption	Imports
1970	19	123	103
1973	39	208	168
1974	40	248	208
1975	49	282	233
1976	72	322	250
1980	148	480	332

Source: Pulp and Paper Association of Indonesia, Repelita-II, and estimates based on trade source interviews.

These mills are designed primarily to increase self sufficiency in newsprint paper and kraft paper (Australian Forest Industries Journal, Feb. 1980). At least in the case of Kraft paper, this goal has failed as in 1983 Indonesia continued to import all its Kraft sack paper amounting to about 60,000 tons (World Wood, Oct. 1983). Table 26 shows paper imports by grade from 1974-1978. At the latest count in 1982 there were 26 paper mills in operation in Indonesia with a combined capacity of 284,000 metric

Table 26. Import of Paper Specified on Major Grade Groups[1] ('000 tonnes)

Year	Newsprint	Kraftpaper	Printing & writing	Box board	Other
1974	58	17	29	20	61
1975	47	100	34	20	36
1976	67	41	24	48	65
1977	67	45	53	36	30
1978	90	57	28	35	42

[1] Including converted papers

Source: Central Bureau of Statistics

tons (using locally produced and imported pulps), producing at about 70% of capacity or almost 200,000 tons (UN Dev. Program 1982).

In 1977, nearly 50% pulp imports came from Japan (21,800) metric tons. In 1979 Japan's share dropped to only 1% or 1,000 M.T. Taiwan jumped to the number one position providing over 25% of Indonesia's total imports (27,900 MT). The U.S. was second with 22,300 MT (or about 23%) and Finland third with 22,200 MT. In 1981 the relative contributions to Indonesia had changed slightly. Taiwan's contribution was nearly a third (48,100 MT), Finland was second (30,100 MT) and the U.S. third at 25,400 MT (still supplying about 25% of Indonesia's imports) (American Paper Institute, Wood Pulp and Fiber Statistics 1982).

According to FAO projections consumption of paper and paper products is expected to increase as follows:

Table 27. Forecasted Paper Consumption in Indonesia up to the Year 2000 Specified by Planning Periods and Paper Grades (in '000 tonnes per year average for each planning period)

5-year Planning Period	Liner Board	Sack kraft	News print	Printing & writing	Fluting	Box Board	Total
1981-1985	58	53	131	193	42	79	556
1986-1990	106	112	212	314	77	155	976
1991-1995	195	225	330	505	142	261	1658
1996-2000	359	415	516	813	262	439	2804

Source: FAO, 1979.

Though the above forecasts indicate more than a fivefold increase over 20 years, they will probably prove to be conservative, especially if the consumption is boosted by a generous supply from an expanded domestic pulp and paper sector.

Soetikno (1984) reports the following projected capacities for the 1983-1990 period (in 000 Metric tons)(see Table 28).

Finally, Table 29 shows expansions under construction and those in advanced planning stages of 1984.

A development that will have important ramifications on the future of the pulp and paper industry in the Pacific Rim and specifically Indonesia is the organizing of the ASEAN Pulp and Paper Industry Club in Jakarta on April 21, 1978. The club currently has five member countries: Indonesia, Philippines, Thailand, Singapore, and Malaysia. The aim of the organization is to promote cooperation and coordination of activities related to the pulp and paper industries.

As far as future growth and potential for pulp and paper, paper consumption across populations tends to be correlated with GNP and per capita income, both of which are rising in Indonesia.

4.5 Other board production and exports

Indonesia presently has no chipboard, fibre board, flake board oriented strandboard and wafer board capacity to speak of. Given its tremendous forest residue left after logging and from its plywood and lumber production and given its truly immense supply of presently unutilized species (unsuitable or not marketable), its potential supply of wood chips is enormous (see Table 30). In the USA, oriented strandboard and wafer board have become formidable competitors for softwood plywood

Table 28. Projected Paper and Pulp Capacities.

		1983		1984		1985		1986		1987		1988		1989		1990	
		Pulp	Paper	Pulp	Paper	Pulp	Paper	Pulp	Paper	Pulp	Paper	Pulp	Paper	Pulp	Paper	Pulp	Paper
Indonesia	Confirmed	167	512	333	706	333	743	408	833	408	833	408	833	408	833	408	833
	Probable	--	--	--	--	--	--	--	16	90	106	265	281	265	281	430	781

Table 29. Expansion and new project pulp & paper mills in Indonesia

I. Project under construction

Name of company	Product	Capacity (M tons) Pulp	Capacity (M tons) Paper	Expected operation
INDONESIA				
1. Bekasi Teguh (West Java)	Fluting	--	16,000	1984
2. Berkat Indah Agung (Riau, Sumatra)	Market pulp (LBKP)	100,000		1984
3. Inpama (West Java)	Tissue	--	3,000	1984
4. Letjes (East Java)	-Writing & printing	60,000 (BBKP)	60,000	1984
	-Tissue & M.G. wrapping		11,000	1984
	-Newsprint	75,000 (BTMP & BSCP)	90,000	1986
5. Papyrus Sakti (West Java)	Coated board	--	9,000	1984
6. Pakerin (East Java)	Folding board, Kraft liner	--	30,000	1985
7. Pindo Deli (West Java)	Coated paper	--	6,000	1984
8. Pura Kertas (Central Java)	Base paper for coating	--	3,000	1984
9. Surya Kertas (East Java)	Fluting	--	6,000	1984
10. Tjiwi Kimia (East Java)	Folding board, Kraft liner,	6,000	38,000	1984
11. Mekabox (East Java)	Kraft liner and Fluting	--	21,000	1984
12. Ayu Wangi (East Java)	Kraft liner and Fluting	--	21,000	1984
13. Incon Cahaya Semesta (West Java)	Kraft liner and Fluting	--	7,000	1985

Table 29. (Cont'd.) Expansion and new project pulp & paper mills in Indonesía

II. Project under advanced planning stage

Name of company	Product	Capacity (M tons)		Assumed completion
		Pulp	Paper	
INDONESIA				
1. PT Indah Klat (West Java)	Writing & printing paper	--	16,000	1986
2. PT Kraft Cilacap (Central Java)	Sack kraft paper	90,000	90,000	1987
3. PT Sumatra Kraft (North Sumatra)	Sack kraft & kraft liner	175,000	175,000	1988
4. PT Sabindo (East Kalimantan)	Market pulp (LBKP)	165,000	--	1990

Source: Soetikno (1984)

during the last 5-10 years. These 2 board products can easily be made from woodchips. Indonesia could become one of the major producers of these 2 products, utilizing raw materials which are presently largely unused (left to rot in the forest, simply not harvested or burned in the mills). However, mills required are capital intensive and expensive to build, probably necessitating another major foreign investment stream. At present, interest exists but it needs further strong encouragement from the government. World wide demand for oriented strandboard and wafer board (structural panels) appears to be increasingly rapidly and is projected to double in the U.S. over the next 10 years. In these products the wood quality characteristics are not critical. Thus the wood quality characteristics which Indonesia enjoys in plywood disappear. This means that chips and boards manufactured from them will have to survive much more rigorous competition than Indonesian plywood. However, Indonesia has the potential of becoming a major low cost chip producer. Whether it can process these chips profitably itself in a domestic industry and/or whether it wants to export chips and can do so at competitive delivered prices are unanswered questions. The fact that there is a successful, though small, chip export enterprise suggests that this opportunity is good. Experience in the U.S. has shown that only those forest product manufacturers who own both the raw material and the manufacturing capacity, develop the flexibility to use a broader spectrum of the forest (among others through chip production and chip use). In Indonesia, ownership of the forest resource and the manufacturing capacity tends to be separated. This means that the government has to provide the incentives for diversification in manufacturing and for the usage of a broader spectrum of the forest.

Presently 88% of all wood material is considered to be waste (according to J. R. Beijer; see his calculation below in Table 30). The potential for increased harvesting and utilization efficiency is considered to be enormous.

Another potential use for this waste material is in energy generation. This is supported by the fact that local domestic energy consumption in Indonesia is increasing by 15% annually while oil production

Table 30. Timber processing: waste factors

	Usable timber (%)	Waste (%)
Virgin forest stand	100	
Non-commercial trees left standing		60
Trees actually felled	40	
of which 30% are rejected due to rotten heart, shattering, or other defects		12
Usable timber remaining	28	
of which 40% is lost during sawmilling or plywood manufacturing		11
Usable timber remaining	17	
of which 30% is lost during kiln drying, planing, moulding etc.		5
Balance fob	12	
Total	12	88

growth is only 1.5% (de Beijer 1984). The government of Indonesia has taken a positive step in issuing Directorate General of Forestry Decree 25/DJ/I/82 on August 10, 1983 that required timber manufacturers to generate their own energy from wood waste before being issued a license to operate.

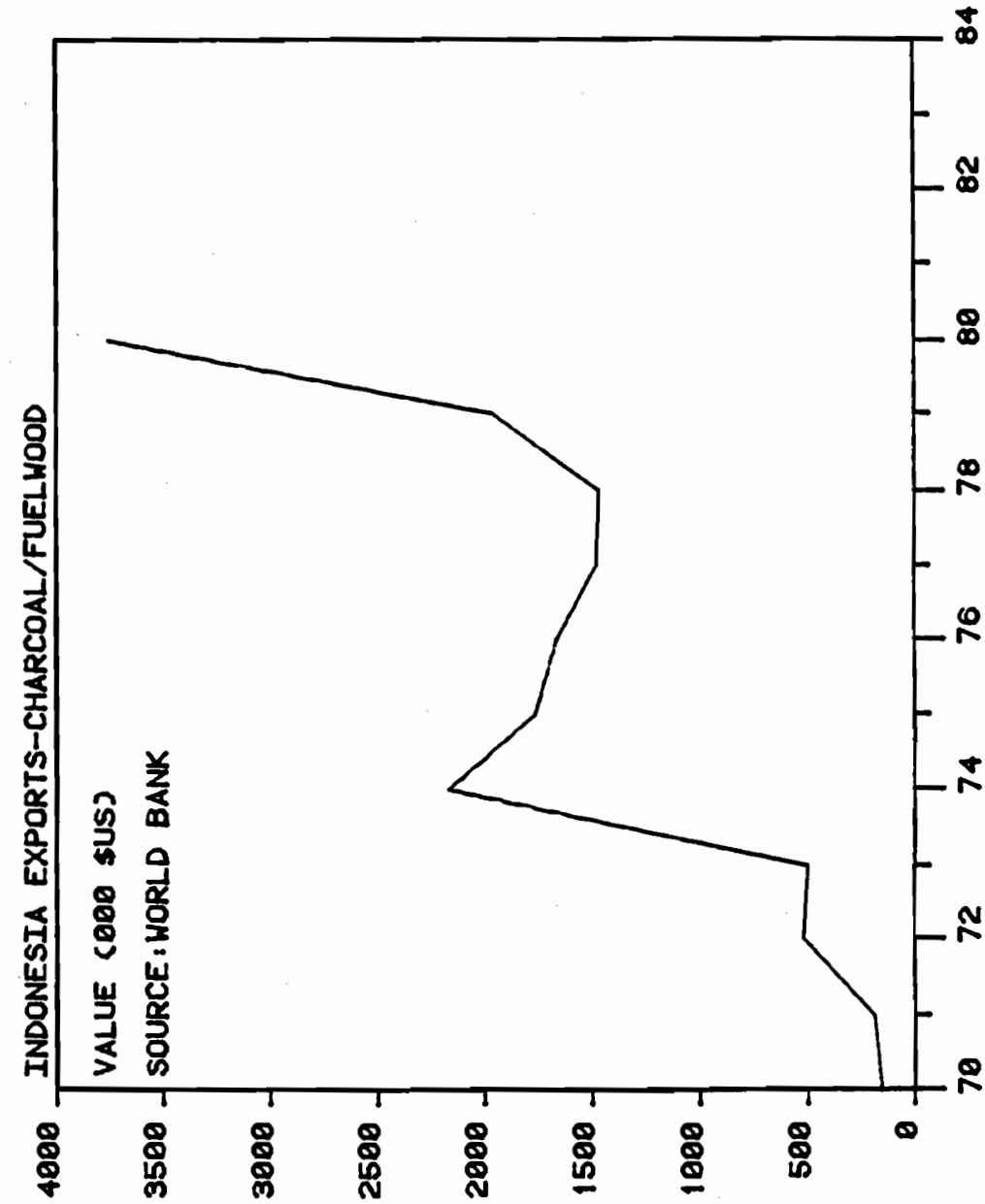
4.6 Energy (charcoal) production and export

A high but unknown percentage of Indonesian wood is consumed annually as energy (some estimates place this at 50%). Experience has shown that the percentage of wood consumed as energy is correlated with per capita income. The poorer a country, the more wood it tends to consume as household fuel. Indonesia, of course, has abundant alternative energy resources. Whether this percentage will decline over the next 1 or 2 decades is again an interesting question. (In the U.S., wood provides 2-3% of all U.S. energy needs, placing it in the same league as nuclear power sources and as hydropower sources; moreover, 50% of all wood used for energy in the U.S. is used by the forest product manufacturing sector, cogenerating and using its own residues.)

Local energy consumption in Indonesia has been growing at a rate of 15% per year. In contrast, oil production is increasing at a rate of only 1.5% per year. Consequently, the government has decided to actively study the potential use of forest and mill residues as fuel and for the production of charcoal. Certainly the plywood sector in Indonesia has an immediate and largely untapped opportunity in this respect. Charcoal production and perhaps the transportation of it in powdered form, from forest residues appears to be another interesting possibility. Indonesia presently is already a net exporter of charcoal, primarily to Japan and Hong Kong (see Figure 5).

4.7 Machinery imports

To extract and produce the forest products, Indonesia needs equipment. Table 33 indicates the results of a 1975 study portraying Indonesia's imports and its sources. While in 1973 the U.S. was still the dominant


INDONESIA EXPORTS-CHARCOAL/FUELWOOD
VALUE (000 $US)
SOURCE: WORLD BANK
4000
3500
3000
2500
2000
1500
1000
500
0
70
72
74
76
78
80
82
84
TIME SPAN (YEARS)

supplier of harvesting equipment, it already lagged badly behind Japan, Singapore, West Germany and even Taiwan in the supply of manufacturing equipment. By 1975, Japan and West Germany were already the dominating suppliers, dwarfing the U.S.

Since 1975, Japan has continued to dominate as a supplier. Indonesia possesses no forest machinery manufacturing capability to speak of and continues to provide a very good market. For the current thrust in plywood production, most of the machinery and necessary auxiliary equipment is being supplied by Japan (World Wood, Oct. 1984). For example, the huge new Barito Pacific timber processing complex currently being constructed includes a sawmill, three substate plywood lines, three multi-ply oversize plywood lines, a blockboard plant and a glue plant. The majority of the equipment for this complex will be supplied by both Japan and Taiwan. Additionally, France and Germany will supply lathes and belt drivers, respectively (Asian Timber, Nov./Dec. 1983).

5. FOREIGN INVESTMENT AND TRADE

5.1 Investment Criteria/Key Items

5.1.1 Main Provisions of Foreign Investment Law of 1967

5.1.1.1 Stimulation of foreign capital investment

Foreign Investment Law of 1967 (amended 1970 and 1974). Investment applications are approved by Investment Coordination Board (BKPM), an agency designed to cut down on bureaucratic procedures. BKPM issues a priorities scale list which changes to reflect economic priorities and developments. Main provisions of the law:

a. Exemption from corporation tax for two to six years for projects in priority sectors.

b. All foreign investments are normally entitled to accelerated depreciation (for a period of 4 years from when the expenditure is incurred), compensation for losses resulting from state expropriation, investment allowances, and a limited period of exemption from dividens, tax. As a result of 1974 amendments, the right to import machinery and materials duty free has been abolished.

c. Repatriation of profits permitted though repatriation of capital not allowed during the period in which a project is enjoying tax and other concessions.

d. Joint ventures with Indonesian counterparts has been compulsory since 1974. A timetable must be established to transfer at 51 percent ownership to Indonesia. Also since 1974 a tightening of rules requiring maximum employment of Indonesia nationals in foreign owned projects.

5.1.1.2 Trade and Exchange Regulations

- No stringent licensing system exists.
- Tariffs and surcharges are imposed to regenerate the flow of goods.
- Importing and exporting done primarily by Indonesian nationals but companies that invested under Foreign Investment Law may operate under special license.

5.1.2 Imports

- Imports are divided into 4 categories ranging from extremely essential to unclassified.
- Duties range fro 0-100%. Other surcharges range from 50-400% based on competitiveness with Indonesian counterpart.
- Goods also subject to sales taxes and excess profits levies.
- With few exceptions, letters of credit is required for all imports by private enterprises.
- Import of some goods prohibited (textiles, clothing, agricultural chemicals, and newsprint).

5.1.3 Exports

- Export companies are registered by the government to ensure control over foreign exchange proceeds.
- Exporters have to sell these to Bank Indonesia at current rate of exchange.
- Normally exporters require overseas buyers to raise letter-of-credit.
- Export duties are applied to a range of goods.
- Bonded warehouses exist and goods may be imported to these for re-export.

- Export inventories (tax holidays) exist and depend upon priority attached to enterprise.
- Export credit available from local works at reasonably favorable terms.

5.1.4 Counter Purchase Policy

January, 1982 government introduced counter purchasing policy whereby foreign companies awarded contracts exceeding Bp500 MN ($8 Mn) must arrange for exports of Indonesian products equivalent to value of the equipment and materials brought into the country. The rule applies only to government construction and procurement contracts and to enterprises outside the oil and natural gas sector.

Table 31. Approved Foreign Investment[a]

($ mn)	1978	1979	1980	1981	1982[b]
Agriculture	--	25.9	26.8	12.2	--
Fishing	12.7	45.9	--	21.6	--
Forestry	--	23.0	112.6	92.1	16.9
Mining & quarrying	44.8	150.0	3.0	9.0	--
Manufacturing	297.5	756.8	665.4	839.0	460.8
Construction	5.2	0.5	9.7	39.2	9.4
Transport & communications	36.5	--	32.4	--	17.9
Trade & tourism	9.7	3.0	38.6	--	19.2
Real estate & other services	22.7	45.7	11.1	23.2	--
Total	429.1	1,050.8	896.6	1,036.4	524.2

[a] Excluding oil and banking sector.
[b] January-June.

Source: Bank Indonesia.

5.2 FOREIGN INVESTMENT - FOREST PRODUCTS INDUSTRIES

5.2.1 Background

Forest related products constitute the third largest contribution to Indonesia's foreign exchange earnings after oil and natural gas. This high ranking has been made possible through foreign investment, either straight investment or joint ventures in forest products industries. Since the Foreign Investment Law was passed in 1967, the government of Indonesia has encouraged foreign investment through the issuance of timber concessions which are legal agreements or licenses issued by the government that acknowledge the right to exploit a given forest area.

By March, 1984, 80 foreign investment projects in forest industries valued at $569 million had been approved (Quarterly Economic Review of Indonesia. Annual Supplement 1984). Concessions typically span 20 years and may be renewed at the discretion of the government. There are certain stipulations to the concession license that include appropriate reforestation activities, employment of only Indonesian blue collar level workers, at least 51% Indonesian control in the case of joint ventures and the construction and operation of a processing facility on site. In recent years, primarily as a result of the log export ban and the ensuing thrust toward plywood production, these processing facilities have been plywood mills. Table 28 shows the status of foreign investments in concessions in 1980. Malaysia, Hong Kong, Japan together comprise nearly 60% of all foreign investments but the U.S. is third in terms of dollars invested after the Philippines and Japan.

Domestic investment in forest concessions was initially encouraged under the Domestic Investment Law No. 6/1968. As Table 32 shows, in 1980

there were over 5 times as many domestic forest concessions as foreign with a total investment of $1.2 billion.

5.2.2 Present Situation

5.2.2.1 Domestic Concessions

Because of the restructing of the forest industry, (log export ban, plywood capacity increase) the climate for both domestic and foreign investment is presently uncertain. In the case of domestic concessions, union officials estimate that over 50,000 industry workers have lost their jobs and many sawmills and plywood manufacturers are threatened with bankruptcy. Industry sources say that in the province of S. Kalimantan, 64 of the 71 sawmills in operation are on the verge of bankruptcy because of not receiving enough logs to saw to cover operating costs (Manguno, 1984).

A situation usually confined to domestic concessions which is causing distress to many of the conservationists concerned with Kalimantan's forests is the popular practice of hiring a contractor to handle timber production and exploitation. Under this arrangement, the concession-holder who uses the contractor receives a contract fee of approximately US $10/m3 - $30/m3 according to the volume of timber sold by the contractor. It is estimated that around 50% of the concession-holders contract-out forest exploitation to another party. This practice is condemmed by the government as it usually ends in violation of the agreement concerning forest conservation, replanting, limited felling, and the development of wood-based industries. In addition, many feel that the contractors pay little heed to environmental concerns. Forestry officials have begun taking action against culpable concession-holders by cancelling their concessions.

Table 32

Forest Concessions in Indonesia by Countries and Investment Types (December 1980)

Investment Type and Country	Investment (1000 U.S. $)	Area (1000 ha)	No. of Enterprises		
			Joint	Straight	Total
I. FOREIGN INVESTMENT					
a. Japan	50,150	1,362	10	2	12
b. Panama	1,500	85	1	--	1
c. Malaysia	41.200	1,753	14	2	16
d. Singapore	10,250	420	5	--	5
e. South Korea	31,500	875	4	2	6
f. Hong Kong	47,200	1,465	11	5	16
g. Philippines	52,500	988.5	7	1	8
h. U.S.A.	48,676	1,081	2	2	4
i. France	7,200	260	--	1	1
j. Italy	3,500	236	2	--	2
k. Netherlands	700	10	1	--	1
l. Others	15,500	215	3	--	3
Sub-total I	309,876	8,840.5	60 (6,728.25 ha)	15 (2112.25 ha)	75
II. DOMESTIC INVESTMENT					
a. Indonesia	1,201,229.456 + Rp 10,834.4 million	40,019.9	--	--	433
Total I and II	1,511,105 + Rp 10,834.4 million	48,860.4	60	15	508

Source: Directorate General of Forestry - 1980

For example, in early 1983 it was reported that 127 concessionaires had been notified of cancellation of cutting rights for breach of contract obligations mandated under the Forest Agreement. Specific allegations were defective forest harvesting plans, no attempt to reforest cutover areas, and no plans for plywood mill construction (Japan Lumber Journal, January 15, 1983).

The government has made an attempt to stem domestic failures by abolishing export duties on processed products in 1978, but in light of present concession failures, this action has had little effect.

5.2.2.2 Foreign Concessions

Almost all foreign investments in concessions are joint ventures which is actually a concession given to an Indonesian firm transferred to a foreign concern. According to Liang, (Masters thesis, University of Washington) this type of investment is considered to be the weak spot in the forest concession system in Indonesia. It is charged that the foreign partner tends to dominate the joint venture, and in the long run after production has provided a steady flow of cash, the foreign concern, not having a strong vested interest in the forest resource, has been found not to finance further investment to achieve satisfactory levels of reforestation.

As a result of this, a growing hostility toward foreign exploitation of the forest resource has arisen. The government has taken a somewhat knee jerk reaction to this sentiment by banning foreign participation in any new forestry project, even on a joint venture basis (Quarterly Economic Review, Annual Supplement, 1984).

Dozens of foreign logging concerns have opted to leave Indonesia, rather than invest millions of additional dollars into secondary processing

facilities imposed on their ways of doing business or on production or found it undesirable to live with other limits and constraints (some imposed years after they started operations). For the U.S., this has meant a pullout by two of the largest investors, Weyerhaeuser and Georgia-Pacific Co. Also, Japanese forestry investments in Indonesia, historically the principal source of tropical hardwood logs, presently have a high rate of mortality. Two large concerns, P.T. Triomas and P.T. Zedsko, have ceased functioning since 1979. The Japan Export and Trade Organization (JETRO) reports that five other Japanese forestry projects valued at U.S. $14 million have been "revoked" (Truitt 1983).

Also closed to foreign investment are sawmill and sliced veneer industries. The government insists, however, that investment opportunities are still available in logging plus processing facilities such as sawnmills, plywood mills, or pulp mill (Philippine Lumberman, Dec. 1983).

Forestry Minister Sudjarwo states "Indonesia has expanded its forest industry just about as much as it can. Investment possibilities in this field are 'almost at the saturation point'. However, opportunities in the pulp and paper industry remain 'wide open'." (World Wood, Nov. 1984).

Even though the government is enthusiastic about attracting foreign investment in selected areas and the existance of Indonesia's vast forest resource may whet the appetite of potential investors, there has generally been a great deal of resistance on the part of foreign firms to invest their capital in anything more elaborate than logging facilities. This 'wait and see' approach will probably continue to be the situation as companies are not keen on committing large sums of money for construction and operation of sawmills, plywood mills or pulp and paper mills.

Table 33. Indonesia: Size of the Market for Wood Harvesting and Processing Equipment (in thousands of U.S. dollars).

	1973	1974	1975
Timber Harvesting and Handling Equipment:			
Imports			
United States	1,269	1,398	765
Japan	1,078	3,343	3,088
Singapore	500	800	400
Malaysia	100	100	90
Philippines	50	60	10
West Germany	50	60	50
Others	100	120	100
Total	3,147	5,972	4,506
Wood Production and Processing Equipment:			
Imports			
United States	396	470	182
Japan	2,923	3,759	3,947
Singapore	1,917	236	383
West Germany	1,028	3,104	3,101
Taiwan	499	938	752
Australia	119	271	19
United Kingdom	82	114	310
Others	1,150	2,300	350
Total	8,114	11,192	9,044
Total Market Size	11,261	17,164	13,550

[1] Includes wheeled logging skidders; chain saws and accessories; logging chains, cant hooks, tongs, and other specialized logging tools and equipment, but excludes tractors and other heavy equipment used in road building and heavy construction for logging purposes.

Sources: Official Indonesian and supplier statistics and estimates based on trade source interviews.

BIBLIOGRAPHY

1. Quarterly Economic Review of Indonesia Annual Supplement 1982, The Economist Intelligence Unit, 1982. The Economist Publications, Ltd.

2. International Monetary Fund, Financial Statistics, Databank data base, CINTRAFOR, University of Washington, Seattle, WA.

3. Quarterly Economic Review of Indonesia No. 1, 1984. The Economist Intelligence Unit, 1984. The Economist Publications, Ltd.

4. Quarterly Economic Review of Indonesia. No. 2, 1984. The Economist Intelligence Unit, 1984. The Economist Publications, Ltd.

5. Foreign agricultural Service, U.S. Dept. of Agriculture Attache Report, Indonesia: Annual Forest Products Report. Report No. ID-3042, Sept. 28, 1983.

6. De Beijer, Dr. J. R., "Alternative Energy for Indonesia". Asian Timber. September/October, 1984.

7. Liang, DJWA Hui, "The Indonesia Meranti and Agathis." Masters Thesis, University of Wash. May 10, 1983.

8. World Wood Review. World Wood. November, 1984.

9. World Wood. February, 1983. News.

10. Profound Changes in Industry Result of 'Enforced' Industrialization. World Wood. April, 1982.

11. World Wood. April, 1983. News.

12. United Nations Development Programme 'Indonesia, Forestry and Forest Products Development', FO:DP/INS/78/054. Terminal Report. Rome, 1982.

13. Asian Timber. April, 1983.

14. 'Major Plans for Pulp and Paper Industry', Australian Forest Industries Journal, February, 1980.

15. Wood Pulp & Fiber Statistics, 1979-1980, 1980-1981, 1977-1978. Europe, Asia, Africa, Oceania, Central and South America. Pulp, Materials and Technology Group. American Paper Institute, Inc.

16. Sebire, R. A. Resource Review - The Forests and Forest Industries of Indonesia. Australian Forest Industries Journal. June, 1980.

17. World Wood. October, 1983. News.

18. Takeuchi, Kenji. Marketing Prospects for Tropical Hardwoods from Southeast Asia. Proceedings, World Trade in Forest Products. 1983. University of Washington Press.

19. World Wood. August, 1983. News.

20. World Wood. September, 1983. 'Asian Timber Industry had a Difficult 1982'.

21. World Wood. November, 1984. News.

22. World Wood. April, 1982.

23. United Nations Development Programme. Forestry and Forest Products Development. Indonesia, FAO/UNDP. Rome, 1982. Terminal Report.

24. World Wood. October, 1984. News.

25. Asian Timber. November/December, 1983. Barito Pacific Complex: a Huge Investment on the Banks of Banjarmasin.

26. U.S. Department of Commerce, Bureau of Census Statistical Abstract of United States. 1984.

27. Ross, M.S. Forestry in Land Use Policy for Indonesia (Doctoral Dissertation) Green College.

28. U.K. Tikal and Palenewen, J.L. (1974). Mechanical Logging Damage After Selective Cutting in the Lowland Dipterocarp Forest at Bolero, East Kalimantan. In Proceedings of the Symposium on the Long Term Effects of Logging in Southeast Asia (BIOTROP Special Publication No. 3) Bogor: SEAMEO Regional center for Tropical Biology.

29. 1984. Director of the Plywood Industry in Indonesia. APKINDO (Indonesian Wood Panel Producers Assocation) Jakarta, Indonesia.

30. Tropical Timbers of the World. U.S. Dept. of Agriculture. U.S. Forest Service Handbook No. 607.

31. Manguno, Joseph P. "Indonesian Timber Companies Cry Foul". Wall street Journal, April 11, 1984.

32. Japan Lumber Journal. January 15, 1983. '40 Indonesian HPH Holders Confiscated of Concessions'.

33. Quarterly Economic Review of Indonesia Annual Supplement 1984.

34. Sunduredjo, Karsudjano. 'Indonesia's Immense Forests Wake to Rapid Development. Philippine Lumberman. December, 1983.

35. Truitt, J. Frederick. "International Joint Ventures and the Pacific Rim Wood Industry". Proceedings, World Trade in Forest Products, University of Washington Press, 1983.

36. U.S. Department of State Airgram (unclassified) Report on the Timbering and Wood Processing Industries of Indonesia (Part One, CERP 5161) Drafting Date 4/7/80.

37. U.S. Department of State Airgram (unclassified) Report on the Timbering and Wood Processing Industries of Indonesia Part Two (CERP 5161) Drafting Date 4/7/80.

38. Forestry and Forest Products Development in Indonesia. Prospects for the Development of Pulp and Paper Industries in Indonesia up to the year 2000. FAO of United Nations Bogor. FO:INS/78/054. Working Paper 4, September 1979.