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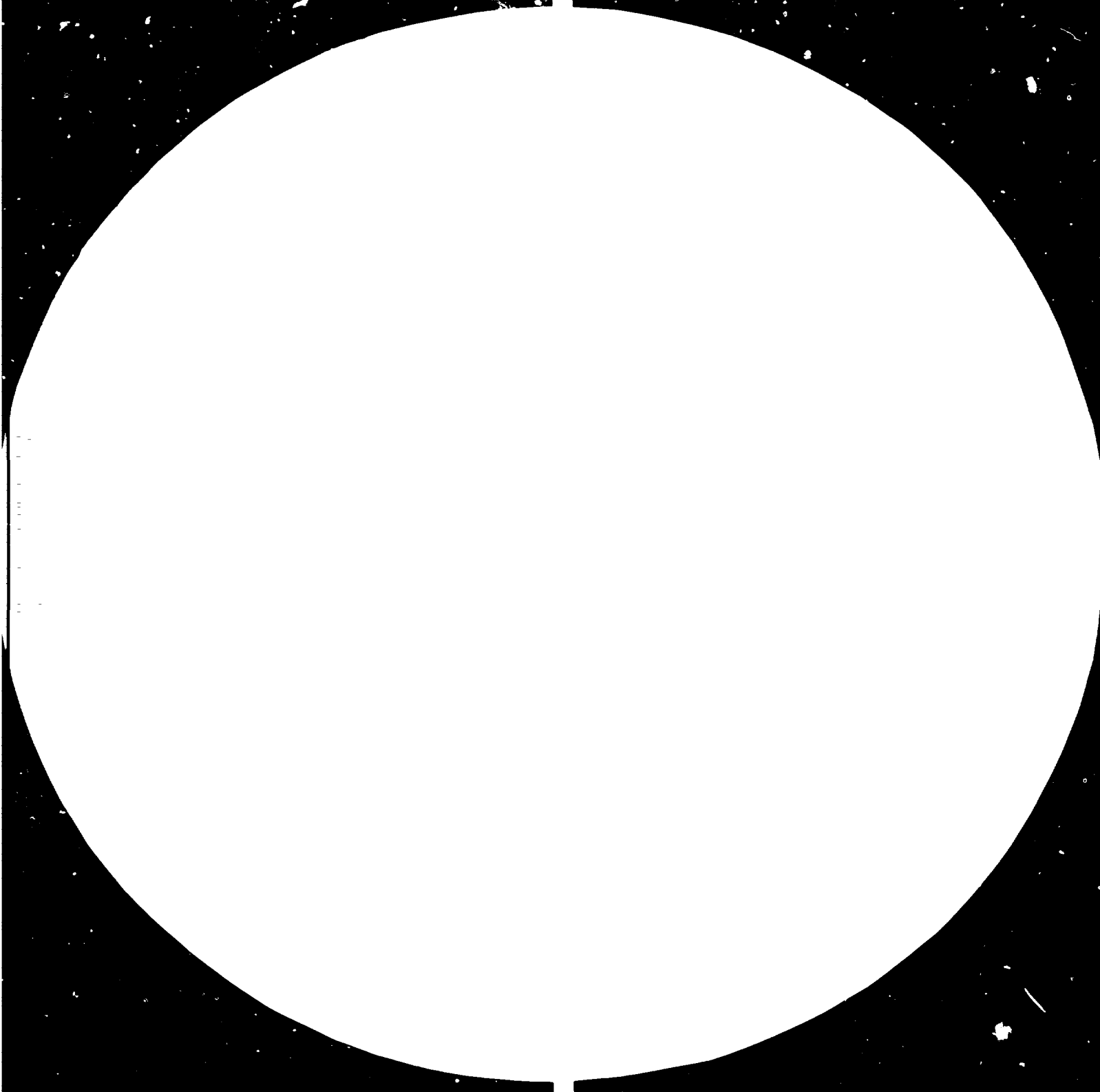

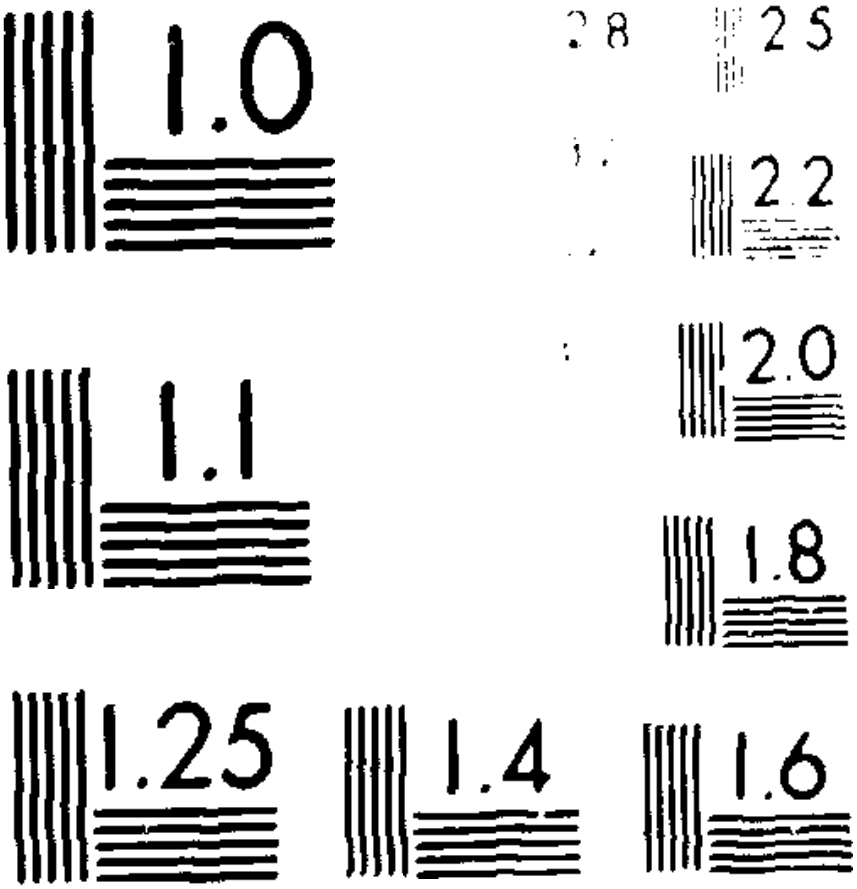
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REGIONAL SITUATION PAPER: THE WOOD AND WOOD PRODUCTS INDUSTRY OF ASIA, ITS CURRENT STATUS (1981 - 1982) AND FUTURE DEVELOPMENT *

by

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UNIDO Consultant

* The views expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

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TABLE OF CONTENTS

TABLES

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EXPLANATORY NOTE

The currency exchange rates used in the collation of data for this paper are as follows :

PAPUA-NEW GUINEA	: KINA	- K0.75	=	US$1.00
SINGAPORE	: S-DOLLAR	- S$2.00	=	US$1.00
INDONESIA	: RUPIAH	- Rp.635	=	US$1.00
MALAYSIA	: RINGGIT or M-DOLLAR	- M$2.15	=	US$1.00
THAILAND	: BAHT	- ฿22.50	=	US$1.00
INDIA	: RUPEES	- Rs. 9.90	=	US$1.00
PHILIPPINES	: PESOS	- PHP8.20	=	US$1.00

The following numerical and measurement conversions were used :

In INDIA - 1 LAKH = 100,000 units

For plywood volumes expressed in square meters :
Actual cubic volume calculated on the basis of 5 mm plywood thickness.

For Land Areas :

1 square mile = 256.65 Hectares (Ha.)

The following abbreviations were used in this paper :

Ha.	- Hectare (10,000 square meters)
D.B.H.	- Diameter at Breast Height, referring to standing tree (before felling)
cu.m. or m^3	- cubic meter
N/O	- refers to data which is available, but could not be OBTAINED during the survey mission.
N/A	- refers to data which is not AVAILABLE, either because it is not yet ready for public release, or that data is non-existent.
(1), (35), ----	- numbers enclosed in parenthesis appearing at the end of sentences or paragraphs, refer to sources listed in the Bibliography.

NEG	-	refers to statistic of negligible quantity in relation to other statistics presented in the same tabulation
NIL	-	none or ZERO Quantity
A.D.	-	Air-dried sawn timber
K.D.	-	Kiln-dried sawn timber
B.D.U.	-	Bone-dry unit, the unit of measure for woodchips
M.T.	-	Metric tons

The terms "small, medium and large" size mills, as used in this paper are relative sizes of such mills based on input/output volumes and mill manpower employed, as used and accepted in each country visited. These references are not related to any international standards for factory size. Hence, what may be a "large" sawmill in India would be equivalent to a "medium" size sawmill in Indonesia and the Philippines.

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I N T R O D U C T I O N

1. BACKGROUND AND OBJECTIVES OF THE PROJECT

Under the programme of activities designed to fulfill its original mandate "to promote and accelerate the industrialization of the developing countries", the United Nations Industrial Development Organization (UNIDO), at the Second General Conference in Lima, Peru, in 1975, decided that "every effort must be made to increase the share of world industrial production in developing countries to 25 per cent by the year 2000". At that time (1975), the UNIDO Secretariat estimated the developing countries to be producing only 10.3 per cent as compared to 8.2 per cent in 1960.

In accordance to the Lima Declaration, as endorsed by the UN General Assembly at its Seventh Special Session in September 1975, UNIDO has been conducting global Consultation meetings on selected industries since 1977. These Consultation Meetings produce a forum for a continuing North-South dialogue on specific industrial sectors and topics. The Industrial Development Board (UNIDO) has decided to include the First Consultation on the Wood and Wood Products Industry for the biennium 1982 - 83. The First Consultation Meeting on the Wood and Wood Products Industry will be convened in Finland in September 1983.

In preparation for the Global Preparatory Meeting, regional preparatory conferences have been scheduled for Asia, Latin America and Africa in 1982. This survey paper has been prepared "in connection with the world-wide study to be undertaken and as a means to identify the issues for the First Consultation". The following objectives have been set for the regional survey mission to the six selected developing countries in Asia :

"a. To give a clear assessment of the Wood and Wood Products Industry in the region,

b. To review the present status and expected future development,

c. To identify major constraints which give scope for international cooperation to overcome them, and

d. To identify potential participants (individuals and institutions) for the preparatory meeting to be convened at regional and global levels".

2. THE SURVEY MISSION AND THE REGIONAL PICTURE

Preparation of industry situation papers for each of the three regions were recommended during an Experts Group meeting in Vienna, in October 1981. To help prepare the paper for Asia, visits to six selected developing countries were also recommended. For Asia, the following countries were chosen : PAPUA-NEW GUINEA, SINGAPORE, MALAYSIA, INDONESIA, THAILAND and INDIA. The choice of these six countries is made more significant with the inclusion of the Philippine wood and wood products industry for the following reasons :

a. The selected countries possess more than 90% of the remaining tropical closed forests of Asia ;

b. The countries (excluding Singapore) represent different stages of "MATURITY" in the development and industrialization of the wood and wood products industry, with India coming out as the most "MATURE" and PAPUA-NEW GUINEA, the "INFANT" wood industry among the countries ; and

c. Singapore, devoid of the forest resources found in the other countries, presenting a well-developed wood processing industry.

Lack of time (only 8 weeks) was the principal constraint during the survey mission and the preparation of this paper, considering

the number of countries visited and the wide scope required of the study : from forests, to manufacturing and marketing, together with areas of the economy which affect the development of the industry in developing countries. The other factors considered include : transport facilities (both domestic and international) available to the country, national legislations and policies which affect the growth of the industry, financial and manpower resources available to the industry, and training facilities and programme for manpower skills development.

Lack of time also prevented as many visits to wood processing plants as was desirable. Thus, the Expert-on-Mission had to rely on each country's pertinent government agencies and/or industry associations to recommend visits to at least two factories from each sector of the wood processing industry : a) the most advanced and b) the mill which is considered most typical of each of the processing sectors in the country's wood industry. Nevertheless, additional plant visits were made in each country whenever time permitted. The current status and foreseeable future of the wood processing industry were also discussed with responsible officials of the factories visited. To widen the coverage of the survey, meetings with executives and plant managers from the primary and secondary sectors of the country's wood processing industry were also conducted. Common problems being encountered and potential problems expected to be encountered in each country's efforts to encourage further growth of the industry were also crystallized in such meetings.

Data from UN agencies (FAO, UNIDO, ITC, etc.) publications were used in instances where significant variance were encountered among data gathered from various sources in the same country, or where such data could not be obtained during the short period available for such purposes.

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The writer expresses deep gratitude to all government officials and private individuals in the countries visited who, in one way or another, have contributed to the preparation of this paper.

I. WOOD AS A RAW MATERIAL AND A RESOURCE

1.0 FORESTS AND TIMBER RESOURCES

1.1 Forests Distribution

About 292 million hectares of closed tropical rain forests still exist in Tropical Asia. Indonesia, Papua-New Guinea, the Philippines and Malaysia account for more than 65% of this forest area.(23). These four countries alone possess approximately 10 billion cubic meters of standing timber.

The forest areas in these four countries may be generally classified as follows :

Coniferous Forests	: 35.6 Million Ha.
Closed Broadleaved Forests	: 111.83 Million Ha.
Other (Bamboo, Mangrove, etc.) Forests	: 35.4 Million Ha.

Table I shows a more detailed classification of the forest areas according to exploitability and legal status.

Initial focus of this paper is therefore directed to an inquiry into the timber production and consumption balance of these four seemingly "Timber Surplus" countries during the next 20-year period (till 2000), as shown in Table II.

Table II gives the following indications :

1) Based on domestic demand for industrial roundwood up to the year 2000, Indonesia, Papua-New Guinea, Malaysia and the Philippines, in that order of decreasing surplus status, may be considered "Timber Surplus" countries ;

2) The indicated surplus for Indonesia and Papua-New Guinea are under-stated in view of the fact that the programmed annual production levels for both countries refer only to forest areas made available for exploitation during the period under study.

Vast areas of timberland (about 31,000,000 hectares in Indonesia and 21,000,000 hectares in Papua-New Guinea) still have to be declared open for exploitation. Hence, these two countries are not expected to experience any roundwood shortage during the period 1981 - 2000 ;

3) Although Table II indicated that both Malaysia and the Philippines have timber in excess of their domestic needs, their present installed capacities for processing wood are expected to erase the apparent surpluses. Malaysian forest authorities forecast timber shortage by the year 1990 in Peninsular Malaysia.(7) ; while the Philippine situation indicate possible shortage earlier than 1990. In fact, both countries have not programmed for any additional primary processing plants for wood, but, subject to certain limitations, only expansion and modernization of existing primary wood processing plants will be allowed.

The other three countries (India, Thailand and Singapore) covered by the survey mission are already importing wood and wood products to meet their respective domestic demands and provide raw material to fill in the deficiency of their domestic roundwood production.

The other Asian countries, as indicated in FAO studies are "TIMBER DEFICIT" countries, in varying degrees of deficiencies. This condition is further confirmed by the wood and wood products export figures given in Tables VI and VII where it is shown that substantial volumes of wood and wood products to other Asian countries were imported from Indonesia, the Philippines, Malaysia and Papua-New Guinea.

1.2 Forest Ownership and Exploitation Policies in the Region

National ownership of forest lands is most common in many countries in Asia. This type of ownership exist in the Philippines, Thailand, Indonesia, China and Bangladesh, among others. The right to exploit timberland in these countries is granted to private or public entities through contracts for definite periods of time. Thailand and the Philippines, exhibit extreme opposite situations with respect to governments' participation in the exploitation of forests. 90% of the forest exploitation activities in Thailand is done by the national Government through a corporation wholly-owned by the government. In the other extreme, we find hardly any forest exploitation being done by the Philippine national government, as almost all timber licenses are given to the private sector. Terms and conditions covering the manner of exploitation and extraction of timber are specifically laid down in the exploitation agreements between the government and the licensees. These conditions of use usually reflect the national government's forest industry development policies, which, in general, aim to preserve the continuity of the forest resource through judicious felling of timber, forest rehabilitation through reforestation and afforestation, and a controlled rate of timber production.

State or provincial ownership of forest lands is found in such countries as India, Pakistan and Malaysia, among others. Exploitation policies are established and enforced by the state and provincial governments, with consultation and advice from the national governments. The state or provincial governments have a high degree of autonomy in the management of their forest resources.

The situation found in Papua-New Guinea is unique among Asian countries. This situation is brought about by the country's recognition of tribal ownership of land in the early part of 1900's which was subsequently adopted when their present Constitution was promulgated. Thus, the Timberland and other natural resources that exist in customarily-owned lands belong

to the people who have been living on the land. The implementation of government policies on land use and exploitation thus becomes cumbersome, for oftentimes tribal interests do not completely agree with national policies. The magnitude of this problem is emphasized by the fact that more than 90% of the forest lands belong to numerous different tribes in the country. Thus, the national government of Papua-New Guinea has provided for three methods by which forest may be exploited in a manner which conforms to national policies and recognizes tribal ownership of the land, at the same time, to wit : (33, 47 and 64).

a) Timber Rights Purchase - This method applies largely to large scale exploitation projects. The national government acquires timber rights (the right of felling, cutting, removing and disposing of the timber) thru negotiations with the customary owners. Upon consumation of such Timber Rights Purchase agreement, exploitation permits can then be issued to concessionaires under terms and conditions which conform to national forest policies.

b) Native Timber Authority - Authority is granted to any person to purchase timber directly from a customary owner upon payment of fees to Forest Inspectors. This apply only to small volumes of timber.

c) Private Dealings Agreement - Owners of timber by natural custom can dispose of their timber to any person provided the Minister of Forests is satisfied that conditions of the sale conform to national policies. Only a few of this type of agreements have been approved, so far.

In order to attain better control of the exploitation of its forests resources, the government of Papua-New Guinea is now engaged in a huge programme to acquire Timber Rights Purchase from the customary owners.

Although problems arise in the implementation of national policies on forest industry development, interviews with various administrators of country's forest policies and the timber licenses, indicate that more effective control and management of the country's forest resources is attained under national ownership of forest lands.

1.3 Deforestation, Degradation, Afforestation and Regeneration of Forest Resources

Before the establishment of forest development and management programmes in Asian countries in the late '60's, deforestation was rampant and beyond control of the national governments of most Asian countries. Thus, we find huge areas of timber stands laid to waste by shifting agriculture and the abusive cutting practices of the mining industries in Asia. As the pressure for agricultural land use mounted with the increase in each country's population, timberland were converted to farming, pasturing and other uses, without due consideration for the accepted practice of balancing the extraction of timber with the natural tree growth cycles. The status of deforestation in Asia's major forest areas as of 1980 is given in B-4 of Table I. Indonesia reported 28 - 37 million hectares converted to agricultural and other non-forestry purposes, of which approximately 90% occurred before a feasible national policy on forest exploitation was adopted in the middle of 1960's. (24, 88, 91 and 96). Lower degrees of deforestation were reported by the other countries surveyed. However, the annual rate of deforestation in these countries has been curtailed and brought to more controllable levels with each country's adoption of wise forest exploitation policies. To date, rules and regulations governing exploitation of forest resources have become more rigid and strict in the face of the countries realization of their dwindling forest resources. Simultaneously with the implementation of policies to arrest the wanton and undesirable practices of deforestation, governments have adopted forest rehabilitation programs. Incentives were provided for the private sector to cooperate

in the country's forest rehabilitation programs. The Philippine government has even gone to the extent of providing specific funds to encourage tree planting and forest rehabilitation and including such activities in the country's Investment Priorities Programme.

The extent of achievements of each country in this direction is shown in C-1 and 2 of Table I. (30).

1.4 Timber Production

Annual availability of round logs in Asia is estimated at more than 200 million cubic meters. More than 60% of these is contributed by the timber producing countries visited in this survey mission (excluding Singapore which does not have any forest land to speak of a forest industry in the country). Of this annual forest harvest potential, approximately 75.8 million cubic meters are sawlogs and veneer logs (see E-3, Table I), which are predominantly of the Dipterocarp or broadleaved species.

Actual production since 1976, however, has been much below the potential harvest figures (see F, Table I). The principal reasons for low harvest are summarized as follows :

a) The slump in the international wood and wood products market which has prevailed since 1975, with a slight recovery in 1978-79, has discouraged loggers from exercising their prerogatives to produce timber to the Maximum Allowable Cut, as provided in their timber licenses ;

b) Government policies in these major Asian timber sources have shifted towards more industrialization, so that the transition from purely extractive type of forest industry to a more wood-processing-oriented programme thru tight restriction and/or partial or complete timber export ban discouraged concessionaires from operating at higher levels of timber extraction operations, presumably on a temporary basis until their processed wood products have

attained quality and price levels which are acceptable and competitive in the foreign market ;

c) The significant increases in costs of oil products during the period, effected high increases in cost of production, so that marginal operators found it totally unprofitable to continue operations, in the face of low market prices for round timber.

Actual sawlogs and veneer logs production in 1980 in the six countries visited amounted to a total of approximately 55 million cubic meters which is only 64% of the available timber cut for the year, and significantly lower than their production during the previous years.

These conditions prevail up to the present time, although some signs have appeared to indicate possible recovery of the wood and wood products international market towards the end of 1982.

However, any up-turn in timber harvests in the region will depend to a great extent on the successful attainment of the wood processing industries development programmes of the various countries.

1.5 Timber Species and Future Timber Supply

As shown in Table II, only Indonesia and Papua-New Guinea are expected to remain as "Timber Surplus" countries in Asia towards the end of the last decade of this century. This eventuality raises the importance of timber specie utilization for both the "Timber Surplus" and "Timber Deficit" nations in Asia. The forests in the Philippines, Malaysia (including Sarawak and Sabah) and Kalimantan (of Indonesia) have more homogenous timber specie growths than the rest of the area. The current wood and wood products market is partial to a small number of timber species (Philippine Lauan family, Malaysian Ramin and Teak, Indonesian Meranti, Ramin, Keruing and Teak, Indian Padauk, Teak and Rosewood and Thai Teak). The supply of these timber species is expected to

become less and less towards the end of the century, as the remaining operable forest areas will be more and more heterogeneous in timber species contents, such as those found in the forests of West Irian (Indonesia) and Papua-New Guinea.

The matter of more intensive utilization of what is currently known as "Commercially-Less-Acceptable Species" i/ thus becomes a problem which needs the immediate attention of both the supplier and buyer countries of wood and wood products. This problem shall be discussed at length in latter sections of this paper.

1.6 Fuelwood and Other Minor Forest Products

1.61 Fuelwood

Among the developing countries in South, Continental Southeast and Insular Southeast Asia, India and Thailand have shown the most concern for fuelwood supply.

In most developing countries a major portion of the fuelwood supply is obtained from sources outside of the closed tropical forest areas and are not included in the monitoring activities of government agencies. Thus, data on fuelwood supply and consumption available in those countries hardly reflect the true supply and demand picture of fuelwood.

Section G, Table I, shows data on fuelwood requirements of the countries visited during the survey mission. It will be noted that Singapore has discouraged the use of fuelwood for household and industrial purposes under its strict anti-pollution laws.

1.62 Rattan Products

Next to wood, rattan has become a major forest product of countries with tropical forest areas. This material

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i/ --- instead of the widely used term "Lesser-Known-Species".

has found extensive use in the production of furniture and other items of room furnishings.

The Philippines has led all other developing countries in the development of the rattan furniture manufacturing industry (see Tables VII, IX, X and XI) to the extent that it has become a significant export product of the country. This has led the Philippine government to ban the export of unprocessed rattan poles in order to assure the domestic supply of the material.

Indonesia is another major source of rattan materials. Table VIII shows that the country exports more unprocessed rattan materials and less manufactured rattan products than the Philippines.

Although data on its rattan products industry was not obtained in Thailand, visits to rattan furniture factories indicate a significant degree of development of the industry in the country.

Papua-New Guinea is also keenly interested in its rattan resources. However, development of the rattan industry in the country has to wait for further development of its logging industry. Papua-New Guinea may be expected to become another major source of rattan products in the last decade of this century.

1.63 Bamboo

Bamboo is commonly found in lowland areas where there is abundant supply of moisture. It is also found in the lower levels of tropical forests. China and Japan are known to have well developed bamboo industries which date as far back as the 17th century. Considerable volumes of bamboo clumps are also found in South, Continental Southeast and Insular Southeast Asian countries. There are about 75 genera and 1,250 species of bamboo, differing according to the climate and soil conditions of their habitat.(98).

Sharma (98) has presented an extensive treatise on the distribution of bamboo in South and Southeast Asia and the Far East, citing its usefulness, characteristics, method of propagation and care. It was pointed out that 80% of the bamboo produced in Asian countries are used by the people for housing materials, food containers, etc., and only a very negligible amount for the production of paper. Among Asian countries, India has used bamboo more intensively for paper making.

Yet, annual reports prepared by Government forest agencies in these Asian countries, hardly give enough importance to bamboo, it being considered as a minor forest product.

2.0 PROBLEMS IN THE EXPLOITATION OF FOREST RESOURCES

The principal aim of the forest industry is to obtain the maximum possible amount of natural raw materials per unit area of forest land exploited. However, extraction activities of forest materials is allowed only to the extent that they conform to each country's policies and guidelines on forest operations which are primarily geared to conserve the country's forest resources. Except in specifically selected forest areas which are eventually converted to agriculture or other purposes where "Clear Cutting" is allowed, developing countries in Asia have permitted only "Selective Timber Felling" in areas which have been declared or reserved for the country's permanent productive forests. No timber cutting is allowed in forest areas which have been declared as protective forests - areas for watersheds, animal sanctuaries, parks, etc. These policies and regulations on the preservation of forest resources have been adopted and seriously implemented only during the last 20 or 25 years, so that it is still too early at this time to attain a true measure of their effectiveness.

2.1 Forest Fires

Undesirable destruction of forest lands is reported as the major problem in the conservation of forests. Forest fires,

whether initiated by man or natural cause, are reported to have wasted hundreds of thousands of hectares of forest land, particularly in countries which have pronounced dry seasons in the year. Unfortunately, the type of forest fire-fighting organizations found in developed countries are generally non-existent in developing countries. Such fire-fighting organizations cost money to maintain and operate. Thus, in the economic tug-of-war for priorities of allocating the developing country's meager finacial resources, protective measures to safeguard forests are often forgotten or allocated token appropriations which usually are not enough to make them truly effective.

2.2 Shifting Agriculture

Uncontrolled conversion of forest lands to "shifting agriculture" is the next major problem of developing countries in their efforts to conserve their forest resources. Indonesia has reported millions of hectares of virgin forest lands laid waste by "shifting agriculture" until the late 1960's. Similar situations were also reported in the Philippines, Thailand, Malaysia and Papua-New Guinea, although to a lesser degree.

2.3 Forest Surveillance and Protection

The solution to the problem of forest fires and undesirable effects of "shifting agriculture" lies in a more vigilant and effective organization of forest rangers and forest guards. At present the burden of this responsibility is laid on government forest protective agencies. In some countries like the Philippines, India and Indonesia, the private sector, mostly forest concessionaires, are required to share in the protective and safeguarding activities of government agencies. The common complaint from these agencies, however, is that there is so much to guard 24-hours a day with so few people to do the job. It is a common practice among the developing countries visited during the mission to have one forest ranger or guard responsible for at least 10,000 hectares. In some situations, as in East and Central Kalimantan, West Irian, Indonesia, and in the Sepik area and Western Highlands of

Papua-New Guinea, as much as 100,000 hectares (or more) is under the care and responsibility of one forest ranger, who oftentimes has to take care of his forest protection activities on foot, aside from performing other responsibilities called for by his position.

It is therefore a matter of the country's degree of concern for the protection and preservation of its forest resources, relative to other national socio-economic problems, which will determine how effective its forest protection organization and system of activities is set up and maintained.

2.4 Increasing the Yield Per Hectare of Forest

Profitability considerations have always guided logging concessionaires in their timber extracting operations. They operate on the basis of marketability of their timber harvest. Thus, they are prone to cut only those timber species which are readily accepted in both the foreign and domestic timber market.

On the other hand, recent forest inventories in developing countries of Asia indicate that timber harvest per hectare of forest land can be increased by as much as 10% in relatively homogenous forest stands (such as those in Indonesia's Kalimantan forests, the Philippines and Malaysia) and up to 40% in more heterogeneous forest stands (such as those in Indonesia's West Irian and Papua-New Guinea) if "Commercially-Less-Acceptable Species" of timber were also cut by logging operators.

So much work has been done in each country on the identification and determination of physical and machining properties of the "Commercially-Less-Acceptable Species". However, the results of these research activities have yet to be translated in terms of industrial practice and commercial acceptance.

To-date, it appears that among developing countries in Asia, India has gained significant progress in the use of

"Commercially-Less-Acceptable Species" for industrial purposes. It is the writer's opinion that other developing countries of Asia, and of the world for that matter, will benefit from India's experience on this aspect of the forest-based industry.

Another major aspect of increasing the timber yield per hectare of forest land is brought up by studies on the portion of the standing tree which is eventually converted to processed products which are usable. Rough estimates for tropical forests indicate that only a maximum of 50% of the tree is eventually brought down from the forests to be processed in industrial mills. The other 50% tree residue (composed of stumps, branches, toppings, etc.) are left to decay on the forest grounds. This does not include the amount of residual trees destroyed during timber felling operations and roads and skidways construction activities. Accurate figures on this type of wastage of forest resources are not readily available in many developing countries, for it appears that the monitoring and reporting systems of those countries are not adequate enough to cover such data.

Certainly, more intensive measures by governments of developing countries, together with increased cooperation from the private sector of those countries can do much to further the achievements of current activities to protect and conserve their forests. As pointed out by Rao (91), and amplified by FAO (21 and 62), government forestry development programmes may be better implemented should these include steps designed to satisfy "the spectrum of basic needs of rural people in a rational manner". Furthermore, simultaneous and more concentrated efforts by both the government and private sectors in those countries to make use of the "Commercially-Less-Acceptable Species" will result in a higher yield per hectare of forest land exploited, more specifically in terms of government revenues, and increased profits for the private sector.

II. THE WOOD PROCESSING INDUSTRY - MECHANICAL PROCESS

3.0 GENERAL OUTLOOK

There is an accelerated shift towards further industrialization in the forest-based industry among the timber-rich developing countries of Asia during the last 5-year period. To-date, all timber producing countries have imposed either rigid restrictions or total ban on the export of roundwood. Thus, greater and increasing volumes of sawntimber, plywood, veneer and other forms of processed wood products is expected to be supplied by the timber-rich countries of Asia. Among the developing countries of Asia, Indonesia, Malaysia, the Philippines and Papua-New Guinea will dominate the wood products supply during the remainder of this century. However, by the 21st century, only Indonesia and Papua-New Guinea will have adequate timber resources to sustain their expanded programmes for the industrialization of their wood industry.

Thus, Malaysia, Thailand, India, Singapore and the Philippines have not programmed for additional primary processing plants for wood products within the next decade. With the exception of Singapore, these countries will allow limited expansion and modernization of existing primary wood processing plants. Singapore, without its own forest resources, saddled with strict anti-pollution laws and limited land area, understandably, has refrained from encouraging further expansion of its wood processing industry. In fact, it is seriously considering the possibility of phasing out its wood processing industry in favor of other industries which are less labour-intensive, require less land area per unit return on production and less pollutant-generating activities than the wood processing industry.

The current forest-based industries development programmes of Indonesia and Papua-New Guinea will certainly require foreign assistance in the following aspects of the industry :

a) Financial support for projects to establish additional wood processing plants ;

b) Improvement of existing wood processing technology to maximize the utilization of timber and improve product quality ;

c) Training skilled and highly-skilled manpower needed to operate the wood processing mills and properly maintain machinery and equipment ;

d) Training of middle management personnel needed to put both the new and existing wood processing plants in a position to maximize utilization of the raw material inputs, up-grade and maintain product quality at levels acceptable to both domestic and foreign wood products markets and at costswhich are competitive in the world wood products market ;

e) Marketing and transport activities ; and

f) More industry-oriented research and development activities.

The remainder of the century will find the Philippines, Malaysia and the "Timber Deficit" countries of Asia engaged in more intensive activities designed to attain higher levels of utilization of the "Commercially-Less-Acceptable Species" and plantation timber. Existing mills in these countries are now being re-evaluated for possible expansion and modernization to improve productivity and reduce unit production costs to counter-act the unfavorable effects of increasing costs of raw materials, labour, power and operating capital. The production of wood-based panels other than plywood in these countries is also expected to be intensified towards the end of this century, in view of the decreasing supply of industrial round logs, and according to the countries' programme to maximize utilization of its forest resources. Most "Timber Deficit" countries of the region will be looking for sources of building and construction materials other than the traditional species formerly supplied by their forests. Work has already been initiated in these countries to use coconut timber, rubber wood, bamboo, etc., in the building and construction industry.

4.0 THE PRIMARY WOOD PROCESSING SECTOR (Excluding Chemical Processing of Wood)

4.1 The Sawmilling Industry of Asia

To-date, there are thousands of sawmilling units operating all over Asia ranging from small units using circular saws to the more advanced highly conveyorized and semi-automated bandmills. Indonesia alone, reports 3,400 units as of 1980, and expects this to reach the 4,000 level by 1982 (see Table III).

However, only a very small percentage of these sawmilling plants may be considered up-to-date in design and construction with productivity comparable to levels in more advanced countries. The rest of the sawmills reported in operation are quite old, using the more wasteful circular saws, and manual transfer of materials-in-process, thus operating at significantly low levels of efficiency and productivity. China, which has the oldest sawmilling industry in Asia, reported 209 sawmills operating within the forestry administration and another 1,000 (approximately) units integrated with furniture factories, with a total sawmilling input capacity of more than 35 million cubic meters of round wood in 1980. Data on the sawmilling plants of selected developing countries in the Region are given in Table III. Based on the average sawmilling capacity and output per sawmill from Table III, the developing countries of Asia may be estimated to have a total installed sawmilling input capacity of about 180 million cubic meters i/ of sawlogs, with an estimated output of 85.4 million cubic meters of sawn-timber, as of 1980. (65). The total installed production capacity is expected to increase, primarily due to the expansion of the industry in Indonesia and Papua-New Guinea during the remaining years of this century.

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i/ --- based on 48% recovery rate of sawn-timber

Japanese sawmilling equipment dominate the sawmilling industry of the Philippines and Indonesia. Only a few mills in these two countries are equipped with American or European machinery. The working complements of the industry in other Asian developing countries are mixtures of European, American and Japanese products. It is interesting to note that locally fabricated sawmilling equipment have gained acceptance in the Philippines, India, China and Thailand.

The main problems of the industry is low yield of sawn-timber with an approximate industry average of 48%, and low utilization of the installed processing capacity. Except in Singapore and the more advanced countries of Asia it is typical of sawmilling plants in the region to operate for one work shift per day (either 8 or 10 hours per work shift), and not at all during the rainy season, when round logs are not readily available.

Among other causes, low sawn-timber yield in developing countries of Asia, is principally caused by :

a) Use of circular saws and other old types of timber cutting machinery which use cutting blades with wide kerfs ;

b) Obsolete sawing techniques which ignore the advantages of cutting patterns fitted to the timber size and species to obtain better yield and higher grades of sawn-timber ; and

c) Lack of market for narrow width and other off-standard size boards.

Low levels of utilization of sawmilling capacities are primarily caused by the unreliable and highly fluctuating supply of roundwood. The problem is also greatly aggravated by the high incidence of machinery breakdown due to poor maintenance practice and/or high frequency of stoppage for changing cutting blades. These undesirable situations may ultimately be traced to inadequate "saw doctoring" technology

and lack of spare parts for regular and proper maintenance of sawmilling equipment. These problems become predominant among mills which have operated for two years and longer.

Solutions to these common problems among Asian sawmilling plants are indicated as follows :

1) Introduction of more efficient sawmilling technology thru :

   a. The re-training of key supervisory and operations personnel of sawmilling plants ;

   b. The re-training of "saw doctoring" personnel on better techniques and practices of sawblade maintenance ;

   c. Wherever socio-economic conditions of the locality will permit, encourage the replacement of old circular saws with the less woodwaste-generating bandsaws and introduce basic conveyor systems to transport material-in-process from one work station to another ; and

2) Introduction of the basic concepts of production management, particularly in the control of materials and spare parts inventories.

4.2 The Plywood and Veneer Manufacturing Industry

Next to sawmilling, veneer and plywood manufacturing dominates the primary wood processing industry of Asia.

To-date, there are no less than 350 plywood and veneer manufacturing plants in the developing countries of Asia, including blockboard manufacturing mills. China reports a total production 300,000 cubic meters in 1980, which were produced by eleven plants ranging from 10,000 to 20,000 cubic meters annual capacity and several other smaller plants with about 5,000 cubic meters annual capacity. (103). Thailand

has thirteen veneer and seventeen plywood plants which have a total installed capacity for producing at least 15,000 cu.m. of veneer and 80,000 cu.m. of plywood per annum. Table IV, shows corresponding data on the veneer and plywood manufacturing plants of selected developing countries in Asia. Indonesia dominates the plywood industry with a reported total installed capacity for processing 400,000 cubic meters of logs into veneer and a total installed capacity for processing 2,133,000 cubic meters of logs into plywood in 1981. The veneer and plywood industry of Papua-New Guinea is the youngest and smallest in the region with a total installed capacity of 90,000 cubic meters of veneer and 32,000 cubic meters for plywood. (16 & 39). Its veneer industry started only 1978, much later than its plywood industry which started in early '70's.

Utilization of installed capacities for veneer and plywood plants in the region is reported at between 50% to 70%, with Thailand and India reporting 50%, reflecting their problems in the supply of roundwood in 1980, and Singapore reporting the highest at 70% for both veneer and plywood plants. The Philippines reported the lowest utilization, 25% of installed plywood capacity, reflecting the bad plywood market situation in 1980 which forced more than 50% of the plywood plants to operate intermittently or totally stop operations. However, a strong veneer market, primarily Israel, made it possible for all the nine Philippine veneer plants to continue full operation during 1980, assisted by a number of plywood plants which produced veneer only. The reported yield rates for 1980 showed a wide range, 42% to 70%. Countries with plywood mills using smaller roundwood diameters showed lower yield rates than countries whose plywood mills input consist of larger diameter roundwood. Among the developing countries of Asia, and presumably including the developed countries of the region, only Indonesia has made definite plans for the expansion of its veneer and plywood manufacturing industry. Papua-New Guinea has not yet made definite plans for future expansion of its veneer/plywood industry, in spite of its "Timber Surplus" status.

High glue and transport costs prevent its plywood products from being competitive in the foreign market. In fact, the country still imports a significant portion of its total plywood requirements.

Japanese veneer and plywood manufactruing equipment dominate the industry in the Philippines and Indonesia. European equipment predominates in the plywood and veneer industry of India, Thailand, Malaysia and Singapore. However, locally fabricated veneer driers, multi-opening hot and cold presses, trimming saws and sanders have found wide acceptance in India.

Quality levels of raw plywood (excluding those with special veneered faces) manufactured in the developing countries of Asia are generally of lower quality as compared to corresponding products manufactured in the advanced countries of Asia, like Japan and the Republic of Korea. However, the raw plywood products of the Philippines and Singapore appear to have attained quality levels comparable to those manufactured in Japan and Korea, such that both developing countries have exported significant quantities of plywood products (at comparable prices) to the same countries (such as the U.S.A. and U.K.) which buy the products from the Republic of Korea and Japan.

Except for a few new plywood plants in the Philippines and Indonesia, whose recovery rates are comparable to plywood plants of equal size in Japan and the Republic of Korea, the recovery rates of the plywood and veneer industry in the developing countries of Asia are generally much lower than those of Japan and the Republic of Korea. Among others, the most dominant factors for this situation are :

a) The roundwood inputs of veneer and plywood mills in the developing countries have generally high proportions (up to 25%) of low grade logs (Sawlog 3 and 4) ; while the roundwood inputs of the veneer and plywood plants in Japan and the Republic of Korea are Sawlog 2 and better, with at most 10% of logs whose nominal diameters

are smaller, 50 to 60 cm, but whose quality are equal to Sawlog 2 and better, locally known as LSQ (Lowest Sellable Quality) grade logs. It should be noted, in this connection, that for reasons of higher revenues the timber-exporting countries of Asia export Sawlog 2 and better to Japan and the Republic of Korea. There have been small shipments of Sawlog 3 grade roundwood to Hongkong and Singapore, but these were exceptions to the general practice.

b) Except for a few plywood and veneer manufacturing plants, installed in the last 5 years, the equipment complement of the industry in the developing countries of Asia, except Indonesia, are generally old with a generous proportion of second-hand and/or re-built pieces of equipment. This condition, leads to relatively low yield rates. "Below par" machinery maintenance practice and manual handling of materials-in-process, further lead to higher percentage of low grade veneer sheets and plywood panels ; and

c) The veneer and plywood manufacturers in most developing countries of Asia have still much to learn about production technology for veneer peeling, veneer drying, gluing and sanding as applied to their respective timber species input. It is a common characteristic of these plants that so little has been added to the technology acquired from outside sources at the beginning of plant operations.

The solutions to these common problems of the industry are apparently indicated by the type of problem. Almost all timber-exporting countries of South and Southeast Asia may have found a solution to the problem of low grade input for their veneer and plywood mills, through the limitation for total ban of roundwood exports. India, it appears, had long recognized the importance of developing its own veneer and plywood manufacturing technology to suit local conditions, by establishing the Indian Plywood Industry Research Institute in the early

part of 1960's.

The following further moves will help the improvement of the industry :

a) Establishment of an institution whose main objective is the development of existing technology of the country's veneer and plywood industry to make it more suitable and responsive to the conditions peculiar to the country, and train industry personnel in the practical application of these improved or new-found technology to their respective plant operations ;

b) Re-training of key plant personnel in better supervisory and production management techniques ; and

c) Installation of adequate quality control systems for raw materials, materials-in-process and end-products.

4.3 Other Wood-Based Panels Industry

4.31 Particle Board Manufacturing

China, with a total installed annual capacity of 60,000 cubic meters, and India, with nine plants and a total of 64,000 tons installed capacity per year, have shown more interest in the development of the particle board industry than other developing countries of Asia. Table V shows the state of the industry in selected developing countries of Asia as of 1980.

Both China and India started the industry with technology and machinery acquired from external sources (Western Europe) and subsequently developed modified versions of the imported process to suit the conditions of material supply and available labour skills in their respective countries. (31, 63, 77 & 103).

The other developing countries are still in the process of learning about the technology and equipment acquired

from foreign sources (predominantly European). Technical and raw material supply problems beset the two particle board plants in the Philippines ; while technical and glue cost problems prevent continued operations of the particle board plant in Indonesia. To-date, no report on any significant development of this industry in these developing countries is yet available. It is thus understandable that country programs are not definitely set for this sector of the wood-based panel industry.

4.32 The Fibreboard Manufacturing Industry

Here again, China, with an annual installed capacity of 300,000 cubic meters, and India, with 53,000 tons/year, lead the other developing countries of Asia. Both countries have programmes to expand their fibreboard manufacturing industry up to the year 2000. China is reported to have developed the technology for the wet-process of fibreboard manufacture at annual plant capacities (2,000 to 5,000 tons) considered well below economic levels in Europe, Canada and the United States of America. Similarly, India has planned to increase its installed annual capacity for fibreboard to produce 10,000 tons annually by the year 2000 through small wet-process fibreboard plants that it has developed to suit the different local conditions in various states of the country.

It should be noted that both India and China are "Timber Deficit" nations, and the most highly populated nations of the world, with diverse types of forests and timber species, ranging from the tropical types to the predominantly coniferous forests of higher latitude countries. These conditions appear to have motivated these countries to maximize utilization of their forest resources in this direction.

Among the other developing countries of Asia, only

Thailand and the Philippines have shown serious interest in the manufacture of hardboard. Both have installed capacities of 265 tons/day using the Swedish wet-process. To-date, no information is available on the countries' plans to expand their hardboard manufacturing facilities in the future.

5.0 OTHER TYPES OF WOOD-BASED PRODUCTS PLANTS

In addition to the production of basic wood-based panels, the developing countries of Asia, in their efforts to maximize the utilization of their forest resources, have engaged in the production of other wood-based products. Malaysia has three plants manufacturing wood-wool cement slabs. The Philippines, although achieving some success with its wood-wool cement plant (locally known as "Light-Weight-Concrete"slabs), has shown more interest in the manufacture of blockboard panels to maximize the utilization of residues developed in the operations of its woodworks and sawmilling plants. Its twelve blockboard plants have contributed greatly to the revenue generation status of the plywood industry, particularly during the current international wood products market slump. China has also encouraged the development of its blockboard panel production and counts with seventy plants which produced 6.3 million pieces of table-top panels in 1980. (10³).

Both Papua-New Guinea and Singapore have turned to the production of woodchips as a vehicle for maximum utilization of its wood resources. Singapore has two woodchip plants, converting the manufacturing residues of its wood-processing industry into marketable products. Papua-New Guinea has reported successful operations of its first woodchips plant in 1980, using its abundant stock of long-fibered timber species. The country has plans to expand its woodchips manufacturing industry to attain a total installed capacity producing 500,000 BDU of woodchips annually during the last two decades of this century.

Section C, Table V, gives more details on this aspect of the wood processing industry.

6.0 THE SECONDARY WOOD PROCESSING SECTOR

Except for the furniture manufacturing industries of China and Singapore, the following characteristics generally describe the industry in the other developing countries of Asia :

a) Each country's secondary wood processing industry is highly fragmented, composed of units widely ranging in size - from a family-affair shop with less than 10 workers producing a few furniture items each month, to factories employing more than 300 workers having capacities which process up to 750 cubic meters of solid wood per month into various types of furntirue items, case goods and builders' woodworks ;

b) The existing technology levels correspondingly vary from the hand-tools level to fully-mechanized factories equipped with basic and modern woodworking machinery, woodwaste exhaustion systems and conveyors, which produce both panel-based type and solid-wood construction type of furniture items, mouldings and beadings and other forms of builders woodworks ;

c) Product specialization and serial production of furniture, joinery and other woodworks products are only found in export-oriented factories which usually have foreign marketing tie-ups ;

d) The use of basic woodworking machines is generally confined to shops which cater to the upper-middle and higher-income segments of the population. However, these pieces of equipment are more commonly used as tools, rather than as industrial machines, for these manufacturing units accept orders for any type and design of furniture ;

e) Quality levels of the products usually correspond to the minimum quality level acceptable in the local market, but which would hardly find acceptance in the

international market ;

f) The use of inadequately seasoned sawn-timber leads to faulty joinery, poor surfacing of components and low-grade workmanship in general, and to a large extent prevent the production of inter-changeable furniture or joinery component parts ;

g) Productivity, in general, is low, as a result of the antiquated production techniques being used, poor machinery lay-out and poor "house-keeping" practices ;

h) A majority of the furniture and joinery factories are located around urban centers of each country so that channels of distribution of the products are limited by the inadequate land transport infrastructure system ;

i) Formal product packaging is almost totally absent for deliveries are based on assembled and finished furniture pieces, or on sub-assemblies which are completely assembled at customers' sites ;

j) Up-to-date and reliable data about the industry, as a whole, is hardly available ;

k) They lack the industrial infrastructure and research institutions available to the industry in developed countries ; and

l) They lack competent designers and product engineers.

6.1 Status of the Secondary Wood Processing Industries of Selected Asian Developing Countries

6.11 China

China is reported to have around 3,000 furniture plants with a total employment of 290,000 workers, technicians and supporting personnel. (74 & 102). About 10% of the industry's output is for export. There is indicated

organization and direction of the industry as a result of the centrally-planned and controlled economy of the nation. Thus, serial production of furniture, joinery and woodworks products has become a general feature of the industry.

Eying the export potentials of the industry, the government of China has taken steps during the last two decades to develop the industry with the establishment of furniture research institutes in Beijing, Shanghai and Guanchow among others. As an effect of the advanced development of the country's wood-based panels industry, the government has taken steps to encourage a shift to panel-based furniture construction. Specialization in production of joinery and other woodworks items is also being encouraged.

6.12 Singapore

Singapore has a total of 72 furniture and joinery factories 37 of which specializes in the manufacture of "knocked-down" furniture for export. (32). The other factories produce joinery products and other builders woodworks, and are also export-oriented. Only about 5% of the industry's output is sold in the domesitc market, the rest are exported. (53). It appears that Singapore has attained a firm foothold in the export market for solid-wood furniture. The industry appears to have also solved the stability constraints of wood by the use of locally-fabricated, electrically heated kiln-driers. Furthermore, they have developed finishing systems which maintain suprisingly good service characteristics in their foreign market's environment which have more severe climatic changes than Singapore, for approximately 80% of the furniture exports are coated with finishing materials.

6.13 Thailand

Thailand reported about 400 furniture factories in 1980, half of which are concentrated in the Bangkok area.(12 &

26). About 25% of the industry's output is exported, the remainder being sold in the domestic market. Over 50% of the total number of factories are small units employing less than 15 workers, with only a few basic pieces of machinery (planers, radial saw, hand-sanders, etc.). At most 10 factorie· are fully mechanized and are export oriented.

6.14 Indonesia

There is no official record of the number of furniture and woodworks establishments in Indonesia. However, rough estimates by the industry leaders set the total number of manufacturing units at more than 4,000 units, 90% of which belong to the small-scale industry level and only about 10% are mechanized. (25, 49, 52 & 71). Not more than 20 firms are engaged in serial production of furniture, joinery and other woodworks items, and are concentrated in the urban centers of Java and Sumatra.

6.15 Malaysia

Peninsular Malaysia has reported more than 900 furniture and joinery manufacturers, about 90% of which are of the small-scale industry level, employing 10 workers or less. (52). According to estimates of the industry leaders, there are less than 25 firms engaged in the serial production of furniture, joinery and other woodworks products. These firms are concentrated in Kelang, Selangor and the industrial estates around Kuala Lumpur.

No data on the secondary wood industry of Sabah and Sarawak was available at this writing.

6.16 The Philippines

Official data on the Philippine furniture and joinery industry is also not readily available. Industry data

is supplied by industry leaders, thru the Chamber of Furniture Industries of the Philippines which counts with about 300 members engaged in the manufacture of wooden and rattan furniture and joinery products. (15). Recent estimates placed the total industry manufacturing units at more than 2,000 shops, concentrated around urban centers of the country. About 40% of the total is found within the Metropolitan Manila area. Approximately 75% of the shops are of the small-scale industry level, while a little over 20% are engaged in medium scale manufacturing operations. There are at most 50 units engaged in serial production of furniture and joinery products, a majority of which are in the rattan fruniture industry.

6.17 Papua-New Guinea

Papua-New Guinea, which has the smallest secondary wood processing industry among the countries studied, has registered 41 wooden furniture and furnishings manufacturing firms, and 37 firms engaged in the manufacture of components for pre-fabricated housing units, joinery and other builders' woodworks, all of which are found around urban centers such as Port Moresby, Lae, Goroko and Wewak among others. (14).

6.2 Essentials for the Development of the Secondary Wood Processing Industry of Developing Countries in Asia

The highly fragmented nature of the secondary wood processing industry of developing countries in Asia prevents an in-depth study of the industry. No reliable data is available (except in China and Singapore) on the installed capacities, sawn-timber inputs and accurate measure of output to enable a viable and justified inter-country comparison of the industry.

Thus, from the standpoint of potentials for development, this analysis shall be confined to the 5-10% component of the

total industry complement of manufacturing units which possess good potentials for further development or are now engaged in serial production of furniture, joinery and other builders' woodworks. This is made necessary in view of the fact that all of the small-scale units and a large majority of the medium-size, units do not have the financial and technical capabilities to expand their manufacturing operations to more advanced levels.

The secondary wood processing units of developing Asian countries which have good potentials for development to levels comparable to those of more advanced countries generally have the following characteristics :

a) They are now engaged in serial production, whether at limited or intermittent scale or as a regular feature of their daily operations ;

b) They are more or less fully mechanized, with machinery complements composed of basic and specialized types of machinery for wood processing ;

c) Daily production operations in these plants are controlled thru the application of the basic concepts of production management ;

d) Evidence of rudimentary materials and supplies inventory controls exist in these factories ;

e) Production jigs and fixtures, although predominantly in crude form, are regularly used in these factories ;

f) Quality of the furniture joinery or woodworks products of these factories are still below standards acceptable to foreign buyers ;

g) Most usually, these plants have their own sawn-timber seasoning (kiln-drying) facilities and have developed drying techniques which allow more stability of the wooden product while in service under different

environmental conditions ; and

h) The manufacturing plants are accessible to harbors or ports served by international shipping lines.

These firms will need assistance for further development in the following manner :

a) Financial assistance for the acquisition of additional machinery and fixtures which will increase the production capacity and improve the flow of materials-in-process ;

b) Training of key production, supervision and technical support personnel in more advanced techniques and practices on the following factory activities :

1) Production Management as applied to high volume production operations ;

2) Technique for the adequate and timely maintenance of plant machinery and cutting tools ;

3) Product design and engineering ;

4) Quality control systems and procedures for high volume production ;

5) Packaging/crating systems for specific types of export products, using locally available packing materials wherever possible ;

6) More suitable costing systems for products of high volume production establishments ;

7) Design, fabrication and use of more advanced production jigs and fixtures, which may involve pneumatics and hydraulic components whenever and wherever necessary ;

8) Adequate factory waste exhaustion and disposal systems ;

9) To minimize the need for acquisition of highly automated machinery, to train pertinent plant

personnel in the design, installation and operation of Low Cost Automation (LCA) systems, to be applied to existing basic production machines ; and

10) Modern wood drying and surface finishing methods.

c) Technical assistance in the markerketing techniques of their respective products ;

d) Advice on the techniques of industrial financial management suitable for high volume production operations (including inventory control and purchasing systems and pactices) ;

e) Assistance in the development of timber-engineered products, particularly for buildings and infrastructure construction purposes ; and

f) Assistance in the further use of wood as a packaging material.

III. THE MARKET STATUS FOR WOOD AND WOOD PRODUCTS FROM DEVELOPING COUNTRIES OF ASIA

7.0 THE MARKET FOR ROUNDWOOD AND PROCESSED PRIMARY WOOD PRODUCTS

7.1 Log Exports

The Region's trade flow of logs during the last five years was dominated by Malaysia (including Sabah and Sarawak), Indonesia and the Philippines in that order of volume exported. Japan remained as the principal buyer of the Region's logs, 82%, and the European Economic Community (EEC) countries ranked second, at 16% of the total volume exported from the Region. However, it will be noted that there has been a decreasing volume of roundwood exported by the "Timber Surplus" countries of South and Southeast Asia during the last five years. This steady decline reflects

the poor world market conditions for wood and wood products. The national policies of the roundwood exporting countries to restrict or ban the export of roundwood, in favor of processed wood products, is expected to keep the Region's roundwood trade flow at levels as low as, or even lower than, the 1980 volume during the remainder of the century.

There was also a steady decline in the volume of roundwood converted into processed wood products by the Region's processing plant during the last five years, reflecting the world wood products market slump during the period.

7.2 The Sawn-Timber Market

The export of sawn-timber from the Region, however, showed a significant increase during the last five years, with the EEC countries importing 28% and Singapore, 21%, of the Region's export volume of sawn-timber. Other significant features of the Region's sawn-timber trade flows are as follows :

a) The Region's export of sawn-timber to Middle East countries has increased to about 10% of the total vol exported ;

b) Japan, and the Republic of Korea, the top exporters of processed wood products in the Region, are still major markets for the Region's sawn-timber output, importing 16% of the Region's total exports of the product in 1980. However, there is a significant downward trend of their sawn-timber imports from 1978 to 1980, continuing thru the first semester of 1981 ; and

c) About 47% of the sawn-timber trade flow in Asia was within the Region itself.

7.3 The Plywood Market

The EEC countries topped the list of customers for the plywood exports of the five Asian developing countries studied, with 18% of the total exported volume (Table VII). The Middle East

countries imported 15%, with Singapore supplying about 78% of this volume. Hongkong was the next largest importer, at 13% of the total exports of the area. However, FAO studies have shown that the U.S.A. is the major market for plywood products from the developing cojntries of Asia, about 41% of which was exported by the Republic of Korea. (65).

The general trend during the last five years was for increased exports of plywood from the developing countries of Asia. Based on the country plans of Indonesia to more than double its plywood manufacturing capacity in the next two decades, together with effects of the policies among the "Timber Surplus" nations of Asia favoring more processing of its round-wood production, the developing countries of South and South-east Asia should be expected to be the major supplier of the world's plywood demands towards the last decade of this century. Plywood trade flow between Asian countries stood at 28% of the total export from the developing countries of Asia during the period.

7.4 The Veneer Market

The veneer flow from South and Southeast Asia during the last five years closely reflected the world market conditions for the product, with a peak in 1978-79. This market sector is expected to increase during the next two decades for the same reasons as the plywood exports from the Region.

7.5 The Market for Other Wood-Based Panel Products

Domestic consumption dominated the market for the particle board, fibreboard and wood-wool cement slabs output of the developing countries in Asia. However, more than 50% of the area's production of blockboards and parquet boards were exported during the past five year period. (65).

8.0 THE MARKET FOR SECONDARY WOOD PRODUCTS

8.1 The Domestic Market for Secondary Wood Products

Reports from China and India indicated that their production of furniture, joinery and other woodworks products has been predominantly geared for domestic consumption.

The Philippines, Malaysia and Indonesia have reported their domestic markets as the principal outlets for secondary wood products. Malaysia and the Philippines, however, have engaged in the manufacture of pre-fabricated low cost housing units with at least 50% wooden components. The Philippines has also succeeded in the mass production of pre-fabricated wooden components for public school buildings to be located in remote areas of the country.

Singapore has reported sales of only about 5-10% of its total secondary wood products output in the domestic market.

8.2 The Export Market for Secondary Wood Products

The export of processed secondary wood products from the developing countries of Asia showed a steady growth during the last five years, attaining the US$200 million level in 1981. Malaysia exported approximately 46% of the Region's total ; Singapore, 35% ; the Philippines, 12% and Indonesia, barely 1%. This shows the approximate levels of development of the secondary wood processing industries among the developing countries of Asia. Malaysia's woodworks manufacturing industry appears to have been developed more than its wooden furniture industry ; while the converse is true with Singapore. However, the Philippine industry for the manufacture of builders' woodworks and joinery products appear to be the most developed among the developing Asian countries. (Tables VII to XI).

8.3 The Future for Secondary Wood Products

The outlook for the industry in the next two decades indicate accelerated growth, as most of the developing countries of Asia which are "Timber Surplus" nations have adopted massive development programmes for their respective secondary wood processing industries providing generous incentives for new

and expansion projects. The successful realization of these development programmes, of course, will greatly depend on the respective country's ability to provide the necessary ingredients for the growth of this sector of the wood industry. This matter is discussed in latter sections of this paper.

9.0 EXPORT OF OTHER FOREST-BASED PRODUCTS

9.1 Woodchips

Papua-New Guinea and Singapore, among the Asian developing countries have established woodchip plants. In view of Singapore's reluctance to further expand its wood processing industry, it appears that Papua-New Guinea, will be the only remaining source of woodchips among the developing Southeast Asian countries within the next two decades. The principal buyer of woodchips in the region is Japan, a "Timber Deficit" nation. This appears to be the main justification of Papua-New Guinea's plans to at least double its woodchips production capacity during the next two decades. (Table V).

9.2 Rattan Products

The export market for rattan products, both raw and processed, has developed into a major forest-based industry in the last five year. The Philippines, Thailand, Indonesia and Malaysia are the major producers and exporters of the product among the countries of Asia. The total rattan products exports from these countries stood at about US$65 million in 1980, with the Philippines supplying about 65% of the trade. Indonesia's export of processed rattan products is almost nil, but it is the major supplier of unprocessed rattan products in the Region. (Tables VII to XI).

The principal markets for processed rattan products are the United States of America and EEC countries. Hongkong appears to be the major importer of unprocessed rattan products in the Region. Both markets for processed and unprocessed rattan products are still expected to increase towards the end of the century.

9.3 Wooden Packing Crates/Boxes

Among the developing countries of Asia, India, the Philippines and Malaysia have attained significant development in the industry for the manufacture of wooden packing crates and boxes. India's production of wooden packing crates is totally consumed by the domestic market. The Philippines and Malaysia have gained footholds in the foreign market for wooden packing crates, with total exports significantly increasing during the last three years reaching the US$500,000 level in 1980. The future for the industry is not yet clearly defined to-date. But, with the expected decrease in roundwood exports from the "Timber Surplus" countries, it is expected that Japan, the EEC countries and other countries requiring significant quantities of the product will have to rely on imports to meet their domestic demands for the product. And the developing countries of Southeast Asia will be in the best position in the Region to meet the demand. (Tables IX & X).

9.4 Other Secondary Wood Products

With the expected accelerated development of the secondary wood processing industry of South, Continental Southeast and Insular Southeast Asian countries, together with the acquisition and development of processing skills and technology in these countries, more types of secondary wood products are expected to be produced and exported by these countries. To-date, joinery products (such as window frames, door jambs, etc.) produced by developing countries of Asia have just been intro-duced in the international market. Development work is still going on in these countries on timber engineered products (such as trusses glue-lam, etc.) which provide possible increased utilization of "Commercially-Less-Acceptable Species", aside from being potentially exportable.

10.0 DOMESTIC TRADE FLOWS

In general, domestic trade flow of wood and wood products within the developing countries of Asia is hampered by inadequate land

transport infrastructure systems and/or domestic/inter-island shipping services. To illustrate :

In Papua-New Guinea, the absence of roads connecting the northern areas (where timber extraction activities are concentrated) to the southern coasts (where about 40% of the population is concentrated) resulted to concentration of development of the wood industry in the northern half of the country. The only other possible means of transporting roundwood or sawn-timber to the southern coasts of the country is by domestic shipping services which is controlled by three private trading firms. Recent reports indicate that it costs less and takes a shorter time to ship goods from Australia/ New Zealand ports to the Port Moresby area (on the Southern coasts) than from Lae, Wewak and Madang areas (on the northern coast). This leads to the present situation where the wood-based panels and sawn-timber requirements of the Port Moresby, Kerema and Daru areas on the southern coastal regions of the country is partially filled by imports from Australia and New Zealand. Transport of spare parts for machinery of the industry is normally carried by the domestic air cargo services.

Indonesia, also has internal transport deficiency problems. The domestic demand for sawn-timber (especially ramin and meranti) and raw plywood in the densely populated islands of Java and Sumatra could not be filled by the processing plants located on the two islands, where Teak is the main timber specie. The main complaint of the secondary wood processors (furniture and wood-works products manufacturers) and construction firms operating in the islands of Java and Sumatra is summarized as high shipping costs and unreliable deliveries of wood products shipped from East Kalimantan ports.

The recent ban on log extraction operations on the eastern, central and southern regions of the island of Luzon in the Philippines which used to supply the roundwood requirements of the thickly-populated urgan areas of Central, Metro Manila, Southern and Bicol regions of the island, forced the wood processors in these areas to be dependent on Northern Luzon and the Southern islands of

Samar, Palawan and Mindanao, for their roundwood, sawn-timber and plywood panels requirements. Wood supply from Northern Luzon is transported mainly overland, while those coming from the southern islands depend on the inter-island shipping lines for transport services. Increasingly high freight rates plague the wood processors of the ban-affected areas, in addition to lack of carriers. Thus, there is now a significant shift of the export-oriented secondary wood processing industry to the island of Cebu which is the shipping hub of the southern islands of the Philippines and nearer to the biggest raw material source, the island of Mindanao. The same situation has led to the shift of the rattan furniture manufacturing industry from Metro Manila to the City of Cebu, since almost all of the country's supply of rattan poles come from the nearby island of Samar to the East and Mindanao to the South.

The wood and wood products industry of India, in spite of the existence of extensive road and railroad systems, also suffers from transport problems, both on land and coastwise, for food and fuels are given higher priority in the country's transport systems. Thus, we find that the wood products from the timber-rich Assam State do not find domestic markets beyond the State and the urban centers of neighboring States, for reasons of costs, availability of transport carriers and restrictions imposed by the States. An exception are shipments from the Andaman Islands.

The transport of wood and wood products in Thailand is principally dependent on small carriers that ply the Chao Phya river and its tributaries. Thus, we find wood processing centers on the banks or within short distances from the River. Market coverage for these factories extend only to areas within 150 kilometers of factory site.

Peninsular Malaysia expects a negative balance in its roundwood supply by the 1990's. Its nearest possible source of supply are from the States of Sarawak and Sabah. However, inadequate sea transport services between the Peninsula and the two States prevent a desirable trade flow of wood and wood products between them.

Another major constraint to the development of inter-state trade flow of wood and wood products is the almost autonomous control by the State Governments over their forest-based industries. Thus, the existence of "Timber Surplus" and "Timber Deficit" States is made more pronounced in the country.

Further growth in domestic trade flows of the wood and wood products industry in the developing countries of Asia await further development in the land infrastructure and/or domestic shipping systems of the respective countries.

11.0 INTERNATIONAL TRADE FLOWS AND SHIPPING

The volume and directions of trade flows for wood and wood products in the Asian Region was discussed in Sections 7.0 to 9.0 of this paper. This section will present the current transport system, in relation to international movement of the wood and wood products market of Asia.

The current shipping routes and types of carriers for the wood and wood products industry of Asia may be classified according to destination and type of cargo, with Singapore, in the south, and the Taiwan Province of China or South Korea and Japan, in the North, serving as shipping centers for the Region.

Transport of roundwood is dominated by Japanese carriers for the sole reason that Japan imports more than 90% of the roundwood exports of the south and Southeast Asian countries. Shipping arrangements, including nomination of vessel and dates of loading, is the responsibility of the Japanese buyers, prices being on the basis of FOB, supplier's port. For reasons of economics of scale, even ports in the Taiwan Province of China and the Republic of Korea are served by Japanese carriers loading at Philippine, Indonesian, Malaysian and Papua-New Guinea ports. A negligible volume of roundwood is transported on carriers (Korean and Philippine registered) of other countries.

Transport of primary processed wood products (sawn-timber, plywood and veneer) from the Philippines, the Taiwan Province of China

and Korea, thru or to Japan, or directly to American ports is also dominated by Japanese carriers. Sangko Lines of Japan (which took over the shipping business of the defunct Retla Steamship Corp.) carries approximately 90% of the volume while the remainder is shared by Ben Lines (British), Sammi Lines (Korea), Norasia (European) and Transocean Lines. The general pattern of shipment is to use smaller vessels (15,000 DWT to 25,000 DWT) to load at a number ports in the Philippines and Taiwan Province of China (or Korea), where the wood products are transhipped on bigger vessels (60,000 DWT and over) for final transport to Japan and/or American ports. Wood and wood products shipments from Taiwan Province of China, Korea, Japan and the Philippines are transported thru Singapore as the transhipment port. Japanese carriers (principally Sangko Lines) control about 65% of the traffic volume. The remainder is shared by the other shipping lines mentioned previously.

In the South, the same system of transhipment is used, with Singapore as the trans-shipping center. Primary processed wood products from Malaysia and Indonesia destined for Taiwan Province of China, Korea, Japan and American ports follow the same flow as those coming from the Philippines, with Japanese (Sangko Lines) vessels dominating the traffic. Primary processed wood products destined for European, Middle East and African ports are carried on both conference and non-conference vessels, with European carriers (based in EEC countries) transporting about 85% of the volume.

An exception to the foregoing general observations are the wood products traffic from Indonesia and the Malaysian State of Sabah to Japan. It appears that under the bi-lateral agreements between Japan and Indonesia, 50% of the logs shipped from Indonesian ports to Japan are transported on vessels registered in Indonesia. Similarly, special arrangements between Japan and the Malaysian State of Sabah provide for the shipment of logs to Japan (from Sabah) on a 52% (Japanese registry vessels) and 48% (Sabah registered vessels) ratio.

The region's secondary processed wood products is principally transported in sea-going vans (containers). Conference vessels dominate this type of cargo traffic.

Freight rates for wood and wood products had been on periodic increases, simultaneous with hikes in the world prices of oil and oil products, till the last increase in March 1981. However, the freight rates were significantly decreased at the beginning of 1982. No further changes in freight rates is expected this year.

Freight rates from the Philippines to American ports are generally 20% to 25% higher than corresponding rates from Korea or Japan. Freight rates from Indonesian ports to Taiwan Province of China, Japan and Korea are higher than the corresponding rates from the Philippine ports.

Current average freight rates from ports of selected Asian developing countries to foreign ports are as follows :

PRODUCT	FROM	TO	FREIGHT RATE
Logs	Malaysia (Sarawak & Sabah)	Japan	US$65.00/1000 BMF
	Papua-New Guinea	Japan and Korea	21.50/cu.m.
	"	China and Hongkong	26.00/cu.m.
	Philippines (Mindanao Port)	Japan	21.50/cu.m.
	Indonesia (East Kalimantan)	Japan	26.00/cu.m.
Sawn-Timber	Philippines	U.S. West Coast	52.00/cu.m.
	"	U.S. East Coast	67.00/cu.m.
	"	U.S. Gulf Ports	64.00/cu.m.
	"	Europe	30.00/cu.m.
	Papua-New Guinea	Australia	41.00/cu.m.
	"	Singapore	58.00/cu.m.
Wood-Based Panels	Philippines	U.S. West Coast	46.00/cu.m.
	"	U.S. East Coast	58.00/cu.m.
	"	U.S. Gulf Ports	56.00/cu.m.
	"	Europe	58.00/cu.m.
	Papua-New Guinea	Australia	83.00/cu.m.

12.0 REGIONAL INDUSTRY AND TRADE ASSOCIATIONS

There are distinct trade and industry associations for the wood and wood products industry of Asia. The Southeast Asian Lumber

Producers Association (SEALPA) covers the roundwood and sawntimber sectors of the industry. Its member countries are the Southeast Asian nations and Papua-New Guinea. The wood-based panels sector of the industry is covered by the recently organized (February 1982), Asian Plywood and Panels Federation (APPF) which is composed of members of the former Asian Plywood Federation and KOMASI. The interests of the furniture and woodworks sectors of the industry is covered by two associations : The Asean Federation of Furniture Manufacturers Associations (AFFMA) and the Asian Federation Furniture Industries Association (AFFIA). The AFFMA is composed of national furniture and woodworks manufacturers associations of the ASEAN countries, while the AFFIA has both furniture manufacturers and traders associations from Japan, Korea and the Taiwan Province of China in addition to the ASEAN countries in its membership roll.

At present these associations, aside from the normal exchange of trade information among members, represent the industry with respect to changes in freight rates, their respective government's legislation and policies which affect the industry and in an indirect way, set product price levels. Exchange of industry technology is not openly discussed. However, member associations are given the courtesy of plant visits in other countries, particularly during the annual regional conferences of each association.

13.0 MARKETING PRACTICES

Negotiations for export/import of wood and wood production is generally conducted on a company-to-company basis. Pricing, however, is subject to government export regulations of some of the countries which have tight policies on foreign exchange flows like Thailand, the Philippines and Papua-New Guinea. Abnormal changes in prices of wood products are also consulted and discussed among members of the regional trade and industry associations. In general, member firms of these associations abide by the price ranges agreed upon during such discussions.

Export sales are usually financed through commercial banks of the choice of the exporting firm. In some countries, however, like

the Philippines, the government has set up an export financing institution which guarantees the country's export sales and allows private firms to draw limited amounts against confirmed letters of credit at very reasonable interest rates.

In general, each country has delegated the responsibility of maintaining the quality of exports of wood and wood products to private institutions, where the government is also represented. The range of authorities and responsibilities of such institutions vary from one country to another. Some such institutions are :

a) The Singapore Timber Industry Board ;

b) The Malaysian Timber Industry Board ; and

c) The Forest Industries Council of Papua-New Guinea.

Government control of quality levels of wood products exports is found in the Philippines, Indonesia and Thailand.

IV. IMPORTANT INGREDIENTS FOR THE SUCCESSFUL DEVELOPMENT AND FURTHER INDUSTRIALIZATION OF THE WOOD AND WOOD PRODUCTS INDUSTRY OF ASIAN DEVELOPING COUNTRIES

The preceding sections of this paper pointed out the current situation and varied programmes for further industrialization of the wood and wood products industry of the developing countries of Asia. "Timber Surplus" countries like Papua-New Guinea and Indonesia have embarked on programmes providing for additional units and capacities of their respective existing wood processing facilities. Other "Timber Surplus" countries like the Philippines and Malaysia have programmes to increase the utilization of their existing capacities for primary wood processing to benefit from the "value added" factor to be gained with the export of secondary wood products. "Timber Deficit" countries like Thailand and heavily-populated India and China, realize the possibility of eventual decrease or possible disappearance of the supply of roundwood in the world timber market. They have embarked on programmes to utilize the Commercially - Less - Acceptable Species of timber available

to meet the increasing raw material requirements of their expanding wood products processing facilities which in turn, is made necessary to satisfy the domestic demands for wood products. As a secondary objective for the development of their wood processing industries, these three countries would also like to export some of their wood products to gain "value added" benefits from the secondary processed wood products.

The successful implementation of these countries' programmes for the expansion and development of the wood products industry is largely dependent upon factors which motivate the establishment of additional processing facilities or expand existing facilities. Furhtermore, there are also factors which must be continuously present or available particularly during the initial stages of the projects, to help assure the continued growth and development of the industry. These factors are discussed in the following paragrpahs.

14.0 ADEQUATE AND PROPERLY TRAINED MANPOWER RESOURCES FOR THE INDUSTRY

It is estimated that the current programmes for industry growth up to the end of this century will require annually thousands of properly trained middle management personnel, technical support staff, highly-skilled and skilled production personnel. For Indonesia alone, L. Waring estimates that a total of 1,000 new machine operators are needed annually for the primary processing industry, and may reach as high as 2000 operators if the needs of the expanded secondary processing industry also is to be satisfied. (104). Relating these figures to the programmed additional volume of roundwood to be processed annually up to the year 2000, the following approximate ratio is established:

121 Machine Operators for every additional 1,000,000 cu.m. of logs to be processed annually.

Based on typical production and staff personnel organization of wood processing plants in developing Asian countries, the following requirements for the primary sectors of the industry in two "Timber Surplus" countries (Indonesia and Papua-New Guinea) is calculated :

Country	Additional Logs to be Processed cu.m./year	Required Additional Factory Personnel		
		Machine Operators	Middle Management	Technical Support Staff
Indonesia	850,000	102	500	170
Papua-New Guinea	250,000	30	160	50
Total	1,100,000 m^3/yr.	132 men/yr.	660 men/yr.	220 men/yr.

The existing training facilities for wood processing facilities (excluding vocational schools) are as follows :

PAPUA-NEW GUINEA

1) The Timber Industries Training College, at Lae, Eastern Highlands Province, which has facilities for training forestry personnel and is just starting to establish training facilities for woodworking, with the aid of the government of New Zealand.

(Note : The country does not have training facilities for middle management and technical support personnel.)

INDONESIA

1) The Institute for Woodworking Industry Training (Pendidikan Industri Kayu Atas), a private school in Semarang, which has complete training facilities for sawmilling, kiln-drying, furniture and woodworks manufacture, "saw doctoring" and knife grinding, wood processing machinery maintenance and furniture design. It also offers courses for training middle management personnel, which includes plant supervision, production and inventory control, basic accounting and the languages (English and German). At full operations, this school can train about 150 machine operators and 60 supervisors

for woodworking plants annually.

2) The "Saw-doctoring" School, Forest Products Research Institute, Bogor, which was established about four years ago with UNIDO aid, but is not in operation now due to lack of financial support. This school can train at least 30 saw doctors annually.

(Note : There is a current plan to establish 17 vocational training centers all over the country, with the help of the International Labour Organization.)

The existing training facilities clearly cannot meet key personnel requirements of the programmed expansion of the wood processing industries in Indonesia and Papua-New Guinea. These countries, therefore, have to look to external sources for their wood processing industries' future needs for key personnel.

There are existing training facilities in other developing countries of the Region which may provide assistance in the form of training Trainors for the immediate future needs of Papua-New Guinea and Indonesia, and key personnel for the countries' needs during the first few years which could form the nucleus of trained personnel for the countries' wood processing industries. Among others, the following schools are :

SINGAPORE

1) The Technical Training Center operated by the Singapore Timber Industry Board ; and

2) The various schools operated by the Vocational and Industrial Training Board.

INDIA

1) The Training Division of the Forest Products Research Institute and College, in Dehra Dun,

Uttar Pradesh State.

2) The Indian Plywood Industries Research Institute, Bangalore, Karnataka State.

PHILIPPINES

1) The Training School, Forest Products Research and Industry Development Commission, Los Baños, Laguna, which offers courses in "saw-doctoring" and kiln-drying.

2) The NACIDA Fruniture and Woodworks Training Center, Marikina, Rizal Province, which has complete facilities for training personnel in furniture and woodworks manufacturing.

THAILAND

1) The Furniture Research and Development Center, Industrial Services Institute, Bangkok, which has facilities for training wood industry personnel in kiln-drying, furniture design and manufacturing, furniture testing and quality control.

15.0 RESEARCH AND DEVELOPMENT ACTIVITIES FOR FOREST-BASED INDUSTRIES

The various forest research institutions of Asian developing countries were found to be working on basic and applied research projects along the following processing industry oriented fields, among others :

1) Identification and evaluation of the physical and machining properties of Commercially-Less Acceptable-Species ;

2) Conversion of industrial wood residues into marketable products for fuel purposes ;

3) Use of solar energy in seasoning kilns for sawn-timber ;

4) Improvement of existing adhesives formulation and application techniques ;

5) Development of special formulations of preservatives for specific species of timber ; and

6) Glue lamination techniques for currently known and newly identified timber species.

Almost all of these research institutions have plans or have just started actual work on stress grading of various species of sawn-timber. No significant progress has been achieved yet in this field.

Invariably, all these government research institutions are plagued with the following major problems :

a) Lack of programmes to solve industrial problems ;

b) Inadequate funds available to carry out more extensive and intensive work ; and

c) High turn-over of qualified research personnel.

It was also noted that inadequate communications between these research institutions and the potential beneficiaries of their work in the industry sector (whether publicly or privately owned) lead to non-appreciation of the results of the former's work by the latter.

Among the research activites of government institutions which promise great potentials to the industry in developing countries are :

a) The development of coconut timber as a raw material source for building construction and woodworks turnery at the Forest Products Research and Industry Development Commission laboratories in Los Baños, Laguna, Philippines ;

b) The development of methods of artificial culture and

planting of rattan at the Forest Research Institute, Los Baños, Laguna, Philippines ;

c) The development of preservation and handling techniques for rubberwood being done by the Forest Research Institute, Kepong, Malaysia, and the development of industrial processing techniques for the use of rubberwood in the manufacture of furniture at the Furniture Research and Development Center, Industrial Services Institute, Bangkok, Thailand ;

d) The development of techniques in producing corrugated roofing sheets out of wood processing factory residues, under the direction of the Academy of Forestry, Beijing, People's Republic of China ; and

e) Basic research in Commercially-Less-Acceptable Species in almost all institutions.

Privately owned and operated research institutes or divisions of industrial corporations, such as those in India, have attained some degree of success in developing materials and techniques for direct application to industrial processing. Among others, the following achievements will be of benefit to the wood processing industries of other developing countries in Asia, or in the world :

a) The Indian Plywood Industries Research Institute in Bangalore, Karnataka State, India, has

   1) Developed the technique of producing adhesives materials from peanut shells, cashew (Anacardium Occidentale, Linn) nut, and other non-conventional plant parts and fruit sources ; and

   2) Development of a process to manufacture core panels out of rice husks.

b) The Research Division of Ascu-Hickson, Ltd., a timber preservation firm in Calcutta, India, in cooperation with another private entity in Sri Lanka, has succeeded in

developing a method for handling treating and seasoning rubberwood which has desirable machining and finishing properties for furniture and joinery manufacturing.

c) The Research Group of the Western Indian Plywood, Ltd., in Baliapatam-Cannanore, Kerala State, India, has developed :

1) A special process for the production of hard laminated plywood (with abrasion properties and service life comparable to steel fish-plates) which is already in use as flooring material for railroad coaches and factories in India ;

2) Glue lamination techniques for impregnated and highly-compressed laminated plain sheets and moulded plywood ; and

3) A process for chemically treating and irradiating low density timber species to increase their densities and improving their machining properties and widening their use for industrial purposes.

16.0 ACCEPTABLE AND WORKABLE INVESTMENT ATMOSPHERES FOR BOTH DOMESTIC AND FOREIGN INVESTORS

A majority of the "Timber Surplus" developing countries of Asia have existing investment policies which aim to stimulate domestic and foreign investment in the wood and wood products industry.

The Philippines, Indonesia, Malaysia and Papua-New Guinea have the following common provisions in their respective investment policies :

a) Investment Priorities Plans include the wood products industry among the industries given priority in the economic development programmes of the countries ;

b) Incentives for foreign investors are offered in the following form :

1) Up to 49% equity participation in selected pioneering ventures in the industry ;

2) Tax holidays for specific period of time during the initial stages of the Project life ;

3) Exemption from paying tax on dividends ;

4) Tax deduction for re-investment of profits in other industries listed in the priority list ;

5) Carry-over of losses for specified periods of time ;

6) Accelerated depreciation of fixed assets is allowed ;

7) Certain forms of repatriation of profit and capital ;

8) Duty-free importation of machinery and equipment ;

9) Certain degrees of freedom to manage the joint-venture project ; and

10) Specified privileges for expatriate technicians and management personnel.

Most of these incentives also favour domestic investors. Other forms of additional incentives are offered according to labour and capital conditions existing in the country.

Except for the manufacture and export of rubberwood into exportable products, Thailand does not provide investment incentives for the wood processing industry.

Malaysia, India and Indonesia have investment incentives only for domestic investors in the secondary wood processing industry. In particular, India offers such incentives only if the Project is located in areas designated by the Government as "Backwards".

In general, investment policies of the developing countries appear to be fair and attractive to foreign investors. However, foreign

investors still wish to be assured on the following matters :

a) Better guarantees on the security of foreign investments in the event of nationalization of the industry ;

b) Clearer definition on the rights of the foreign partner to the resources of the joint venture project, more specifically relative to ownership of land, right to standing timber and other fixed assets ; and

c) More stable laws on Labour employment, contracts entered into by the joint venture project, forestry policies, among others.

Furthermore, domestic investors would like to have access to financial resources with relatively lower rates of interest than those offered by existing commercial and industrial lending institutions, and look up to their governments to provide such facilities which will be of tremendous boost to the stability of export-oriented Project during its early stages of operations.

Effective resolution of the above-mentioned problems need the attention of the Government administrations of the respective countries.

17.0 ENCOURAGEMENT FOR LOCALLY FABRICATED WOOD PROCESSING MACHINERY AND EQUIPMENT

Aside from its general socio-economic benefits to the developing countries' population, encouragement to develop the domestic industry for the local fabrication of wood processing machinery and equipment will help minimize the outflow of foreign exchange which the developing countries of Asia badly need for their economic development programmes. This will affect positively the wood processing industry, and also help accelerate the development of other types of processing industries which are included in the country's development programmes.

It has been noted that some developing countries of Asia have engaged in the local fabrication of machinery and equipment for the wood processing industry. To mention some :

a) The People's Republic of China has designed and manufactured machinery and equipment for small size wood-based panel manufacturing plants ;

b) A number of private companies in India have successfully fabricated and sold to the domestic plywood manufacturing industry such processing items as veneer driers, wide-belt sanders, veneer clippers and panel trimmers. Other firms have specialized in the manufacture of basic woodworking machinery such as planers, drills, table saws, vertical spindle, moulders, sanders, etc. ;

c) A few private firms in the Philippines have successfully fabricated (based on foreign designs) and exported sawmilling machinery ; and

d) Basic woodworking machinery is being fabricated Kuala Lumpur and Singapore, and have found acceptance in the local woodworking industry.

In general, the products of these local machinery fabrication industries have lower degree of precision and sophistication than corresponding products produced in advanced countries. However, the cost difference is so significant that the local industry is happy to use locally fabricated machinery in production operations which do not require a high degree of precision. There is no doubt that with proper and tangible encouragement the local machinery fabrication industry in developing countries can be developed to produce pieces of equipment that have acceptable degrees of precision but sells at attractively lower prices.

V. CONCLUSIONS AND RECOMMENDATIONS

The common constraints to further development of the wood processing

industries of developing countries of Asia are summarized and suggested solutions are indicated as follows :

18.0 MANPOWER RESOURCES PROBLEM

The primary constraint to the development of the industry is the availability of adequate numbers of trained factory personnel at all levels of factory operations (middle management, technical support staff and machine operators). Current skills training programs cannot produce enough trained people in time to meet the increading demands of the industry. Majority of existing training institutions for the wood processing industry are either non-operational (but with existing training facilities) or are training a minimum number of skilled workers due to budgetary limitations.

18.1 Indicated Solution

Assuming that language barriers can be hurdled effectively, the following moves are indicated :

a) Revitalize existing training institutions in the Region to enable them to operate at maximum capacities ;

b) Arrangements among countries invovlved should be made to facilitate training of foreign recruits in the revitalized training institutions with the object of providing Trainers for the beneficiary country, skilled workers and trained management and technical staff personnel for the immediate needs of both the beneficiary and host country ;

c) Continued training activities in both the host and beneficiary countries until the industry demands are met; and

d) An international-oriented agency may be called upon to act as catalyst to these moves.

19.0 RAW MATERIALS SUPPLY PROBLEM

The next major constraint to the industry development in Asian

developing countries is the need for more roundwood in Timber Deficit countries, the expected depletion of more commonly known species in some Timber Surplus countries within the next two decades, and the low yield per unit forest area in other Timber Surplus countries in view of the more heterogenous growth of timber species in their forests.

19.1 Indicated Solution

a) Acceleration of research work on the evaluation and use of Commercially-Less-Acceptable-Species and their immediate application in the processing industry ;

b) Special arrangements with Timber Surplus countries for the supply of roundwood in exchange for other raw materials, technical-know-how or resource which the Timber Deficit country is in a position to share with other countries ; and

c) Modification of standards and specifications to allow the use of Commercially-Less-Acceptable Species of timber.

20.0 DUPLICATION OF BASIC AND APPLIED RESEARCH ACTIVITIES AMONG DEVELOPING COUNTRIES

It has been noted that a number of developing countries have on-going research activities directed towards identical goals. Significant amounts of funds and time have been spent for knowledge that has already been found and being used in industry by another country.

20.1 Indicated Solution

Steps should be taken by the countries concerned for a much closer cooperation in the field of research and development (particularly in the applied sector of the en-

deavor). Concurrently, an equitable and feasible method of sharing the knowledge thus gained should be developed among the countries' institutions or private entities participating in the cooperative research and development venture.

21.0 THE NEED FOR MORE ADVANCED TECHNOLOGY

The demand for wood products in the form of furnitures and furnishings and as materials for building construction will increase as each country becomes more developed. Concurrently, the cost of wood products will increase corresponding to the rate of depletion of the more commonly accepted timber species at present, and because current production techniques in the developing countries will not be able to meet the volume of domestic and world demands for the products in the next two decades. Thus, new technology which will enable the production of more wood products at lower unit costs must necessarily be introduced in these developing countries.

21.1 Indicated Solution

The developing countries must take steps to put their wood industry in a position to effectively assimilate the new advanced technology and develop it to suit local labour and economic conditions.

Understandably, the source of this advance technology will most probably be countries which are known as'Developed'at present. Thus, considering the fact that new technology was developed thru expenditures of significant amount of money and effort, the developing country wishing to avail of such advanced technology must be prepared to pay for the acquisition of such technology in one form or another which it is in a position to afford. On the other hand, the developed country must recognize that low availability of foreign

exchange is a common characteristic among developing countries. The developed country should therefore be prepared to accept payment for such transfer of technology in terms other than cash and under conditions which will not provide deterents to the effective and early use of the transferred technology in the recepient country.

Furthermore, the developing countries should also take steps to attain a desirable degree of self-reliance, by way of developing skills in planning, industrial design and engineering, so that technology assimilated from external sources can be retained and further enriched to suit the changing local conditions.

22. THE NEED FOR FINANCIAL ASSISTANCE FOR DEVELOPMENT PROGRAMMES IN THE ASIAN WOOD INDUSTRY

Correspondingly important is the need for financial support of country programmes for the development of the wood industry. In the face of increasing cost of money in the world, development programmes are often noted to suffer delay (or even discontinuance) because, the proponent country's over-all economic development could not generate the revenues originally allocated for the lower priority-rated wood industry.

22.1 Suggested Solution

It is suggested that more intensive studies are necessary to ascertain more accurately the financial requirements for the development of the wood products industry, relate these to the country's over-all committments for economic development and set up systems which will assure financial support adequately to a project once it is initiated.

The obervations given in the preceding paragraphs indicate the need for financial assistance programmes covering the following aspects of the wood and wood products industry :

a) Forest regeneration and rehabilitation activities ;

b) Research and development activities in more industry-oriented problems ;

c) Manpower training at all levels of the industry ;

d) Development of more effective land and sea transport infrastructure ;

e) Expansion of existing processing facilities, further modernization wherever needed, and acquisition of more advanced wood processing technology to help bring down product cost.

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TABLE 1

FOREST RESOURCES AND EXPLOITATION OF SELECTED ASIAN COUNTRIES 1980

MALAYSIA

	INDIA	INDONESIA	PENIN-SULAR	SABAH	SARAWAK	PAPUA-NEW GUINEA	THAILAND	PHILIPPINES
A. TOTAL LAND AREA (million Ha.)	328.8	191.9	13.2	7.4	12.4	46.0	52.0	30.0
B. TOTAL FOREST AREA (million Ha.)	74.8	122.0	8.1	6.3	9.4	36.0	20.0	16.7
1. According to Exploitability :								
a) Exploitable	44.8	45.0	4.1	5.5	8.9	15.0**	15.7	10.7
b) Potentially Exploitable	16.3	48.0	2.8	0.8	0.4	21.0**	1.9	1.8
c) Others	13.7	29.0	1.2		0.1		2.4	4.3
2. According to Legal Status :								
a) Reserved	29.0	47.0	5.3	3.6	3.2	6.2**	16.7	8.8
b) Protected	23.2	48.0	0.8	0.2	2.4	29.8**	2.9	0.9
c) Unclassed	12.6	27.0	2.0	1.5	3.8		0.4	7.0
3. According to Timber Species :								
a) Coniferous	4.8	24.4	0.2	NEG	NEG	0.5**	4.3	0.2
b) Non-Coniferous	63.5	72.9	5.6	5.0	8.4	33.7**	15.5	11.7
c) Others	6.5	24.6	2.3	1.2	1.0	1.8**	0.2	4.8
4. Deforested Area as of 1980 (Converted to Agriculture, Industrial, Tree Plantations and other use)	4.2	32.5	1.0	1.4	3.3	N/A	5.2	5.7
C. MAN-MADE FOREST (million Ha.)								
1. Total Area Planted as of 1980	3.3	6.0	0.2	0.02	N/A	0.02	0.4	0.3
2. Programmed Total Area for Planting up to year 2000	8.4	20.0	0.5	0.17	N/A	N/A	0.7	2.0
D. TOTAL ANNUAL ROUND LOG AVAILABILITY (million m^3)	26.5	38.2*	31.8	N/A	N/A	N/A	N/A	16.8
1. Non-Coniferous Species	24.8	37.4*	31.6	N/A	N/A	N/A	N/A	16.7
2. Coniferous Species	1.7	0.8*	0.2	NEG	NEG	N/A	N/A	0.1
E. TIMBER STAND								
1. Total Estimated Available Timber, as of end 1980 (million cu.m.)	1,946.0	4,787.0*	1,265.0	2,600.0	758.0	1,480.0**	707.0.0	1,549.0
2. Timber Species Distribution, 1980 (% of Total)								
a) Diptherocarps and other Broad Leaf Species	84.9	59.8*	70.9	62.0	77.5	50.0**	92.0	90.6
b) Coniferous	6.3	20.6*	0.8	NEG	NEG	40.0**	2.0	1.1
c) Mangrove Type	NEG	19.5*	3.6	9.8	0.4	10.0**	6.0	0.5
d) Other Species	8.8		24.7	28.2	22.0			7.8
3. Annual Availability of Sawlog and Veneer Logs (million cu.m.)	20.0	29.0*	11.0	8.5	10.0	6.0	3.5	16.8
F. ANNUAL SAWLOG AND VENEER LOGS PRODUCTION (million cu.m.)								
1979, Actual	11.1	27.5	10.4	6.1	9.8	0.7	3.1	6.6
1980, Actual	13.5	21.5	10.0	6.7	8.5	1.0	2.5	6.3
1981, Estimated	15.0	21.5	9.5	6.4	8.2	1.3	N/A	4.6
1982, Programmed	16.5	N/A	8.5	6.5	6.0	1.7	N/A	4.0
1983, Programmed	17.7	N/A	7.5	N/A	N/A	2.4	N/A	N/A
1984, Programmed	18.5	N/A	6.5	N/A	N/A	3.3	N/A	N/A
1985, Programmed	19.0	N/A	6.0	N/A	N/A	4.3	N/A	N/A
Yearly, Thereafter	N/A	N/A	5.0	N/A	N/A	N/A	N/A	N/A
G. FUELWOOD								
1. Present Production, Annual (million cu.m.)	18.5	N/A	N/A	0.01	N/A	5.0	0.6	24.5
2. Total Requirement up to Year 2000 (million cu.m.)	225.0	514.5	N/A	N/A	N/A	N/A	15.5	N/A

LEGEND:

* Based on 29,000 Hectares of Designated Forest Concessions which is made available up to the Year 2000. Additional forest concessions will be made available after Year 2000. (2 105)

** Subject to revision as more forest areas are brought under the Timber Rights Purchase Programme of the National Government, Papua-New Guinea. (16)

Note: Singapore, with total land area of approximately 58,000 hectares, does not have forest resources as above-described.

SOURCE: (3), (4), (5), (6), (11), (13), (14), (16), (17), (20), (23), (24), (27), (28), (32), (39), (40), (41), (42), (53), (54), (55), (57), (58), (59), (62), (65), (88), (95), (96), (104) and (105) of Bibliography.

T A B L E II

ANALYSIS OF INDUSTRIAL ROUNDWOOD SUPPLY AND DOMESTIC DEMAND FOR SELECTED ASIAN COUNTRIES FOR THE PERIOD 1981 TO 2000

	INDONESIA	MALAYSIA	PAPUA-NEW GUINEA	The PHILIPPINES
Year 1980 :				
Estimated Population (x 1,000)	152,000	12,456	3,134	48,000
Roundwood Production, Estimated (x 1,000 m^3)	38,270*	25,200	1,250*	16,817
Less : Domestic Demand for Roundwood (x 1,000 m^3)	9,580**	785	200**	4,500***
Difference	+28,690	+24,415	+1,050	+12,317
Year 1985 :				
Estimated Population (x 1,000)	172,800	14,327	3,666	53,500
Roundwood Production, Estimated (x 1,000 m^3)	38,270*	24,500	4,310*	16,817*
Less : Domestic Demand for Roundwood (x 1,000 m^3)	10,880**	903	230**	6,300***
Difference	+27,390	+23,597	+4,080	+10,517
Year 1990 :				
Estimated Population (x 1,000)	196,500	16,378	4,300	59,670
Roundwood Production, Estimated (x 1,000 m^3)	38,270*	23,500	4,310*	16,817*
Less : Domestic Demand for Roundwood (x 1,000 m^3)	12,380**	1,032	270**	8,700**
Difference	+25,890	+22,468	+4,040	+8,117
Year 1995 :				
Estimated Population (x 1,000)	223,380	18,774	5,036	66,530
Roundwood Production, Estimated (x 1,000 m^3)	38,270*	23,500	4,310*	16,817*
Less : Domestic Demand for Roundwood (x 1,000 m^3)	14,070**	1,183	320**	12,000***
Difference	+24,200	+22,317	+1,990	+4,817
Year 2000 :				
Estimated Population (x 1,000)	253,975	21,551	5,874	74,170
Roundwood Production, Estimated (x 1,000 m^3)	38,270*	23,500	4,310*	16,817*
Less : Domestic Demand for Roundwood (x 1,000 m^3)	16,000**	1,358	370**	16,700**
Difference	+22,270	+22,142	+3,940	+ 117

L E G E N D

*Figures from Table I, Based on Programmed Roundwood Production Targets, or on Indicated Annual Availability of Round Logs, if Annual Targets are not available.

**Based on Dr. A. I. Fraser's 1975 Study on Wood Consumption : 0.3 m^3 Roundwood equivalent, per capita per year, of which 79% is firewood, for Asian Tropical Countries.

***Based on NEDA construction Growth Rate, as calculated by M. Segura, "Demand for Philippine Timber Products in the Year 2000", PRE PF Final Report Volume II, September 1977.

Note : Population figures were calculated from country populations and corresponding annual growth rates given in (6), (16), (23), (35) and (42), whichever is applicable.

T A B L E III

SAWMILLING INDUSTRY OF SELECTED ASIAN COUNTRIES

		INDONESIA	MALAYSIA	PAPUA-NEW GUINEA	SINGAPORE	PHILIPPINES
A.	NUMBER OF SAWMILLING PLANTS (Units)					
	1976, Actual	N/O	643	60	40	325
	1977, Actual	N/O	684	60	40	341
	1978, Actual	1,034	707	60	40	357
	1979, Actual	1,942	716	62	40	227
	1980, Actual	2,700	731	65	40	209
	1981, Actual	3,426	731	65	40	200
	1982, Programmed	4,000	N/A	N/A	N/A	N/A
	1983, Programmed	N/A	N/A	N/A	N/A	N/A
	1984, Programmed	N/A	N/A	N/A	N/A	N/A
	1985 - 2000, Programmed (Total)	N/A	N/A	N/A	N/A	N/A
B.	INSTALLED SAWMILLING CAPACITY, BASED ON CUBIC METERS, LOG INPUT					
	1976, Actual (x 1,000 m^3)	N/O	10,780	120	N/O	7,868
	1977, Actual (x 1,000 m^3)	N/O	11,500	120	N/O	8,164
	1978, Actual (x 1,000 m^3)	6,716	11,800	120	N/O	7,893
	1979, Actual (x 1,000 m^3)	7,175	12,000	155	N/O	4,674
	1980, Actual (x 1,000 m^3)	8,500	12,300	202	N/O	4,715
	1981, Actual (x 1,000 m^3)	10,000	12,300	202	N/O	4,715
	1982, Programmed (x 1,000 m^3)	11,500	N/A	202	N/O	N/A
	1983, Programmed (x 1,000 m^3)	13,000	N/A	202	N/O	N/A
	1984, Programmed (x 1,000 m^3)	14,000	N/A	202	N/O	N/A
	1985, - 2000 Programmed (Total)	15,000	N/A	202	N/O	N/A
C.	ACTUAL ANNUAL PRODUCTION, BASED ON CUBIC METERS, SAWN TIMBER OUTPUT*					
	1976, Actual (x 1,000 m^3)	3,005	4,767	78	1,385	1,609
	1977, Actual (x 1,000 m^3)	3,500	5,100	76	1,412	1,567
	1978, Actual (x 1,000 m^3)	4,030	5,282	55	1,363	1,780
	1979, Actual (x 1,000 m^3)	4,000	5,419	97	1,597	1,626
	1980, Actual (x 1,000 m^3)	4,797	5,000	103	1,305	1,529
	1981, Estimated (x 1,000 m^3)	6,250	N/A	N/A	1,095	N/A
	1982, Programmed (x 1,000 m^3)	7,500	N/A	N/A	N/A	N/A
	1983, Programmed (x 1,000 m^3)	8,250	N/A	N/A	N/A	N/A
	1984, Programmed (x 1,000 m^3)	9,500	N/A	N/A	N/A	N/A
	1985 - 2000, Programmed (Annual)	10,000	N/A	N/A	N/A	N/A
D.	TYPICAL DAILY OPERATING SCHEDULE BASED ON 8-HOURS SHIFT, 1981	1	1	1	2	1
E.	TYPICAL MILL UTILIZATION, BASED ON % INSTALLED MILL CAPACITY, 1981	60	65	33	75	33
F.	ESTIMATED AVERAGE SAWN TIMBER YIELD RATE, % LOG INPUT, 1981	48	40	45	50	50

L E G E N D : *Includes "SLEEPERS"

S O U R C E S : (3), (4), (5), (6), (11), (13), (14), (16), (17), (20), (23), (24) (27), (28), (32), (39), (40), (41), (42), (53), (54), (55), (57) (58), (59), (62), (65), (88), (95), (96), (104) and (105) of Bibliography.

T A B L E IV

VENEER AND PLYWOOD INDUSTRY OF SELECTED ASIAN COUNTRIES

	INDIA		INDONESIA		MALAYSIA	PAPUA-NEW GUINEA		SINGAPORE		PHILIPPINES	
	Veneer/Plywood		Veneer/Plywood		Veneer & Plywood	Veneer/Plywood		Veneer/Plywood		Veneer/Plywood	
A. NUMBER OF VENEER AND PLYWOOD MILLS (Units)											
1976, Actual	N/A	102	NIL	14	35	NIL	1	1	9	9	25*
1977, Actual	N/A	103	1	16	36	NIL	1	1	9	9	26*
1978, Actual	N/A	104	2	17	42	NIL	1	1	9	9	26*
1979, Actual	N/A	105	3	21	42	1	1	1	9	9	26*
1980, Actual	N/A	106	3	27	43	3	1	1	9	9	26*
1981, Actual	N/A	107	3	34	43	3	1	1	7	9	26*
1982, Programmed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	26*
1983 - 2000, Estimated Total at the end of Century	N/A	N/A	18	90	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B. INSTALLED PRODUCTION CAPACITY BASED ON LOG INPUT (x 1,000 m^3)											
1976, Actual	N/A	316	NIL	405	1,924	NIL	32	25	750	941	3,180*
1977, Actual	N/A	334	120	535	1,924	NIL	32	25	750	941	3,486*
1978, Actual	N/A	360	240	799	2,400	NIL	32	25	750	941	3,486*
1979, Actual	N/A	402	400	1,089	2,400	30	32	25	750	941	3,486*
1980, Actual	N/A	440	400	2,133	2,500	90	32	25	750	941	3,486*
1981, Actual	N/A	450	400	2,293	2,500	90	32	25	650	941	3,486*
1982, Programmed Total	N/A	N/A	N/A	7,990	N/A	N/A	N/A	N/A	N/A	941	3,486*
1983 - 2000 Estimated Total	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A
C. ACTUAL ANNUAL PRODUCTION (x 1,000 m^3)											
1976, Actual	N/A	196	NIL	214	653	NIL	14.8	12	570	403	416
1977, Actual	N/A	200	6	279	715	NIL	15.5	12	550	496	489
1978, Actual	N/A	224	39	424	621	NIL	17.0	11	517	546	490
1979, Actual	N/A	240	15	624	677	2.0	18.1	11	568	634	503
1980, Actual	N/A	200	37	1,011	596	1.5	16.5	19	542	660	553
1981, Estimated	N/A	280	N/A	1,544	630	1.0	15.0	N/A	N/A	N/A	N/A
1982, Programmed	N/A	N/A	N/A	2,750	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1983 - 2000, Estimated Total	N/A	N/A	N/A	3,820	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D. TYPICAL DAILY OPERATING SCHEDULE, BASED ON 8-HRS. SHIFT, 1980	N/A	2	2	2	2	2	2	2	2	3	3
E. TYPICAL MILL UTILIZATION, BASED ON % INSTALLED MILL CAPACITY, 1980	N/A	65	50	65	65	65	65	70	70	70	25**
F. ESTIMATED AVERAGE YIELD RATE, % LOG INPUT, 1980	N/A	45	45	55	42	45	45	60	70	55	53

L E G E N D :

*Does not include blockboard plants.

**Reflects poor wood products market situation for the period 1980 - 1981.

SOURCES :

(3), (4), (5), (6), (11), (13), (14), (16), (17), (23), (24), (39), (40), (41), (42), (45), (46), (53), (54), (58), (59), (62), (65), (90), (92), (95), (104), and (105) of Bibliography.

T A B L E V

OTHER WOOD-BASED PANELS INDUSTRY OF SELECTED ASIAN COUNTRIES (EXCLUDING PLYWOOD AND VENEER PLANTS)

	INDIA	INDONESIA	MALAYSIA	PAPUA-NEW GUINEA	SINGAPORE	THAILAND	PHILIPPINES
A. PARTICLE BOARD							
1. Current Status (1980) :							
a. No. of Units Installed	9	N/O	2	NIL	1	2	2*
b. Production Capacity, Installed	64,100 tons/yr.	N/O	8,000 cu.m.	NIL	N/O	68 tons/day	100 tons/day
c. Typical Daily Operating Schedule 8-Hr. Shifts	2	N/O	2	NIL	2	3	NIL
d. Typical Mill Utilization, Based on % Installed Mill Capacity	40%	N/O	50%	NIL	N/O	50%	NIL
e. Total Actual Production for the Year	14,000 tons	N/O	4,000 cu.m.	NIL	N/O	10,200 tons	NIL
2. Programmed for 1982 - 2000 :							
a. No. of Units to be Installed	N/A	N/A	N/A	NIL	N/A	N/A	N/A
b. Total Expected Annual Production	30,200 tons	N/O	N/A	N/A	N/A	N/A	N/A
B. FIBREBOARD PLANTS							
1. Current Status (1980) :							
a. No. of Units Installed	3	1	NIL	NIL	NIL	2	1**
b. Production Capacity, Installed	53,000 tons/yr.	3,000 cu.m./yr.	NIL	NIL	NIL	265 tons/day	265 tons/day
c. Typical Daily Operating Schedule, 8-Hr. Shifts	2	1	NIL	NIL	NIL	3	3
d. Typical Mill Utilization, Based on % Installed Mill Capacity	40%	33%	NIL	NIL	NIL	45%	85%
e. Total Actual Production for the Year	21,000 tons	1,000 cu.m./yr.	NIL	NIL	NIL	36,200 tons	36,200 tons
2. Programmed for 1982 - 2000 :							
a. No. of Units to be Installed	N/A	N/A	N/A	N/A	NIL	N/A	N/A
b. Total Expected Annual Production	100,000 tons	N/A	N/A	N/A	NIL	N/A	N/A
C. OTHER TYPES OF WOOD-BASED PRODUCTS PLANTS, MECHANICAL PROCESSING							
1. Type of End Product	NIL	N/A	wood-wool cement slabs	woodchips	woodchips	parquet board	blockboard plants
2. Present (1980) No. of Units	NIL	N/A	3	-	2	33	12
3. Present Installed Capacity	NIL	N/A	N/O	300,000 cu.m./yr. (log input)	N/O	60,000 cu.m./yr.	30,000 MT/yr.
4. Present Actual Production	NIL	N/A	N/O	130,800 BDU	N/O	52,000 cu.m.	3,020 MT
5. Additional Units Programmed for 1982 - 2000	NIL	N/A	N/A	2	N/A	N/A	NIL
6. Additional Capacity Programmed for 1982 - 2000	NIL	N/A	N/A	500,000 BDU	N/A	N/A	N/A

LEGEND : *Both existing plants not in operation.

**Another mill (MDF) under construction, while existing plant (HARDBOARD) was in operation.

SOURCES : (3), (4), (5), (6), (16), (17), (23), (24), (39), (42), (53), (58), (59) and (104) of Bibliography.

T A B L E VI

EXPORTS OF WOOD AND WOOD PRODUCTS FROM SELECTED ASIAN COUNTRIES

PRODUCTS EXPORTED AND YEAR	INDIA	INDONESIA	MALAYSIA	PAPUA-NEW GUINEA	SINGAPORE	THAILAND	PHILIPPINES
A. SAWLOGS/VENEER LOGS (x 1,000 m^3)							
1976, Actual	NIL	17,861	16,176	444	N/O	49	2,331
1977, Actual	NIL	18,932	16,972	403	N/O	32	2,047
1978, Actual	NIL	19,060	17,262	445	34	17	2,211
1979, Actual	NIL	15,091	16,640	476	21	1	1,248
1980, Actual	NIL	14,185	15,462	642	18	NIL	715
1981, Estimated	NIL	7,000	N/A	890	20***	NIL	650
1982, Programmed	NIL	N/A	N/A	1,360	N/A	NIL	N/A
1983, Programmed	NIL	N/A	N/A	2,060	N/A	NIL	N/A
1984, Programmed	NIL	N/A	N/A	3,020	N/A	NIL	N/A
1985 - 2000, Estimated (Annual)	NIL	N/A	N/A	4,100	N/A	NIL	N/A
B. SAWN TIMBER (x 1,000 m^3)							
1976, Actual	NIL	649	3,088	51	1,142	97	493
1977, Actual	NIL	594	2,993	50	1,194	51	455
1978, Actual	NIL	756	2,827	36	1,267	16	573
1979, Actual	NIL	1,273	3,008	63	1,438	7	915
1980, Actual	NIL	1,130	3,148	45	1,175	2	742
1981, Estimated	NIL	438*	N/A	N/A	822***	N/A	789
1982, Programmed	NIL	N/A	N/A	N/A	N/A	N/A	N/A
1983, Programmed	NIL	N/A	N/A	N/A	N/A	N/A	N/A
1984, Programmed	NIL	N/A	N/A	N/A	N/A	N/A	N/A
1985 - 2000, Target (Annual)	NIL	N/A	N/A	N/A	N/A	N/A	N/A
C. PLYWOOD (x 1,000 m^3)							
1976, Actual	33	10	298**	10.7	459	11	261
1977, Actual	15	17	321**	5.4	441	5	221
1978, Actual	15	83	378**	6.3	517	1	360
1979, Actual	7	126	424**	7.8	568	2	324
1980, Actual	NEG	283	423**	6.5	542	1	322
1981, Estimated	N/A	655	N/A	N/A	488***	N/A	352
1982, Programmed	N/A	1,595	N/A	N/A	N/A	N/A	N/A
1983, Programmed	N/A	2,320	N/A	N/A	N/A	N/A	N/A
1984, Programmed	N/A	3,900	N/A	N/A	N/A	N/A	N/A
1985 - 2000, Programmed (Annual)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D. VENEER (x 1,000 m^3)							
1976, Actual	1	NIL	170	NIL	29	7	166
1977, Actual	4	6	208	NIL	31	8	155
1978, Actual	4	39	185	NIL	26	12	154
1979, Actual	3	15	88	2.0	11.3	13	186
1980, Actual	NEG	38	91	1.5	19.6	8	62
1981, Estimated	N/A	N/A	N/A	N/A	9.3***	N/A	96
1982, Programmed	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1983, Programmed	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1984, Programmed	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1985 - 2000, Programmed (Annual)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

L E G E N D : *Data for January - May only

**Includes Blockboards

***Data for January - October only

S O U R C E S : (3), (4), (5), (6), (16), (17), (20), (23), (24), (28), (39), (40), (41), (42), (45), (46), (53), (57), (58), (59), (65) and (90) of Bibliography.

T A B L E VII

MARKET DISTRIBUTION OF PRIMARY WOOD AND WOOD PRODUCTS EXPORTED FROM SELECTED ASIAN COUNTRIES, 1980

PRODUCTS AND IMPORTING COUNTRIES	INDONESIA	MALAYSIA	PAPUA-NEW GUINEA	SINGAPORE	PHILIPPINES
A. ROUND LOGS (x 1,000 m^3)					
Japan	8,613	6,653	462	2.2	471
Republic of Korea	***	1,116	107	0.8	53
Hongkong	***	484	5	NEG	8
Singapore	907	262	NIL	---	NIL
Other Asian Countries	4,570	2,767	56	14.5	132
E. E. C. Countries	92	3	10	0.3	50
Other European Countries	NIL	NIL	6	NEG	1.5
Middle East Countries	NIL	NIL	NIL	0.3	NIL
U. S. A.	NEG	NEG	NIL	NEG	0.2
Canada	NIL	NIL	NIL	NIL	NIL
Australia	NEG	NIL	NIL	NIL	NIL
African Countries	NIL	NIL	NIL	0.5	NIL
B. SAWN TIMBER (Air-Dried & Kiln-Dried, m^3)**					
Japan	91,011	83,143	27,200	73,100	198,826
Republic of Korea	11,451	132	NIL	300	NIL
Malaysia	125,259	---	NIL	1,500	NIL
Singapore	264,497	943,934	22,500	---	10,056
Other Asian Countries	198,211	213,084	NEG	115,300	30,888
Italy	301,067	33,707	NIL	41,200	17,347
Federal Republic of Germany	10,121	233,976	NEG	69,600	38,880
Netherland	50,597	201,856	NIL	195,300	2,624
Other E. E. C. Countries	38,774	246,816	200	97,200	239,117
Other European Countries	6,233	35,366	400	171,600	62,542
U. S. A.	12,880	30,524	NIL	8,500	79,890
Canada	319	683	NIL	500	3,751
Other American Countries	NIL	NIL	NIL	NIL	NIL
Australia/New Zealand	1,722	106,941	15,300	32,800	67,688
Middle East Countries	9,701	556,485	NIL	351,100	612
African Countries	NIL	36,401	NIL	156,200	9,805
Oceania	NIL	NIL	NIL	22,100	1,375
C. PLYWOOD (cubic meter)					
Japan	8,801	2,147*	NIL	200	76
Hongkong	99,810	38,157	NIL	40,700	81,797
Singapore	50,491	202,446	NIL	---	NIL
Other Asian Countries	10,423	2,464	NIL	32,300	35
United Kingdom	16,348	57,927	NIL	52,100	36,655
Other E. E. C. Countries	14,546	20,999	NIL	66,700	63,169
Other European Countries	NIL	1,497	NIL	11,600	32
African Countries	NIL	6,837	NIL	88,400	NIL
U. S. A.	26,095	5,509	NIL	1,700	136,299
Canada	NIL	544	NIL	500	3,094
Oceania	NIL	580	10	6,400	993
Australia/New Zealand	531	1,059	6,500	2,000	NIL
Middle East Countries	17,969	47,963	NIL	237,000	NIL
Other American Countries	NIL	NIL	NIL	1,700	NIL

L E G E N D :

*Including Blockboard

**Includes Graded, Ungraded, Kiln-Dried Sawn-Timber and Railroad Sleepers

***Included in exports to other Asian Countries

S O U R C E : FAO, Wood Products Trade Flows, January - December 1980, Rome, 1980

T A B L E VIII

FURNITURE AND OTHER SECONDARY WOOD PRODUCTS EXPORTS OF INDONESIA

(in U.S.$, FOB Indonesian Port)

	1978	1979	1980	Jan. - April 1981
I. WOODEN PRODUCTS :				
A. Wooden Furniture and Furnishing	1,706,578	3,380,372	5,015,690	713,926
B. Wooden Mouldings and Beadings	5,652,828	2,072,000	2,704,710	268,948
C. Other Builders Woodworks and Joinery Products	1,420,494	2,623,273	991,021	1,083,680
Total, Wooden Furniture, Joinery and Builders Woodworks	8,779,900	8,075,645	8,711,421	2,066,554
II. CANE (RATTAN) PRODUCTS				
A. Rattan and Cane Poles	22,412,019	58,172,973	57,424,434	16,705,067
B. Rattan Split	----	----	----	42,700
C. Other Rattan Items, Unprocessed	4,852,522	16,646,340	18,881,941	5,394,325
D. Rattan Furniture and Components	----	----	1,186,410	65,609
E. Rattan Matting	2,184,928	5,724,132	7,608,304	----
Total, Cane (Rattan) Products	29,449,469	81,543,445	85,101,089	22,207,701

T A B L E IX

FURNITURE AND OTHER SECONDARY WOOD PRODUCTS EXPORTS OF MALAYSIA
(in U.S.$, FOB, Malaysian Port)

		1976	1977	1978	1979	1980
I.	WOODEN PRODUCTS :					
	A. Wooden Furniture and Furnishings	8,537,000	10,233,000	12,350,000*	15,600,000*	14,750,000*
	B. Wooden Mouldings and Beadings	21,576,350	35,818,900	44,389,700	60,238,500	69,707,450
	C. Other Builders Woodworks and Joinery Products	----	1,318,250	192,700	182,100	617,480
	Total, Wooden Furniture, Joinery and Builders Woodworks	30,113,350	47,370,150	56,932,400	76,020,600	85,074,930
II.	CANE (RATTAN) PRODUCTS	N/A	N/A	N/A	216,909	365,218
III.	WOODEN BOXES	NIL	NIL	6,070	14,215	418,244

Note : *Estimated from over-all export data.

T A B L E X

FURNITURE AND OTHER SECONDARY FOREST PRODUCTS EXPORTS OF THE PHILIPPINES

(in U.S.$, FOB Philippine Port)

	1978	1979	1980
I. WOODEN PRODUCTS			
A. Wooden Furniture and Furnishings	US$ 2,848,552	US$ 7,402,217	US$ 7,825,860
B. Wooden Mouldings and Beadings	875,000	1,469,744	534,569
C. Other Builders Woodworks and Joinery Products	14,500,000	20,283,841	15,412,367
Total, Wooden Furniture, Joinery and Builders Woodworks	US$18,223,552	US$29,155,802	US$23,772,796
II. CANE (RATTAN) PRODUCTS			
A. Rattan and Cane Poles	NIL	NIL	NIL
B. Rattan Split	NIL	NIL	NIL
C. Other Rattan Products, Unprocessed	NIL	NIL	NIL
D. Rattan Furniture and Components	US$14,762,900	US$30,331,694	US$41,979,191
E. Rattan Matting	NIL	NIL	NIL
Total, Cane(Rattan) Products	US$14,762,900	US$30,331,694	US$41,979,191
III. OTHER PRODUCTS			
A. Bamboo Furniture	US$ 126,138	US$ 195,155	US$ 318,918
B. Buri Furniture	8,849,057	16,905,398	26,969,158
C. Wooden Packing Cases	94,000	148,291	227,185
Total, Other Secondary Forest Products	US$ 9,069,195	US$17,248,844	US$27,515,261

T A B L E XI

FURNITURE AND OTHER SECONDARY WOOD PRODUCTS EXPORTS OF SINGAPORE
(in U. S. $, FOB, Singapore)

	1978	1979	1980	Jan.-Oct. 1981
I. WOODEN PRODUCTS				
A. Wooden Furniture and Furnishings	19,885,000	29,815,000	35,980,000	39,514,328
B. Wooden Mouldings and Beadings	19,945,000	26,640,000	31,240,000	20,378,900
C. Other Builders Woodworks and Joinery Products				1,252,855
Total, Wooden Furniture, Joinery and Builders Woodworks	39,830,000	56,455,000	67,220,000	61,146,083
II. CANE (RATTAN) PRODUCTS				
A. Rattan and Cane Poles	N/O	N/O	N/O	N/O
B. Rattan Split	N/O	N/O	N/O	N/O
C. Other Rattan Itmes, Unprocessed	N/O	N/O	N/O	N/O
D. Rattan Furniture and Components	N/O	N/O	N/O	N/O
E. Rattan Matting	N/O	N/O	N/O	N/O
Total, Cane (Rattan) Products	N/O	N/O	N/O	N/O

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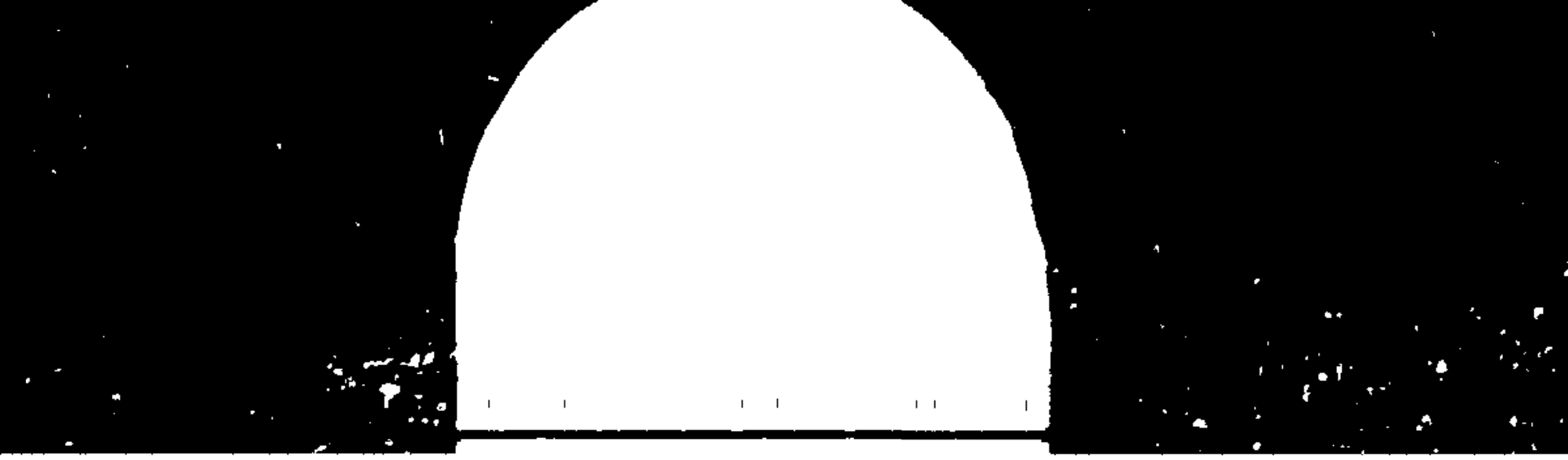

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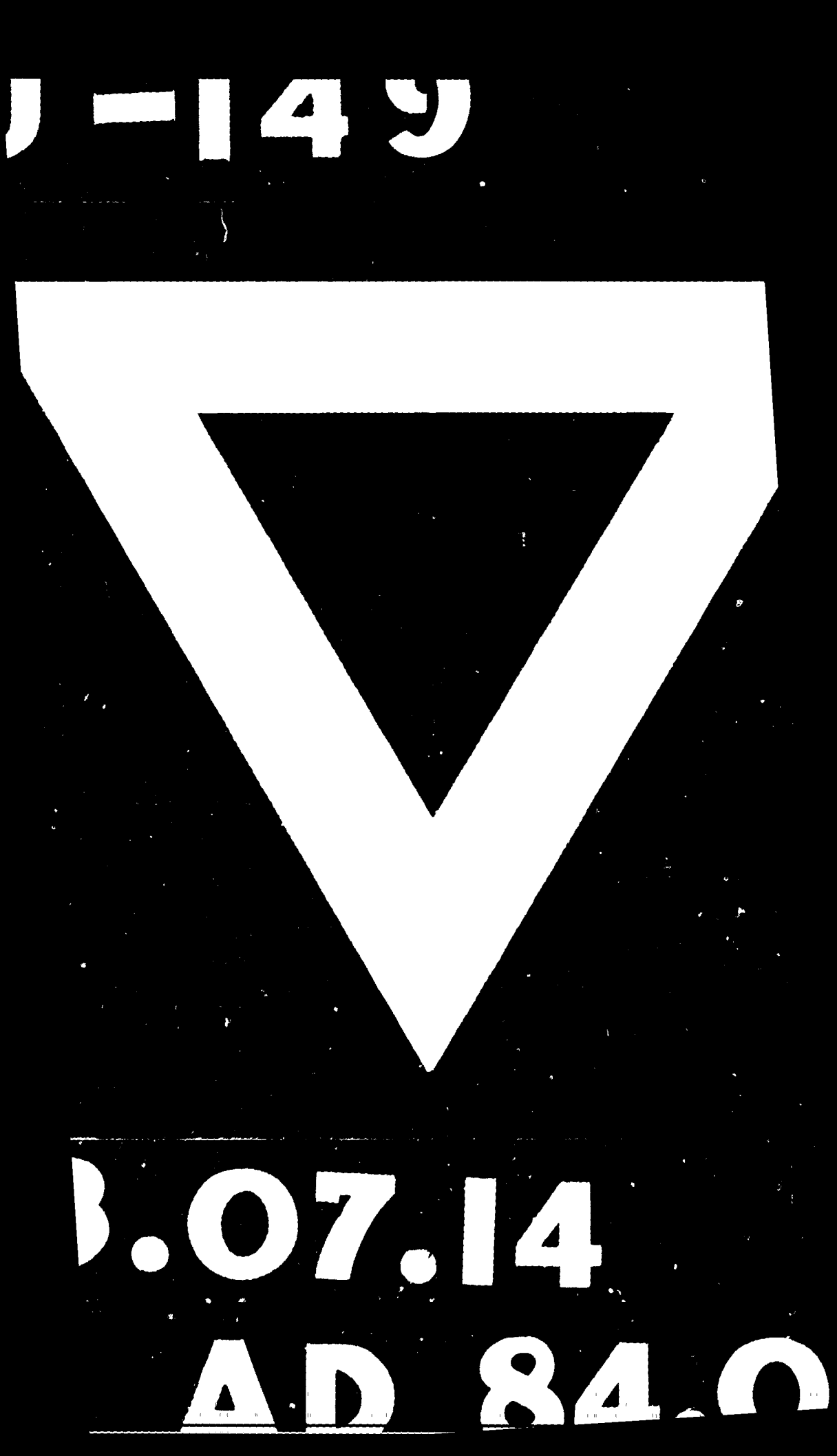
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