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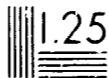
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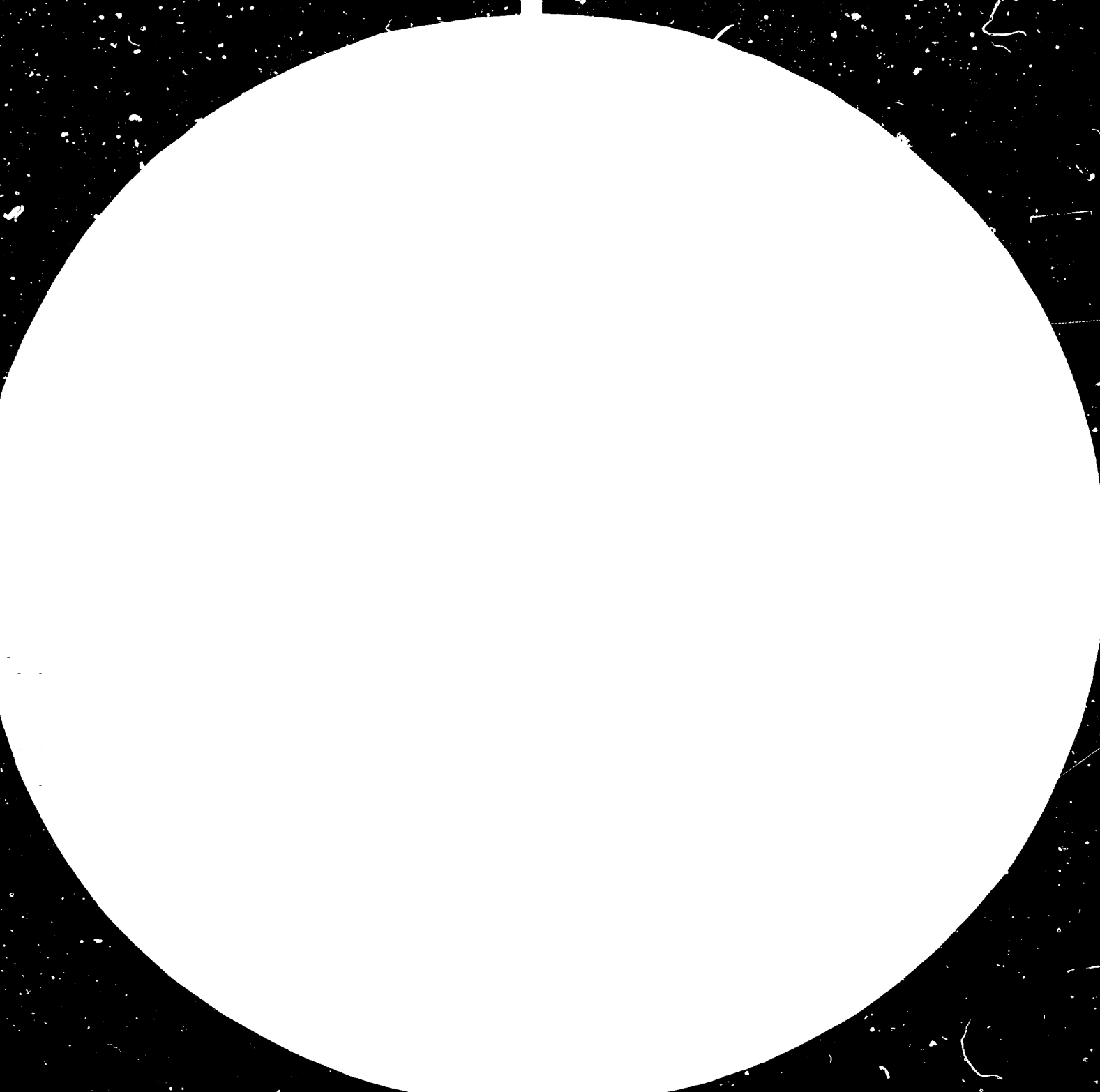


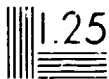
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REVIEW OF THE ^WOOD AND WOOD PRODUCTS INDUSTRY IN
SELECTED COUNTRIES OF LATIN AMERICA *

by

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INTRODUCTION

This report is a review of the situation of the woodworking industry in seven countries of America; Brazil, Chile, Colombia, Guyana, Mexico, Paraguay and Peru were visited in the period of January 7 to February 10, 1982.

The objective of the study was to review the present status of the woodworking industry in the region and to identify the obstacles hampering its further development.

The main problem in surveying developing countries is the lack or shortage of information. This is more evident when the secondary wood industry is treated since primary processing is a concern of forest authorities while secondary processing is scattered under several different branches of government, and it is therefore very difficult to find adequate data.

Each country was reported separately and conclusions were drawn for each country individually.

One important aspect of the seven reported countries is that with exceptions in some products all are self sufficient or exporters.

With the exception of Chile, the other are dependent almost exclusively on natural forests. Chile has a relatively strong wood industry based on plantations of exotic species. Efforts need to be made in order to increase the participation of man-made forests in countries which are depleting natural ones.

Local production of equipment is relatively adequate in Brazil, but most of the other countries depend on imports for specific equipment.

Regarding wood technology and research, most of the countries have small groups of knowledgeable professionals, but their knowledge is not disseminated through industry. Therefore efforts to disseminate technical information in industry will be needed in the future.

BRAZIL

1. FOREST RESOURCES

1.1. Natural forests

1.1.1. Forest types

- Closed broadleaved forests

a) Amazon forest

The Amazon forest covers about 340 million hectares in Brazil and corresponds to humid or very humid climates (rainfall more than 1,500 mm).

The Amazon forest is characterized by a large number of species pro hectare and the predominant species differ from one region to the other. There are a few species that are common to almost all regions of the Amazon area of Brazil and of other countries; one of them is cedrorona (Cedrelinga catenaeformis). This specie occurs from eastern of Brazilian Amazonia to Ecuador, Peru and Bolivia. Virola (Virola sp) occurs in the lowlands of almost all countries of northern South America. Other very spreaded species are: Ceiba pentandra, Hura crepitans, Goupia glabra, Carapa guianensis, Swietenia macrophylla. There are regions with one or more palms which occupy a variable share of the forest cover.

b) Atlantic forest

This forest covers a strip of variable width from the Atlantic coast, from 6°S to 30°S, and its total extension does not exceed 3 million hectares. This forest presents prime hardwood species like rose wood (Daldergia nigra), Pau Brasil (Caesalpinia echinata), Jatobá (Hymenea sp), Vinhatico (Plathymania reticulata), Caviúna (Machaerium scleroxylon), etc.

c) Semi-deciduous and deciduous forest

This type of forest is found in patches within the "cerrado" area and on the fertile soils of the Paraná bassin reaching the border with Paraguay and has been destroyed almost completely for agricultural uses. The species to be found are not so valuable as those of the Atlantic forest. The most representative are Peroba (Aspidosperma polyneuron), Pau Marfim (Balfanrodendron riedelianun), Cedro (Cedrela sp), Gujuvira (Patagonula americana).

d) Mangroves

They stretch along the Atlantic coast from the border with French Guyana to Florianopolis (28°S). The main species are Mangue branco (Laguncularia racemosa), Mangue vermelho (Rhizophora mangle), Mangue sirimba (Avicennia nitida). Mangrove stands are estimated at 2.5 million ha.

- Open broadleaved forests

a) The "cerrado"

The cerrado region corresponds approximately to an area of 200 million hectares, located in the center and in the center-west of the country. It comprises a series of formations that vary from scrubby and grass to relatively high forests (up to 20 meters).

b) Other types of open woodlands

- Wooded savannas within the Amazonian forests.
- The "chaco" stands with the main genera Schinopsis and Aspidosperma which can be found along the Paraguayan border (about 1.500.000 ha).
- The wooded and tree savannas of the "caatinga" region, in the northeastern region.
- The "Pantanal Matogrossense", is a large area of some 12 million hectares, of periodically inundated areas with tree and scrub vegetation on the higher elevations.
- Coniferous forests

The Araucaria forest occurs in the high lands, more than 500 meters above the sea level, with rainfall well distributed along the year and temperate climate with some frosts during the winter. The dominant storey is occupied by the Paraná pine (Araucaria angustifolia). The trees reaching 20-25 m high, the dominated storey is composed generally by Podocarpus spp, Imbuia (Phoebe porosa), and trees of the genera Ocotea and Nectandra. The area originally occupied by the Araucaria forests was about 16-17 million of hectares, heavy exploitation and clearing for agriculture have drastically reduced the area.

1.1.2. Present situation of natural forests

Table no. 1 shows the areas of natural forests in Brazil, estimated at the end of 1980. There are about 300 million hectares of productive hardwood forests, and 280 thousand hectares of productive coniferous forests.

Regarding management, FAO's view is that "there is not at present intensive management on significant areas" in Brazil. ^{1/} There exist about 4,650,000 hectares under protection in national forest and national parks, but not really under forest management.

Ownership of forest land in Brazil is a very intricate subject. There are, mainly in remote regions, areas named "Terras devolutas" (vacant land) which in principle are owned by the state, but are destined to be transferred to private ownership through bidding, selling, cession for colonization, or other ways. "Terras devolutas" are common in the remote areas of northern Amazon, but are rarely found in the more populated areas of the south of the country. In 1973 it was estimated that 93 per cent of forest lands in the north were public, compared with only 28,6 per cent in the south.

In spite of the settlement of vast areas of the borders of the Amazon region, about 200 million hectares remain inaccessible, because of the aggressive tropical environment. The area on the banks of the big rivers of the low Amazon is relatively settled as well as some regions like the Marajo island and along the road linking Belem to Brasilia. There are centres of wood industries in the regions near the cities of Manaus, Belem, Macapá, Imperatriz, etc., with hundreds of sawmills and dozens of plywood mills. Other areas where settlements are taking place are the state of Rondonia near the border with Bolivia, and some large areas in the southern limit of the Amazon forest, a transition region between the forest and the "cerrado". Lack of roads are one of the major constraints to a more balanced settlement of the Amazon area. The concentration of wood based industries in more accessible places causes an intense harvesting and the depletion of the more valuable and desirable species. For example, the virola has almost disappeared in the lower Amazon area, and mahogany (Swietenia macrophylla) has also been overexploited. Other regions of the country like the south, northeast, east, southeast and center-west are relatively accessible, but very little commercial forests remain there.

^{1/} Proyecto de Evaluación de los Recursos Tropicales. FAO/UNEP, p.41.

TABLE No. 1

Areas of Brazil natural forests estimated at the end of 1980
(in thousand ha)

Forest types	productive	unproductive (physical reasons)	unproductive (legal reasons)	total unproductive	productive + unproductive	secondary forests	
CLOSED HARDWOOD FORESTS	North	286 060	41 340	4 350	45 690	331 750	27 420
	South	14 570	9 660	300	9 990	24 530	19 000
	Brazil	300 630	51 000	4 650	55 650	356 280	46 420
CONIFEROUS FORESTS	280	910	10	920	1 200		
WOOD LANDS AND SCRUBLANDS	117 150	64 050	211 200	22 700	38 500	61 200	

SOURCE: FAO/PNUMA/ROMA 1981.

It is estimated that 2,53 million ha of forest and productive woodland have been deforested each year in Brazil, out of which 1,36 million of closed broadleaved forest, 120 thousand of coniferous forests and 1,05 million of open broadleaved forests (mainly "cerrado"). The main causes of the deforestation are the clearing of land for agriculture and pasture.

Harvesting is generally highly selective and the forest is left disturbed and without the more valuable tree species. Economic value diminishes, but the forest is rarely completely destroyed.

The growing stock of natural forests estimated for 1980 is shown in table no.2. The total commercial volume is estimated at 2.080 million cubic meters. The total gross volume of natural forest and woodland is estimated at 57.645 million of cubic meters.

There is not enough information about Amazon forest increments; it appears to be negligible in the intact forest, with growth being traded off by mortality.

1.1.3. Plantations

Forest plantation activities were initiated at the beginning of the century in the state of Sao Paulo with Eucalyptus species, mainly for production of fuelwood for locomotives. In the 40's and 50's the plantations increased and other exotic species started to be planted; however, only after 1966 have the plantations had any significant growth, with the enactment of a law that conceded fiscal incentives for reforestation. The man-made established forest is presented in table no.3. In this table it is possible to see that the most important species planted in Brazil are from genus Eucalyptus, totalizing 2 105.000 ha, 1.505.000 ha of which are for the production of charcoal, and 600.000 ha for pulp, fibreboard, particleboard, poles, saw-milling, etc. The major species are: E. saligna, E. alba or E. urophylla, E. citriodora, E. tereticornis, E. grandis, E. paniculata and others. The genus Pinus is the second group in importance with 1.132.000 ha planted until 1980, the main species being: P. elliottii, P. taeda, P. patula, P. caribaea, P. oocarpa and P. khasya.

The Eucalyptus have been managed until recently exclusively by coppice, with clear cutting every five to eight years. Presently there is a tendency to maintain a number of trees per ha when cutting pulpwood in order to produce saw logs in the future.

TABLE No. 2

Growing stock estimated at end 1980
(totals in million m³)

FOREST TYPES	CLOSE BROADLEAVED UNMANAGED FORESTS								
	PRODUCTIVE						UNPRODUCTIVE		gross volume
	INTACT				EXPLOITED				
	gross volume		commercial vol.		gross volume		gross volume		TOTAL
m ³ /ha	total	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total		
Amazonian forests	155	43 565	5	1 405	145	725	80	3 655	47 945
Close broadleaved outside Amazonia	195	1 475	10	75	175	1 225	95	950	3 650
Total close broadleaved	-	45 040	-	1 480	-	1 950	-	4 605	51 595
	CONIFEROUS FORESTS								
Coniferous forests	350	98	50	14				92	190
All closed forests		45 140		1 495		1 950		4 695	51 785
Productive woodlands	50	5 860	5	585					5 860
TOTALS		51 300		2 080		1 950		4 695	57 645

SOURCE: FAO/PNUMA/ROMA 1981.

TABLE No. 3

Areas of established plantations estimated at end 1980

(in thousand ha)

SPECIES	Years	76-80	71-75	66-70	61-65	51-60	41-50	before 41	TOTAL
	Age class	0-5	6-10	11-15	16-20	21-30	31-40	> 40	
<u>Eucalyptus</u> spp charcoal		700	405	90	30	260	10	10	1 505
<u>Eucalyptus</u> spp industrial*		240	240	30	10	75	3	2	600
<u>Gmelina arborea</u> industrial*		40	35						75
Native hardwoods		13	24	8	7	14			66
Total hardwoods		993	704	128	47	349	13	12	2 246
Total industrial hardwood		293	299	38	17	89	3	2	741
<u>Pinus</u> spp		487	398	222	17	8			1 132
Other conifers		9	42	4	5	35	5		100
Total conifers		496	440	226	22	43	5		1 232
Total industrial plantation		789	739	264	39	132	8	2	1 973
Total plantations		1 489	1 144	354	69	392	18	12	3 478

SOURCE: FAO/PNUMA/ROMA, Adapted.

* industrial plantation means plantation destined to produce raw material for wood processing industry

The average annual increment of Eucalyptus plantations is quite variable, values from 5 to 30 m³/ha/year have been found.

Pinus plantations have been managed in order to produce logs, with thinnings to avoid overcrowding and, consequently, stagnation. Mean annual increments from 8 to 24 m³/ha/year have been reported in pines planted in acceptable ecological conditions.

In the last few years there has been a tendency to increase yields as a result of better practices, selected seeds, and more knowledge about the adaptability of the species to particular ecosystems.

Regarding the area to be planted in the next years, no reliable projections have been found. It is expected that the total plantations reach 400.000 to 500.000 hectares per year, of which 50 % would be industrial and 50 % for charcoal and other types of energy.

1.1.4. Prospective supply of roundwood

As was already mentioned the annual average of deforestation is about 2,53 million hectares, of which 1,36 millions are of closed broadleaved forest, 0,12 millions of coniferous forest and 1,05 millions of open broadleaved forests.

The most menaced are productive coniferous forests, which out of a total area of 280.000 ha experience a deforestation of 80.000 ha annually. There logging and deforestation will have to be dramatically diminished or stopped in order to ensure the conservation of some intact stands for the future.

Regarding the Amazon region the figure of 1,36 million ha deforested per year does not seem to be worrisome, because it corresponds to 0,45 per cent of the productive forest area. But it must be borne in mind that the areas presently being deforested are the most accessible and probably the most valuable ones because of their composition. There is a necessity of deeper analysis than simple comparisons of existent and deforested areas. The present growing stock of intact Amazon closed forests is estimated at about 43.000 million cubic meters and the commercial volume at 1.40, million. The demand for hardwood logs is estimated at around 30 million cubic meters in 1982, 3 million in 1985 and 50 million in 1990. It is assumed that the total needs from 1981 to 1990 totalize about 223 million cubic meters. These figures, however, are very rough estimations.

In any case, the fact that in the next ten years 1/16 of the commercial growing stock will be depleted shows that the Amazon reserves are not inexhaustible.

1.1.5. Timber harvesting

Harvested land is almost exclusively of private ownership; the only requirement for the owner is to hold a licence from the National Institute for Forestry Development (IBDF). IBDF also enforces dispositions obliging forest industries to reforest on a basis of a certain number of trees per cubic meter of harvested timber.

There does not exist a fixed annual limit for harvesting, the total harvested volume depending on the dynamics of the sector. Regarding arrangements for harvesting, there are a few kinds of them: some companies take care of the operations themselves, others contract loggers to harvest and others buy logs directly from independent loggers. In some regions on the rivers of the Amazon basin there exist middlemen, who buy the logs from loggers and sell them to the companies.

Generally the logger is a small contractor; there is no information about large and capitalized companies dedicated just to logging.

The machinery depends on who does the job. In the case of company operations crawler tractors are used, also few wheel skidders, farm tractors, frontal loaders, trucks tractors and trailers. In the low swampy areas of "varzea" or "Igapó" in the Amazon area, the logs are hauled through ditches of about 1,0 m width by 1,0 m or more depth over one kilometer or more. It is also common that the logs be skidded by hand over crossed bolts of trees or palms.

The transport is made predominantly by truck and in certain regions there is some transport by means of railroads. In the Amazon region the river is much used for log transport, the floating logs are sent in rafts and the non-floating in barges.

In some areas of the Amazon region axes are still used, but chain-saws predominate in felling, bucking and limbing operations.

Productivity depends very much on tract conditions and equipment utilized. It is common in some areas for a crew of three people to log 10 or 12 cubic meters of a truck load per day. Of course, more equipped operations allow for higher productivity.

Most equipments are now produced in the country, The latest equipment to be produced in Brazil is the wheel skidder, which used to be imported.

2. MECHANICAL WOOD PROCESSING INDUSTRY

2.1. Primary processing

2.1.1. Sawmilling

In Brazil there exist about 13.000 sawmills. It is not known how many of them are operating at the present time, since in the last two years many sawmills have stopped or reduced their production. This is due to slack demand, caused by low levels of construction and reduced economic activity.

The statistics of sawnwood production from 1965 to 1979 are shown in table no. 4. This information was given by IBDF, but it appears that coniferous sawnwood production is underestimated since 1975. The information corresponds most probably to production verified by IBDF.

TABLE No. 4
Sawnwood production in Brazil 1965 - 1979
(thousand m3)

Year	Coniferous	Broadleaved	total
1965	2 961	2 700	5 661
1966	3 272	2 800	6 072
1967	3 618	3 000	6 618
1968	3 865	3 100	6 965
1969	4 167	3 300	7 467
1970	4 535	3 500	8 035
1971	4 500	3 600	8 100
1972	4 350	3 200	7 550
1973	3 665	3 444	7 109
1974	3 665	3 977	7 642
1975	5 479	4 659	10 138
1976	5 846	5 397	11 243
1977	6 590	6 953	13 543
1978	6 952	6 385	13 337
1979	7 334	6 736	14 070

SOURCE: IBDF - Departamento de Comercialização

There is no information about production capacities except for some projections made by IBDF (Diagnóstico do Mercado e Derivados, V.I, Análise da Oferta e da Demanda) in 1978, for the period 1979-1985, but they were very conservative if compared with the actual production in 1979.

The sawmilling industry started in the south of the country and it was there that it had more relative importance, mainly because of its location near Paraná pine stands.

Except for some kinds of sawmilling equipment Brazilian-made machinery is of a lower technological level than the one produced by the leading countries in the sector, but it is very adequate to the prevailing conditions.

The majority of Brazilian sawmills have bandsaw headrigs, with wheel diameters from 80 cm to 200 cm. The typical Brazilian sawmill that converts logs from native forests can be described as follows: its equipment consists of a bandsaw headrig of 125 cm, one or two ring saw handfeed circular edgers, one or two cross cut saws. Energy is supplied by the public network or through electrical generators moved by steam or diesel engines, some saws are powered by electrical motors. The output production capacity in one shift of ten hours is between 300 and 600 cubic meters per month, the number of workers is around 40 people.

Mechanization started about 10 years ago, and the number of sawmills provided with conveying equipment is growing, but to date only very few sawmills have been planned. Most of them are empirically established.

Another change in sawmilling machinery is the development of equipment for small log processing to convert small diameter logs from man-made forests.

In regions of new settlement near the forest it is very common to install large numbers of sawmills and after some years (five to ten depending on the sawmill concentration and the size of the forest resources) to close them. Only those which have some forest reserves or resign themselves to compete for a few logs remain open. The other sawmillers migrate to a new frontier and start again.

There is at present no information about the number of people employed in the sawmilling industry; however, if an average of 20 people per 13.000 sawmills is considered the total would be around 260.000 people.

2.1.2. Wood based panels industry

The wood based panels industry in Brazil comprises the production of veneer, plywood, fibreboard and particle board. Companies producing veneer and plywood are mainly of small and medium size and utilize Brazilian-made equipment. A few, large, companies, using imported equipment produce fibreboard and particle board. Table no.5 illustrates the trend of steady growth in the production of wood based panels for the period 1965-1976.

The plywood industry started in the south of the country between 1930 and 1940 in the region of Araucaria.

Initially plywood plants were very small, generally with one lathe, a reel for re-enrolling veneer, a mechanic clipper, veneer drying in sheds, glue preparation devices, a gluer and a cold press. In those days it was common that plants produce exclusively veneer to sell to the plywood plants, whereas today plants that produce only veneer exist but are unimportant.

TABLE No. 5

Production of wood based panels 1965-76
(thousand m³)

Year	veneer and plywood	particleboard	fibreboard	total
1965	270	10	148	428
1966	305	19	148	472
1967	347	42	149	538
1968	370	42	162	574
1969	390	61	209	680
1970	438	112	269	819
1971	547	162	323	1 032
1972	758	265	368	1 391
1973	847	313	351	1 511
1974	830	360	395	1 585
1975	814	407	491	1 712
1976	864	461	574	1 899

SOURCE; IBDF/COPLAN

One particular feature of the Brazilian plywood industry is the size of the panels, normally 2.20 x 1.60 m. This size originated because of the requirements of the main market, the manufacture of cabinets, mainly wardrobes. Even today most of the plywood used and produced in Brazil is of that size. Another size commonly used is 2.20 x 1.10 utilized in water proof plywood for formwork in constructions.

The species most frequently utilized are Paraná pine, a group of woods native in Araucaria region called "canelas", Virola spp, in the north and a number of light broadleaved species.

Most of the plywood industry is still in the south of the country, but due to the shortage of peeling logs in the region some companies are forced to bring logs from the Amazon and others are moving or planning to move production to the Amazon region.

The Brazilian veneer and plywood industry is equipped mostly with Brazilian made equipment. Like in sawmilling, usable equipment for veneer and plywood manufacture is produced in Brazil, some of it under licence. The equipment is not sophisticated, indeed very simple, but apparently adequate to the environment which prevails in developing countries.

There are many problems in the veneer and plywood industries in Brazil which have to be solved. There are problems in knife grinding, recovery in the clippers has to be improved, there are problems of gluing, lack of accuracy in plywood thickness, etc. Up to now the knives for lathes and slicers need to be imported and local production should therefore be envisaged.

There is no information on the number of people employed in this industry, 50.000 persons seem to the author to be a reasonable figure.

The particleboard industry comprised in 1980 12 plants with a capacity of 835.000 m³ per year. Two plants with a total annual capacity of 110.000 m³ were closed during that year because, being located in the east far from the markets, they could not compete with factories, located nearer the markets, in the south or southeast.

The 10 remaining factories produced in 1980 about 670.000 m³, that is 92 % of their installed capacity.

IBDF (Diagnóstico do Mercado de Madeira e Derivados, V.I. - IBDF/COPLAN) projected an annual growth of 12 % in the production from 1980 to 1985. The projected production for 1982 is 1.268.100 m³.

The equipment for particle board plants is mostly imported, part of it is very modern and updated.

The raw material used for particle board production depends on each particular plant. Those located in the Paraná pine region use predominantly sawmill residues, others use Pinus spp, Eucalyptus spp, Acacia nigra, Mimosa scabrela and other native species.

Most of the companies have forest plantations in order to supply at least part of the roundwood requirements.

The fibreboard industry comprises two companies having three plants, all located in the State of São Paulo. Presently there are eight or nine lines working, producing about 550.000 tons per year, all using the wet process.

The raw material is 100 per cent Eucalyptus spp, part of the supply is from company forests, and part from privately owned plantations.

This industry has had a steady growth in the last few years, and its products due to their quality and uniformity have been accepted in the international market. In 1979 173.589 tons were exported, corresponding to about 30 per cent of the production.

2.2. Secondary wood processing

2.2.1. Wood on construction

In Brazil as in other South American countries, there exists a disseminated prejudice against all wood houses. Wooden houses are used with relative frequency in some regions of the south of the country, in the agricultural frontiers and in forest regions. Generally wooden houses are considered second class ones. The use of brick and cement block prevail in walls of houses in more developed areas, whereas in poorer or undeveloped areas houses made of taipa (wood sticks and mud) are common.

The most common type of wooden house in Brazil is a vertical board, and batten wall type, where the walls have a structural function, together with some stud like pieces on the corners around doors and windows. The floor is made of wood stripes nailed over timber beams, the nailed roof structure is made of wood beams and ribs, covered with clay tiles. The ceiling is tongue and groved panel. Windows and doors are of solid wood. The finishing depends very much on the budget, and varies from very poor and ugly houses to very nice and comfortable ones.

Brick and concrete block houses also have a wooden roof structure, sometimes wood flooring or wood parquet. The ceiling can be of tongue and grooved paneling. Windows are of solid wood, steel or aluminium; doors of solid wood or of fibreboard.

Production of prefabricated houses started in Brazil about 20 years ago, but until now this sector of industry did not prosper. Legal constraints impede the construction of such kind of construction in most urban regions and finance is also a constraint. The prejudice against wooden houses can be explained by the fact that some companies have produced low quality and short-lived houses. Presently most prefabricated houses sold are for recreation purposes near the large cities.

2.2.2. Wood in packaging

The wood packaging sector is mostly a marginal one, it is generally developed in order to utilize the shorts and sawmill residues. There is no information about the number of companies that produce packaging material. In some particular areas, where there are pine plantations and fruits, vegetables, or other crop products using wooden packing cases there exist small sawmills exclusively producing packaging material.

The pallet industry is a fast growing one, but it is mostly based on hardwood residues or shorts, as the sawmills are located in agricultural frontier areas, far from industrialized regions, the major component of cost being the freight.

2.2.3. Wood in furniture

The furniture industry is relatively important; it employs about 180.000 persons, that is three per cent of the industrial labor force of the country. The number of firms in the country is 12.600, and most of the companies are small or very small. Only 450 firms can be considered medium or large according to Brazilian standards and fiscal criteria. The capital of furniture manufacturing companies is predominantly national. The equipment used is mainly Brazilian-made, and has been good enough for producing furniture for the domestic market, where quality standards are not so high. However, when producing for export, it has been difficult to meet international quality standards with locally produced equipment.

The furniture industry is located mostly in the south and in the southeast regions of the country. The raw material utilized varies according to the type and the category, for example closets of low cost are made of particle board and even of fibreboard, but more expensive ones are made of veneered plywood and even solid wood. The species used also depend on the type and on the price level. Presently the more desired and procured woods for furniture are: Imbuia (Phoebe porosa), Cerejeira (Torresia sp or Amburana spp), Freijó (Cordia goeldiana) and Mahogany (Swietenia macrophylla). Presently home and office furniture made of Pinus spp grown in plantations are being introduced in the domestic market.

Wood supply is one of the constraints for the development of the sector, almost all solid wood is brought from the Amazon region located about 4.000 km from the furniture producing centers.

The furniture sector sells about 99 % of the total production in the domestic market and exports only one percent. Exports totaled about US\$ 21 million in 1979. The main clients are: U.S.A., Latin America, West Europe, Canada and Japan. The Brazilian furniture exports represent less than 0,3 per cent of world furniture trade. Better designs and increased quality are needed in order to increase the Brazilian participation in the international market.

One of the constraints to improve quality is the lack of trained people in regions which are not traditionally furniture makers and the lack of technical knowledge in wood processing, wood drying, gluing and finishing. The number of technically trained people is very small in all the furniture industry.

3. MARKET AND TRADE RELATIONS

3.1. Domestic trade

Due to the size of the country there are several flows of wood and wood products from one region to another. The most important are: a) logs from the Amazon region supply sawmills, veneer and plywood mills located in the south or southeast of the country. The transport is made by trucks or by sea according to the location of the supplier and the user. The long-distance flow of logs is generally limited to valuable species or peeling-logs; b) sawn-wood flows are generally from north to south, northwest to southeast and in the case of Paraná pine from south to southeast; c) plywood, follows sawnwood flows;

d) fibreboard and particle board are mostly produced in the south and southeast and used in the same region; f) a relatively small fraction of furniture produced in the south and southeast is destined to other regions.

Probably the main constraint to the development of the wood products market is the low income of the major part of the population, which spends most of the earnings to satisfy more basic needs. Inefficiency of wood manufacturing and marketing systems are also other factors that influence the market because of the relatively low quality and high prices.

3.2. International trade

Wood products exports in the period 1959-1980 are shown in table no. 6. Table no. 7 shows the international trade of wood products in the period 1959-1977.

From the above tables it is possible to infer that the country is a wood surplus country. However, wood and wood products represented only 1,56 % of total exports in 1980. The fact that the wood industry has been less dynamic than other sectors in its endeavours to compete internationally is illustrated by the reduction in the participation of wood and wood products in total exports from 5 % in 1968 to its present percentage.

The main obstacles to the development of semi-manufactured and manufactured wood product exports are:

- a) Most of the wood industries are of medium or small size, unable to provide large shipments in time;
- b) Difficulty to form producer associations in order to meet large orders;
- c) Lack of marketing intelligence;
- d) Lack of infrastructure in the main forest areas.

4. CONCLUSIONS

Quantitatively, Brazil has huge forest resources, but due to qualitative aspects and geographical distribution a large part of the resource is, at present, practically inaccessible.

TABLE NO. 6

Value of exports of wood products in the period 1959-1980
(US\$ thousand)

YEAR	Logs hardwood	Sawnwood		Planned		Veneer	Plywood	Fibreboard and particleboard	Total
		conifers	hardwood	conifers	hardwood				
1959	2 448	37 791	365	493	310	270	291	313	42 281
1964	3 466	46 363	1 593	1 099	428	1 151	1 990	1 021	57 111
1968	6 059	72 407	2 407	309	1 340	7 535	1 723	3 009	94 839
1969	4 004	76 865	3 773	160	1 983	16 958	1 753	3 477	108 973
1970	3 119	73 242	3 495	2 609	1 126	5 485	15 951	4 026	109 053
1971	3 593	71 857	10 276	2 043	4 068	18 565	4 248	7 620	122 270
1972	4 493	59 720	12 839	2 715	9 064	24 886	5 596	8 834	128 147
1973	13 564	62 753	27 199	17 755	7 137	33 407	8 971	11 341	182 127
1974	6 834	50 034	35 680	37 531	22 776	23 134	8 727	16 572	201 288
1975	1 233	55 472	22 011	0	25 088	24 471	7 828	18 272	154 375
1976	1 708	31 899	19 437	16 073	30 073	24 475	11 214	20 028	154 907
1977	895	17 989	37 194	18 887	41 248	25 130	15 133	27 292	183 768
1978	-	23 307	21 955	22 621	36 557	24 682	24 376	35 045	188 543
1979	-	39 463	13 889	29 237	125 898	28 556	38 285	37 184	312 518
1980	-	45 683	38 924	18 374	119 979	34 250	41 286	49 338	347 834

SOURCE: CACEX/IBDF/COPLAN

TABLE No. 7

International trade of wood and wood products
and total exports 1959-1977

Year	Wood and wood products			total exports	participation of wood exports on total exports
	exports	imports	balance		
1959	42 261	61	42 220	1 281 969	3.3
1964	57 111	186	56 925	1 429 790	4.0
1968	93 839	665	94 174	1 881 344	5.0
1969	108 973	425	108 548	2 311 169	4.7
1970	109 053	2 182	106 871	2 738 922	4.0
1971	122 270	2 007	120 263	2 903 856	4.2
1972	128 147	4 695	123 452	3 991 219	3.2
1973	182 127	7 382	174 745	6 199 000	2.9
1974	201 288	12 789	188 499	7 950 996	2.5
1975	154 375	17 843	136 532	8 669 944	1.8
1976	154 907	26 688	128 219	10 128 303	1.5
1977	183 768	36 864	146 904	12 140 755	1.5

Note: The figures do not include furniture.

SOURCE: Diagnóstico da Participação do sub setor Florestal na Economia Brasileira, IBDF, 1978.

Most of the forest resources existing in the country are located in the Amazon region, far from the manufacturing and consuming centers. The inexistence of a transport infrastructure and the high cost of oil make transport very expensive.

There is a lack of a comprehensive forest policy that could assure a compromise between supply of wood and other forest products and the maintenance of forest resources on a permanent basis.

The reforestation programs have been directed mainly towards short rotations and concentrated on two genera. There is practically no reforestation with high-quality native species.

Pressure for agricultural and pasture land have caused depletion of large forest areas.

Because of the large number of species existing in most of the country's forests and the small number of commercial ones, the yield per unit of area is very small and the cost of harvesting very high.

The sawmilling, veneer and plywood segments have been developed without any preoccupation with the resource base, and generally with a low efficiency due to lack of technical knowledge and training; resulting in a relatively high-cost and low-quality product.

The secondary wood processing industry, composed mostly of small family firms, functioning with empiric knowledge and generally poorly capitalized is consequently inefficient and has lost progressively to the competition of other materials.

Woodworking equipment, for almost all segments of the sector (with the exception of very specific ones) are produced in the country. However, quality, precision and increasing mechanization need to be stimulated.

Centers for training in woodworking at a college level do not exist in Brazil. Wood technology is a course in some forest schools and some classes in engineering schools, but a formal education in wood processing and furniture manufacturing is still lacking.

CHILE

1. INTRODUCTION

According to the climate, Chile can be divided into four different regions.

- a) The northern region, mostly desert without economic forests, with the possibility of development of tamango forests (Prosopis tamango) and agriculture in valleys with adequate micro-climate.
- b) The central region, with well delimited seasons and semi-arid and sub-humid mediterranean climate, with varied forest types and plantations of Pinus radiata, Populus spp and Eucalyptus globulus. It is adequate for the cultivation of several varieties of agricultural crops, with one crop per year.
- c) The southern region, also called the rain region, because of the abundant precipitation and high moisture. There are several forest types, traditionally suppliers of native timber. Plantations of Pinus radiata can be found in this area.
- d) The austral region, with cold climate with snow on the border of Argentina and abundant rain on the islands. The forest resource are limited to three types of specie. Reforestation is undertaken on a small scale with Pinus silvestress spp.

2. FOREST TYPES AND GEOGRAPHIC DISTRIBUTION

The following are the main forest types and their geographic distribution.

- a) Sclerophylls type. Its limits are between 30°50'S on the north and 38°S on the south. It is composed of species of coriaceous leaves, scrubby or tree sized. Presently this type is reduced to some areas on the mountain slopes. Most parts of the land originally covered by this forest type have been utilized for agriculture and grazing.
- b) Roble-hualo type of forest. It is found in higher altitudes between 32°50'S and 36°30'S. It is a forest of hygrophytic character. Large parts of these forests have been cut over to give land to agriculture or have been transformed into plantations of Pinus radiata.
- c) Cypress of the mountain. It is located in the Andes mountains between 34°45'S to 44°S and grows on soils of limited fertility and is not difficult to be found between 900 and 1.800 m above the sea level.

- d) Roble-rauli-coique type of forest. It occurs between $36^{\circ}30'S$ and $40^{\circ}30'S$. It is a secondary forest originated by fires and devastation of forests. Presently this type has high economic interest; the wood is been utilized for doors, windows, panelling and veneer.
- e) "Lengo" type of forest. It can be found between $36^{\circ}50'S$ and $56^{\circ}S$, can be pure depending on altitude, latitude and exposition. It can be associated with araucaria, coique or coique of Chiloé. In high altitude it presents a scrubby shape. This forest was seriously destroyed by fires in the 1930's to give land for grazing.
- f) Araucaria type of forest. It is found between $37^{\circ}S$ and $40^{\circ}48'S$ between 900 and 1.700 m of altitude. Araucaria occurs associated with lengo or with lengo and coique.
- g) Coique-rauli-tepa type of forest. It occurs from $37^{\circ}S$ to $40^{\circ}30'S$ in the Andes mountains and from $38^{\circ}S$ to $40^{\circ}30'S$ in the coast mountains.
- h) Evergreen type of forest. It occurs between $40^{\circ}30'S$ and $47^{\circ}S$ above 1.000 meters of altitude. It has a variable composition depending on the longitude and on the altitude.
- i) Alerce type of forest. The alerce (Fitzroya cupressoides) has been exploited because of the durability of its timber, it is found between $39^{\circ}50'S$ and $43^{\circ}30'S$.
- j) Forest of the cypress guaitecas (Pilgerodendron uviferum) type. It is an homogenous type occurring in swamps which do not permit the growing of other species. It occurs between $40^{\circ}S$ and $54^{\circ}S$ in islands and plains of low altitude.
- k) Forest of the coique of Magallanes (Nothofagus betuloides) type. In this forest type 50 % or more of the tree are of coique de Magallanes, other species are coique common, canello, maitén and lenga. This type occurs between $47^{\circ}S$ and $55^{\circ}30'S$. This forest type has been little exploited.

3. FOREST RESOURCES

3.1. Natural forests

The total area of Chile is 75,7 million ha, 11,8 million ha out of which (15,6 %) are potentially usable as forests. The major concentration of this type of land is found in the south of the country.

TABLE No. 8

Soil potential use in Chile

potential use	area million ha	percent (%)
Agriculture	1.9	2.5
Grassland	11.8	15.6
Forests	11.8	15.6
Unproductive	50.2	66.3
TOTAL	75.7	100.0

SOURCE: INFOR/CONAF. Chile, 1981.

The native forests presently cover 7,6 million of hectares.

Table no. 9 shows the distribution of native forests in the various administrative regions of Chile. As can be seen most of the forest area (83 %) is located in the south of the country, in the insular region (regions X, XI and XII) where the access is difficult and weather very rigorous. About 13 % of the forest area is located in the middle south and south. The center regions comprise only about 3,5 % of the forest area. The total growing stock of natural forests is estimated at 915 million cubic meters.

TABLE No. 9

Forest areas and volume by regions. 1981

regions	area ha	%	volume million of m ³	%
I a V north	-	-	-	-
M.R.(*) center	2 700	-	-	-
VI	41 200	-	0.3	-
VII	196 400	3	6.4	0.7
VIII middle south	401 700	5	24.1	2.6
IX south	632 900	8	22.0	8.9
X	3 592 600	47	744.2	81.3
XI far south	1 686 000	22	42.0	4.6
XII	1 059 000	14	15.9	1.7
TOTAL	7 612 500		915.1	

(*) Metropolitan Region.

SOURCE: INFOR/CONAF. Chile, 1981.

3.2. Man-made forests

Man-made forests in Chile are based mainly on Pinus radiata. Table no. 10 gives a summary of the species planted.

Pinus radiata found in Chile exceptional conditions for its development. The average annual increment is estimated at 22 m³/ha. In some sites annual increments of 40 m³/ha have been observed. Aside from the very favorable increments, Chile has relatively large areas, about 4,6 million ha, available for the plantation of that species, which cannot be utilized for other purposes due to the mountainous topography.

TABLE No. 10
Summary of man-made forests at the end of 1980

species	area (ha)	percent
<u>Pinus radiata</u>	716 939	90.2
<u>Eucalyptus</u> spp	33 200	4.2
Tamarugo	20 000	2.5
<u>Pseudotsuga menziensi</u>	7 800	1.0
<u>Populus</u> spp	3 500	0.5
Others	13 071	1.6
TOTAL	794 510	100.0

TABLE No. 11
Areas planted with Pinus radiata by regions

regions	area (thousand ha)	percent
I a IV north	-	-
M.R.(*) center	0.7	0.1
V north	12.7	1.8
VI	43.2	6.0
VII	130.3	18.2
VIII middle south	418.0	58.3
IX south	71.2	9.9
X	40.8	5.7
TOTAL	716.9	100.0

Table no. 11 shows the regional distribution of Pinus radiata plantations. Most of the Pinus radiata plantations are concentrated in the Middle south.

Table no. 12 shows the distribution of areas and volume of Pinus radiata plantations according to the age class. It is easy to see the steady growth of area planted since 1944.

3.3. Forest management

The natural forests of Chile have been exploited in a very destructive way. A law promulgated in 1974 establishes the basis for the management of the forests, but this law has been enforced only in 1980. The regulations are inspired by quite pragmatic principles and some are based on recent results of investigations on natural regeneration and harvesting, oriented towards the conservation of the resource.

The second specie planted in the area is the Eucalyptus gobulus. This specie, in spite of the small participation in terms of area of plantation, is of relatively great importance, because of the quality of its wood which is utilized in the furniture industry.

Before, the plantations in Chile were made mainly by CONAF, "Corporación Nacional Forestal" a public institution, but presently most of the plantations are made by private companies or persons (see table no. 13).

The management of planted forest is taken for granted, since the plantations are made with clear economic objectives, and many investigations have been made on the subject.

3.4. Harvesting

Timber harvesting in Chile varies from highly manual operations to highly mechanized ones.

TABLE No. 12

Areas and volumes of Pinus radiata plantations
according to the age class

class of age	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	36 and more
Year of planting	75 - 80	70 - 74	65 - 69	60 - 64	55 - 59	50 - 54	45 - 49	44 and before
Area (ha)	303 994	192 220	76 959	51 974	44 655	33 898	9 163	4 076
Volume (m ³)	-	-	8 313 913	13 969 543	20 202 369	19 027 228	5 093 892	2 470 109

SOURCE: INFOR/CONAF. Chile, 1981

TABLE No. 13

Total areas planted by CONAF and the private sector 1973-1980, ha

	1973	1974	1975	1976	1977	1978	1979	1980
planted by CONAF	27 416	35 171	44 073	54 060	44 570	24 939	367	213
planted by private	2 897	21 052	38 521	53 643	48 642	54 048	51 651	72 132
TOTAL	30 313	56 223	82 594	107 703	93 212	78 987	52 018	72 345

SOURCE: CONAF/Chile, 1981.

The main characteristic of the Chilean forests is the very uneven topography. Most of the forests are situated in mountainous regions, since the plains or low sloped areas in favourable ecologic conditions are used mainly for agricultural purposes.

Timber harvesting in Chile is made both by the company crew and by contractors. Equipment utilized varies from horse and oxen to very modern skidders and cable systems.

In some Pinus radiata harvesting operations visited, the author could see horses and oxen used in pre-hauling as well as wheel skidders, track skidders, and a track mounted mobile highlead yarder. The equipment utilized depended on the topography of the terrain, and on the size of the trees. The animals were utilized mainly for reclaiming short and small diameter bolts. Rubber tired cable skidders were used for skidding on rolling terrain, tracked cable skidders were used in relatively more adverse slopes. The highlead yarders were used in places where the skidders could not operate. All equipment was imported.

The number of persons employed in timber harvesting in Chile was estimated to be 4.121 in 1980; in that year a total volume of 10,6 million cubic meters were harvested.

The uses of roundwood production in 1979 and 1980 are summed up in table no. 14.

TABLE No. 14

Volume of roundwood production 1979-1980, m³

Uses	1979	1980
Wood pulp	3 235 271	3 092 837
<u>Pinus radiata</u> sawnwood	3 909 643	3 830 788
Other species sawnwood	679 140	731 750
Wood based panels (fibre and particle boards)	186 004	188 404
Veneers and plywood	34 296	29 817
Transmission poles, pit props and matches	176 005	176 000
<u>Pinus radiata</u> export logs	953 966	1 003 811
Other species export logs	11 749	48 572
Other consumption (fuelwood-charcoal)	1 480 926	1 480 926
TOTALS	10 667 000	10 582 905

SOURCE: CONAF/INFOR/1981.

Radiata Pine plays a large role in industrial roundwood production (about 88,6 %). Table no. 15 shows the utilization of pinus radiata and other species for different uses.

Due to the importance of Pinus radiata and the wide number of native and exotic species it is important to forecast the supply of that specie in the future. According to Hush and Jones (1977), some shortage of timber supply could occur in the period of 1981-1985 with an annual availability of 4,3 to 6,3 million cubic meters.

TABLE No. 15

Utilization of principal species, 1980
(m³ without bark)

Product	<u>Pinus radiata</u>		Other species		TOTAL
	volume	%	volume	%	
Chemical pulp	2 801 083	98.7	36 894	1.3	2 837 977
Mechanical pulp	254 860	100.0			254 860
Board and veneers	176 750	81.0	41 461	19.0	218 211
Sawnwood	3 832 531	84.0	730 007	16.0	4 562 538
Export logs	999 763	95.0	52 620	5.0	1 052 383
Matches, posts and others			176 000	100.0	176 000
TOTALS	8 064 987	88.6	1 036 982	11.4	9 101 969

The availability of timber would start to increase slowly during the period 1986-1990 and then it would have a dramatic increase during the 1990's reaching 27,6 to 34,5 million cubic meters. After a period of shortage there would be an availability surplus, that would require radical changes in the wood based industry.

4. MECHANICAL PROCESSING INDUSTRY

All major sectors (both primary and secondary) of the wood processing industry are represented in Chile. The wood processing industry stagnated in the 1960's and in the 1970's, but after 1975 it started to grow steadily. Tables no. 14 and 15 give an idea about the present situation of the forest industry in Chile. Figure no. 1 shows the main flows of forest products in 1980.

4.1. Primary wood processing

Primary wood processing is represented in Chile by sawmilling and the following types of panels: veneer, sheets, plywood, blackboard, fibreboard and particleboard.

4.1.1. Sawmilling

Sawmilling is the main roundwood-using activity in the country, consuming 43 % (4,56 million m³) of harvested roundwood in 1980.

The number of sawmills in 1980 was of 1.498, the size of which varies from very small and simple to large, modern and capital-intensive concerns. Production capacity in 1980 was 3,6 million cubic meters and actual output 2,2 million cubic meters, leaving unused capacity of about 40 %. Table no. 16 shows trends in sawnwood production from 1962 to 1980.

By the end of 1980, due to slack demand, about 33 % of the sawmills stopped production and the stock of sawnwood rose to about 390,000 m³.

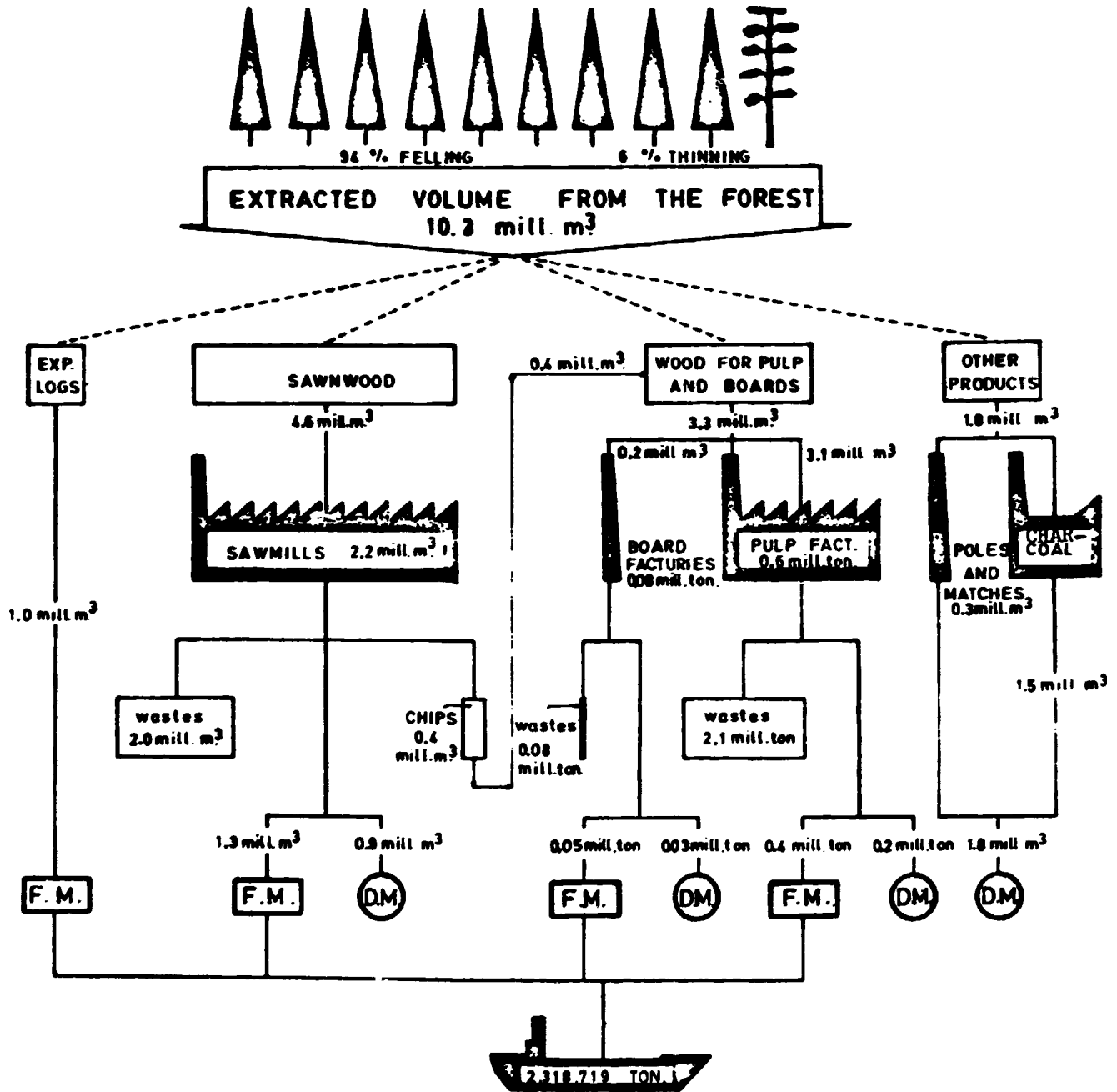
The main specie processed in 1980 by the sawmilling industry was Pinus radiata, accounting for 84 %; other native species, the most important being coique, tepe, roble and rauli represented 14 %, and 2 % corresponded to Eucalyptus spp, alamo and cypress. Table no. 17 shows the species in sawmilling in 1980 and their relative importance.

Production according to the size of the sawmills is presented in table no. 18.

The sawmills in Chile are powered by different types of power sources. Table no. 19 shows the source of energy and the production of sawmills.

FIGURE No. 1

CHILE FORESTRY PRODUCTION DISTRIBUTION YEAR 1980



F.M. FOREIGN MARKET
DM DOMESTIC MARKET

TABLE No. 16

Sawnwood production from 1962 to 1980

(1.000 m³)

Year	<u>Pinus radiata</u>	Other species	total
1962	174.8	601.0	775.8
1963	238.4	571.8	810.2
1964	460.0	573.7	1 033.0
1965	479.4	514.7	994.1
1966	578.2	483.6	1 061.8
1967	468.3	382.2	850.5
1968	573.6	422.5	996.1
1969	534.5	477.8	1 012.3
1970	636.9	339.5	976.4
1971	733.7	313.1	1 046.8
1972	735.3	378.3	1 113.6
1973	630.3	402.1	1 032.4
1974	1 084.0	314.5	1 398.5
1975	744.0	216.0	960.0
1976	1 154.4	68.9	1 223.3
1977	1 291.9	44.1	1 336.0
1978	1 352.9	122.1	1 475.0
1979	1 869.6	326.0	2 195.6
1980	1 832.9	350.1	2 183.0

SOURCE: CONAF/INFOR. Chile, 1981.

TABLE No. 17

Species processed in sawmilling in 1980

SPECIES	PERCENT
Radiata pine (<u>Pinus radiata</u>)	83.96
Coique (<u>Nothofagus dombeyi</u>)	3.48
Tepa (<u>Laurelia philippiana</u>)	2.44
Roble (<u>Nothofagus obliqua</u>)	2.33
Rauli (<u>Nothofagus alpina</u>)	1.73
Lenya (<u>Nothofagus pumilio</u>)	1.59
Eucalipto (<u>Eucalyptus globulus</u>)	1.37
Alamo (<u>Populus spp</u>)	1.01
Mañío (<u>Podocarpus saligna</u>)	0.55
Olivillo (<u>Kageneckia angustifolia</u>)	0.39
Laurel (<u>Laurelia sempervirens</u>)	0.32
Alerce (<u>Fitzroya cupressoides</u>)	0.29
Canelo (<u>Drimys winteri</u>)	0.18
Araucaria (<u>Araucaria araucana</u>)	0.08
Ulmo-Tineo (<u>Eucryphia cordifolia</u> - <u>Weinmannia trichosperma</u>)	0.07
Cipres (<u>Austrocedrus chilensis</u>)	0.07
Lingue (<u>Persea lingue</u>)	0.05
Not specified	0.10

SOURCE: CONAF/INFOR. Chile, 1981.

TABLE No. 18

Distribution of production according to the size
of sawmills 1980

Size of sawmill	Nº of sawmills		production	
	unit	percent	m ³	percent
Very small	1 410	94.0	1 052 545	48
Small	62	4.1	344 546	16
Medium	6	0.4	100 981	5
Large	20	1.3	684 921	31
TOTALS	1 498	100.0	2 183 033	100

SOURCE: CONAF/INFOR. Chile, 1981.

TABLE No. 19

Source of energy and the production of sawmills

Type of source	Percent of nº of sawmills	Percent of production
Electric	8.75	49.19
Diesel Engines	40.39	35.08
Steam Engines	46.86	14.57
Gasoline Engines	1.00	1.06
Others	3.00	1.06
TOTAL	100.00	

SOURCE: CONAF/INFOR. Chile, 1981

Most sawmills in Chile (95 %, accounting for 73 % of the production) have circular headrigs. Table no. 20 presents the distribution of types of headrigs and participation in production.

TABLE No. 20

Sawmills, types of headrigs and capacity of productions and production in 1980

Type of headrig	nº of sawmills	percent	production in 1980 m ³	percent
Circular	1 423	94.89	1 590 363	72.85
Band saw	41	2.74	402 108	18.42
Gang saw	8	0.53	180 088	8.25
Others	26	1.84	10 474	0.48
TOTALS	1 498	100.00	2 183 033	100.00

SOURCE: CONAF/INFOR. Chile, 1981.

According to the time the sawmills remain in the same place, they were classified in mobile and permanent. Mobile sawmills are those which remain less than three years in the same place, and permanent ones, those which remain more than three years. According to this classification 1.098 sawmills or 73 % of the total number were classified as mobile, and 375 sawmills as permanent.

In 1980 about 20 sawmills had dry kilns, with an annual drying capacity of 520.000 m³. In the same year 200.000 m³ of lumber were kiln-dried (38 % of the installed capacity). The majority of kilns are used to dry Radiata pine.

There are 17 sawmills with chippers, in order to chip the residues and sell them to pulp mills.

The radius of the supply region varies very much. Some sawmills are installed in the forest and others transport logs from as far as 150 km. The average transport distance of logs for medium and large sawmills is about 45 km.

In 1980, 56,5 % of the sawmills got their logs from forests owned by third parties and 43,5 % from forests of their own property.

Employment during the summer - the period of major activity - was of 17.808 persons, not including harvesting and transport activities. During the winter the number of employed persons dropped to 7.301, which is the number of persons permanently employed in the sector. In harvesting logs for sawmilling 2.104 persons were employed during the summer and 750 permanently as truck drivers and helpers.

The average man/month productivity according to the size of the mill is the following:

large sawmills	32.65 m ³ /man/month
medium sawmills	25.04 m ³ /man/month
small sawmills	26.51 m ³ /man/month
very small sawmills	19.57 m ³ /man/month

Table no. 21 shows the distribution of sawmills, production capacity and production, by regions in 1980.

TABLE No. 21

Distribution of sawmills by number, capacity and production by regions in 1980

Region	nº of sawmills	annual production capacity m ³	production 1980
IV	1	210	140
V	21	71 546	25 774
M.R.	1	3 750	2 500
VI	41	71 216	55 521
VII	103	300 498	208 985
VIII	500	1 740 233	1 203 825
IX	357	678 074	319 686
X	414	719 553	324 173
XI	29	37 637	16 687
XII	31	32 180	25 742
TOTALS	1 498	3 554 897	2 183 033

SOURCE: CONAF/INFOR. Chile, 1981.

4.1.2. Wood based panels

The wood based panels industry is characterized by the small number of plants, one plant for fibreboard, three plants for particle board four plywood mills and two veneer mills. Presently this sector represents 8,8 % of the value of forest products and 2,4 % of the roundwood demand. Statistics on the production of wood based panels from 1970 to 1980 are attached as table no. 22.

The installed production capacity of wood based panels in 1980 is shown below:

veneer	8.500 m ³ (10.200.000 m ³)
fibreboard	40.000 m ³
particle board	52.200 m ³
plywood	32.165 m ³

From the above figures and table no. 22 it is possible to infer that the unused capacity in veneer was 33 %, in particle board 18 %, in plywood 5 %, and with fibreboard the utilization was 108 %,

The wood based panels industry processed in 1980 218.221 m³ of roundwood of which 81 % was Pinus radiata, 9 % was Eucalyptus spp and the balance were native species,

This sector of the wood industry employs 2.130 persons excluding harvesting and transport.

It is planned that a new plant of particle board with an annual capacity of 45.000 ton will start production this year.

4.2. Secondary wood processing

4.2.1. Wood in construction

Wooden houses have been used only in the southern part of the country. The main material utilized in one-family house in Chile is brick. In the north concrete blocks predominate.

In one-family houses made of brick or concrete block the roof structure is generally made of wood. Window-frames, which were originally made of wood, have been replaced by steel and by aluminium. Plywood, hardboard and particle board are used for built-in furniture. The doors are made of fibreboard and plywood, the use of parquet flooring is widespread.

TABLE No. 22

Physical production of wood based panels 1970 - 1980. m³*

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Veneer	2 139	931	1 434	1 166	1 457	1 457	2 337	3 870	5 195	6 045	5 730
Fibreboard	18 880	19 200	18 050	18 663	26 358	13 013	21 336	26 444	31 340	41 540	43 053
Particleboard	22 430	30 835	30 063	31 209	25 850	16 321	29 167	31 689	42 101	46 153	42 964
Plywood	16 076	18 867	18 680	22 369	14 980	19 370	10 100	14 075	20 513	24 615	30 530

* Conversion factors:

veneer 1 m³ = 0,75 ton = 1.200 m²
 fibreboard 1 m³ = 1,0 ton
 particle board 1 m³ = 0,65 ton
 plywood 1 m³ = 0,65 ton

SOURCE: INFOR/Chile, 1981

It is estimated, that the biggest market for wood products is the building sector; according to Teng (8) it absorbed in 1968 458.000 m³ of sawnwood, 4.700 m³ of plywood, 7.200 m³ of particle board and 11.900 m³ of fibreboard, corresponding to approximately 70, 40, 40 and 60 per cent, respectively of the total output. It is estimated (8), that on average each square meter of construction requires 0,106 m³ of wood, of which 27 % is for forming, 21 % for structure, 14 % for joinery, 15 % for flooring and stairs, and 23 % for lining. Wood houses normally consume 0,307 to 0,354 m³ of wood per square meter of construction, ranging from 0,144 m³ per square meter for emergency houses - without ceiling and interior lining - to 0,519 m³ per square meter for small houses - with ceiling and exterior and interior lining of wood -,

According to verbal information, Chile has four factories for prefabricated wooden houses, with a capacity of about 1.000 units per year. According to "Estadísticas Forestales, 1980, Serie Informática N-1" there exist 9 factories with a maximum capacity of 165.040 square meters. The production in 1980 is not far from the 1.000 units, but the capacity is roughly the double.

According to "Estadísticas Forestales 1980, Serie Informática N-1" Chile has exported prefabricated houses from 1974 to 1980: two units in 1974, 18 in 1975, 448 in 1976, 1.426 in 1977, 3.266 in 1978, 47 in 1979 and four in 1980. The factory that made such exports is not producing prefabricated houses presently, but doors and other joinery products.

4.2.2. Wood in packaging

Many sawmills have a packaging sector where the shorts or the low graded material are processed into packaging material. There also exist plants producing exclusively packaging material, which buy sawnwood for that purpose.

The packaging sector of the sawmills is generally composed of a band-resaw, circular saws, crosscut saws and a thicknesser.

Among the statistics of forest industries the only available information on packaging refers to the volume of packaging products and pallets entered in the metropolitan area in 1981. The volumes were 34.758 m³ of crate material and 1.033 m³ of pallet material.

4.2.3. Wood in furniture

According to verbal information of ASIMAD (Industrial Wood Association) the 26 members of this association produce 80 % of the furniture, windows and doors of the country. The associated firms that produce windows and doors employ from 500 to 600 persons and the furniture manufacturing plants from 2.500 to 3.000 persons.

There are large furniture plants, the largest one employs about 550 persons with total sales of 17 million dollars in 1979. In the largest concerns the plants are very updated, with some mechanization, continuous coating systems, dry-kilns, etc.

Generally, there is no specialization. Most of the factories produce several types of furniture like household goods, office furniture, upholstered furniture or custom-sized furniture. Most of the equipment used in the furniture industry is imported. Some years ago the government lowered the custom tariff rate from 100 or 180 per cent to only 10 per cent and this permitted the importation of relatively sophisticated equipment.

An average furniture plant is equipped with: band saws, panel saws, jointer, thicknessers, spindle moulder, sanding machine, drill press, veneer press, etc. Some factories are equipped with special machinery like edge-belt sanders, multi-spindle moulders, multi-spindle boring machines, etc.

Aside from the large or medium sized furniture plants, there are a number of small and very small furniture workshops. The number is estimated to be between one and two thousand.

There are no high-level technical schools teaching wood-working and furniture manufacturing. There is one lower-level technical school giving courses on furniture manufacturing. The graduates from that school obtain intermediate positions within the industry. Generally the workers are trained on the job in the furniture industry.

According to verbal information the wood specie more used in furniture is the Eucalyptus globulus, followed by Pinus radiata. It is common to see the use of particle board and fibreboard.

One of the most generalized complaints of furniture industrialist is the difficulty to find adequate supply of sawnwood. According to them the most valuable Chilean wood is exported, the lower grades are left in the country and have to be used by the manufacturers.

The manufacturers claim that there is no dry wood available in the market, and this causes lots of trouble to them. This information can be true only in part. The author visited a sawmill that produces about 10,000 m³ of Eucalyptus globulus sawnwood per year. The firm produces a reasonably well processed quarter sawn lumber, kiln-dried and steam-reconditioned.

5. MARKET AND TRADE RELATIONS

Formerly, the forest industry in Chile was oriented mainly towards the domestic market. With the decrease in local construction in the 70's it has started to be oriented towards the international market. The internal consumption of sawnwood has not shown substantial changes in the last decade, but exports have soared. At the beginning of the 70's exports of sawnwood represented about 15 % of the production (150.000 m³), in 1980 they reached 59 % of production (1.295.000 m³). Table no. 23 shows total exports and domestic consumption from 1970 to 1980.

Table no. 24 shows export volumes for 1970-1980 and their share of total production. From this table it is possible to infer that the products with the highest participation of exports in relation to production are sawnwood, fibreboard and veneer, as well as logs. Particle board has been exported reaching 37 per cent of the production in 1976 but has decreased since then. Plywood practically did not participate in exports.

The share of the wood industry in the total exports of Chile has increased since 1974 from 0,8 % to 4,7 % in 1980. Table no. 26 shows the share of wood and wood product exports in total exports and in total forestry exports for 1970-1980.

TABLE No. 23

Production, exports, imports, and domestic consumption
of sawnwood 1970-1980 (m³, x 1,000)

year	production	exports	imports	domestic consumption
1970	876	150	4	830
1971		171	n.a.	n.a.
1972	n.a.	63	n.a.	n.a.
1973	1 032	67	1	966
1974	1 399	133	-	1 266
1975	960	257	-	703
1976	1 223	413	-	810
1977	1 336	684	-	652
1978	1 475	795	-	680
1979	2 196	1 061	-	1 115
1980	2 183	1 295	-	888

n.a. = not available

SOURCE: "INFOR"

Chile has made some imports of wood and wood products. The only information on imports refers to wood, wood manufactures and charcoal, the total value being 2,2 million US\$ in 1979 and 4,4 million US\$ in 1980. Data on imports and exports in 1979 and 1978 is given below in million US\$.

<u>year</u>	<u>exports</u>	<u>imports</u>
1979	138.242	2,2
1981	227.179	4,4

It is easy to conclude that Chile has a substantial surplus in wood and wood products.

The main importers of Chilean wood products are Argentina, the Arab Emirates, Korea, Japan and Germany.

TABLE No. 24

Wood Products. Volume exported and per cent of exports from total production 1970-1980

PRODUCTS	unit	1970		1971		1972		1973		1974		1975		1976		1977		1978		1979		1980	
		volume	%	volume	%	volume	%	volume	%	volume	%	volume	%	volume	%	volume	%	volume	%	volume	%	volume	%
Logs	m ³	-	-	-	-	-	-	-	-	-	-	6 182	-	16 979	-	147 588	-	679 166	-	965 715	-	1052 383	-
Sawnwood	m ³	150 321	15	171 115	16	63 431	6	67 446	6	132 626	9	256 535	27	412 491	34	684 390	51	795 073	54	1 081 162	49	1 295 428	59
Fibreboard	ton	-	-	1 258	7	-	-	-	-	-	-	1 970	15	10 555	49	8 194	31	12 624	40	20 922	50	26 620	62
Particleboard	ton	418	3	-	-	-	-	-	-	-	-	-	-	6 987	37	3 032	15	3 588	13	2 054	7	-	-
Plywood	ton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	183	3	70	1	147	1	16	-
Veneer	ton	116	5	59	6	20	1	48	4	81	6	49	3	479	20	750	19	1 833	29	1 447	24	1 639	29
Prefabricated houses	unid	-	-	-	-	-	-	-	-	2	-	18	-	448	-	1 425	-	3 266	-	47	-	4	-

SOURCE: INFOR with Statistics from Customs Suprintendency

TABLE No. 25

Value of wood products exported 1970-1980

US\$ x 1.000 (nominal value)

PRODUCTS	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Logs	-	-	-	-	-	602	762	4 303	20 595	31 235	56 835
Sawnwood	8 571	6 994	3 312	4 242	12 383	23 783	26 628	43 174	51 102	92 551	148 894
Fibreboard	28	91	-	-	-	207	1 078	1 223	1 849	3 514	5 444
Particleboard	-	-	-	-	-	-	1 532	280	627	221	-
Plywood	-	-	-	-	-	-	-	59	37	35	8
Veneer	80	39	13	29	71	54	395	658	1 092	989	1 220
Prefabricated houses	2	-	-	-	56	39	897	3 215	11 636	12	26
Others	1 633	4 783	1 552	2 343	6 200	6 184	8 652	6 913	6 226	9 685	14 752
TOTALS	10 314	11 907	4 877	6 614	18 610	30 869	39 944	59 825	83 164	138 242	227 179

SOURCE: INFOR with Statistics from Customs Superintendency

TABLE No. 26

Participation of forestry exports and wood and wood products exports in the exports total 1970-1980

Year	total exports (millions US\$)	forestry exports (millions US\$)	wood & wood products (millions US\$)	% of forestry exports	% of total exports
1970	1 111.7	41.7	10.3	24.7	0.9
1971	996.8	42.5	11.9	28.0	1.2
1972	847.4	31.6	4.9	15.5	0.6
1973	1 310.5	31.4	6.6	18.1	0.5
1974	2 238.9	127.0	18.6	14.6	0.8
1975	1 529.6	125.6	30.9	24.6	2.0
1976	1 990.7	169.1	39.9	23.6	2.0
1977	2 190.3	180.5	59.8	33.1	2.7
1978	2 400.6	236.9	83.2	35.1	3.5
1979	3 763.4	349.5	138.2	39.5	3.7
1980	4 818.1	468.1	227.2	48.5	4.7

SOURCE: INFOR/Chile, 1981.

Freight rates vary basically according to distance, but there exist differences in freight rates charged for equal tonnages of different products. The negotiation of low freight rates in the case of large shipments is strongly influenced by the volume involved in each instance and by the possibility of grouping exports.

In 1981 there was a reduction in the volumes exported. For the first semester of 1981 the reduction was of 26,4 % in the value of radiata pine sawnwood. Log exports fell even more, 58,9 % in volume and 59,2 % in value. According to exporters, exports and prices have decreased even more during 1981 and beginning of 1982.

6. CONCLUSIONS

Chile's woodworking industry is based almost exclusively on man-made forests, concentrated mostly on Pinus radiata followed by Eucalyptus globulus.

The sawmilling industry is reasonably developed. The sawmills vary from very efficient and modern to complete obsolete.

The plywood industry is comparatively undeveloped and is apparently not in a position to meet the demand.

The secondary wood processing industry (mainly furniture and joinery) is relatively inefficient.

Chile has in its schools and institutes adequate knowledge, but it is not sufficiently applied by the industry.

COLOMBIA

1. FOREST RESOURCES

1.1. Forest types

- Mixed dense forests

These forests are the most extensive ones and are distributed in two main masses: the Amazon basin and the Pacific Coast from the Equador frontier in the south to the Uraba-gulf on one side, and smaller masses on the middle Magdalena and on the border with Venezuela on the other. They are, more than other types of forest, affected by the progress of agricultural settlements, mainly in the eastern lower slopes of the Andes (Departments of Caquetá, Putumayo and Meta), the middle Magdalena and the Catatumbo region on the Venezuelan border.

- Pure dense forests or with few species

These types correspond essentially to edaphic formations like: mangrove (Ryzophora spp), nato (Mora mugistosperma), sajo (Camptosperma panamensis), cuangaré (Iryanthera joruensis), cativo (Prioria copaifera). These formations can be found almost exclusively along the Pacific Coast and the estuaries of the main rivers.

- Open broadleaved high forests

The greatest areas of open forests of Colombia are located north of the Guaviaré (middle) and Vichaca (low) rivers in the Departments of Boyaca Meta and Vichaca in the eastern part of the country.

- Conifer forests

There are some species of Podocarpus in the Andean forests of Colombia, but there do not exist significative areas with predominance of conifers in Colombia.

- Scrubby formations

There are several areas where the climatic conditions permit only the existence of more or less xerophilous scrubby species, like the Guajira peninsula, the low Magdalena and Cesar valleys in the north of the country, or in the basins in the Central and southern parts of the Andes, for example the valleys of Chicamocha, in Santander, and of Patia in Mariño. Scrubby savannas can also be found in the oriental part of the country.

1.2. Present natural forest resources

Table no. 27 shows the distribution of forest types at the end of 1981. There are 38,6 million ha of dense broadleaved, productive, unmanaged intact forests, and 0,9 million ha of exploited forest. Also, 5,17 million ha of dense broadleaved forest are unproductive due to natural causes, and 2,6 million ha due to legal causes.

Broadleaved dense forest are for 90 % of public property. Public forests have been divided into seven Forest Reserves ("Sierra Nevada de Santa Maria", "Serrania de los Motilones", "Sierra del Cocuy", "Magdalena Medio", "Costa Pacifico-Uraba", "Region Central" and "Amazonia"), destined to forest development, soil protection, water and wildness.

The forest reserves covered originally an area of 55 million ha, and cannot be transferred to private ownership. However, a significant part of such forests are being used for agriculture and grazing. The "reserved" area in 1981 was of 45.552.260 ha (1). A system of National Parks exists with a total area covered of 3.779.408 ha, of which 2.300.000 ha are dense forests.

In Colombia there is no significant area of dense productive forests under intensive management, with on-the-spot control of the harvesting activity and restoration of the forest.

The Amazon forest reserve comprises about 70 % of the total reserved area, and it is the most inaccessible area of the country, because of the characteristics of its soils and climate, and due to the almost complete lack of infrastructure. Amazonia is one of the areas less exploited and disturbed by agriculture and grazing. Other areas more or less threatened by timber exploitation or by deforestation for agricultural or grazing purposes.

It is estimated that 35 million of hectares have already been deforested for agriculture or grazing during this century. The present annual deforestation rate has been estimated at around 1 million ha for all types of forests. In any case, absolute and relative deforestation rates in Colombia are among the highest of the tropical world (1,6 % annually for dense forests) and present trends do not allow to foresee an improvement in the near future.

Growing stock volumes are resumed in table no. 28 where an estimation for the several forest types is also shown. Gross volume was estimated at the end of 1980 at 5,481 million cubic meters. Commercial volume was estimated at 636 million cubic meters.

TABLE No. 27

Distribution of forest areas by types and zones/reserves in 1980
areas in ha x 100

TYPES - ZONES/RESERVES	Dense broadleaved productive unmanaged forests			Dense broadleaved unproductive			TOTALS
	intact	exploited	totals	by natural causes	by legal causes	totals	
<u>Mixed forests</u>	38 150	270	38 420	3 810	1 640	5 450	43 870
Sierra Nevada Santa Maria				360	120	480	480
Sierra de los Motilones	160	190	350				350
Sierra del Cocuy-Arauca	40	10	50		180	180	230
<u>Magdalena Medio-Sinú</u>	230	70	300	150	230	380	680
Serraria San Lucas	130	20	150	150	0	150	300
Alto Sinú-San Jorge	100	40	140		230	230	370
Curaré-Opon	50	10	50				50
Costa Pacifico-Urabá	3 470		3 470	1 180	200	1 380	4 850
Amazonia-Orenocia	34 250		34 250	2 120	910	3 030	37 280
<u>Pure forests</u>							
Costa Pacifico Urabá	450	630	1 070	400	90	490	1 560
Cajuales	275	65	340				340
Guanoales (cuangare-sajo)	155	535	690		50	50	740
Natales	20	20	40				40
Manglares				400	40	440	440
<u>Mixed and pure forests</u>							
Central region				410	550	960	960
TOTALS	38 600	900	39 490	4 620	2 280	6.900	46 390

SOURCE: FAO/PNUMA.

TABLE No. 28

Growing stock in the end of 1981
(totals in million of cubic meters)

TYPES - ZONES/RESERVES	DENSE BROADLEAVED PRODUCTIVE UNMANAGED FORESTS						DENSE BROADLEAVED UNPRODUCTIVE FORESTS	
	INTACT				EXPLOITED			
	gross volume		commercial volume		gross volume		gross volume	
	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total
<u>Mixed forests</u>		<u>4 875</u>		<u>610</u>		<u>26</u>		<u>355</u>
Sierra Nevada Sta. Maria							70	24
Sierra de los Motilones	130	21	15	2.5	100	19.1		
Sierra del Cocuy-Arauca	120	5	15	0.6	90	0.9	60	11
<u>Magdalena Medio-Sinú</u>		<u>31</u>		<u>6.4</u>		<u>6</u>		<u>24</u>
Serrania San Lucas	130	17	35	4.5	60	1.2	65	10
Alto Sinú-San Jorge	120	7	15	0.9	90	3.6	60	14
Cararé-Opon	170	7	25	1.0	120	1.2		
Costa Pacifica-Urabá	155	538	25	86.5			80	107
Amazonia-Orenocia	125	4 280	15	514			60	189
<u>Pure forests</u>								
Costa Pacifico-Urabá		<u>90</u>		<u>26</u>		<u>55</u>		<u>13</u>
Cativalés	250	69	85	23.3	80	5		
Guandales	120	19	15	2.3	90	48		
Natales	110	2	20	0.4	70	2		
Manglares							30	13
<u>Mixed and Pure forests</u>								
Central region							70	67
TOTALS		4 965		636		81		435

SOURCE: FAO/PNUMA.

1.3. Plantations

Forest plantation started in the second decade of this century in Colombia, for aesthetic purposes or soil protection. Commercial plantations only started to increase substantially at the beginning of the last decade. Table no. 29 shows the industrial plantations established at the end of 1980.

In the last years the areas planted have been: 11.610 ha in 1978, 22.280 ha in 1979, 29.470 ha in 1980 and 30.000 ha in 1981. Most of these plantations have been made by individuals benefitting from financial incentives from the government.

1.4. Harvesting

For harvesting in public forests a permit from Inderena (Instituto para el Desarrollo de Recursos Naturales Renovables) is required. Inderena is entitled to grant permanent and single permits for a period of 10 years and over an area not larger than 10.000 ha. Permits for areas larger than 20.000 ha can only be granted through public bidding, for a duration not longer than 10 years and with the prior approval of the National Government. In 1981 a total of 303.000 ha of natural forests were under harvesting permits and concessions.

The major part of the harvesting is made by people without any linkage to the mills. The harvesting activity is almost independent, the loggers sell the logs or pulp wood to the best offerer, large sawmills and other large mills make their own harvesting.

The equipment utilized in timber harvesting depends on the size of the operation, and the relation between the loggers and the mills. Chain saws have been introduced recently, but the use of axes for felling limbing and bucking predominates.

Prehauling is made by hand, animals, wheel skidders, crawler tractors, by cables, etc.

Log transport from the forest to the mills is done by one or more of the following ways: fluvial, maritime, railway, trucking, skidding by animals or tractors. The one chosen depends on the characteristics of the terrain, existing infrastructure and the size of the enterprise.

There is no information about productivity and harvesting costs, apparently this is a very primitive and inefficient sector, where human muscle force is still used for moving heavy logs in the forest. The main constraint is lack of capital for equipment and infrastructure in forest areas.

TABLE No. 29

Areas of industrial plantation established by the end of 1980
(thousand ha)

CATEGORY	SPECIES	Years	76-80	71-75	66-70	61-65	51-60	41-50	before 40	TOTAL
		Age	0-5	6-10	11-15	16-20	21-30	31-40	> 40	
slow growth species	<u>Tectona grandis</u>		0.5	0.5	0.2	-	-	-	-	1.2
	Native species		0.4	0.4	0.2	0.1	-	-	-	1.1
	Sub-total		0.9	0.9	0.4	0.1	-	-	-	2.3
Rapid growth	<u>Eucalyptus globulus</u>		7.8	6.5	2.3	-	-	-	-	16.6
	Other <u>Eucalyptus</u> spp		4.7	4.5	1.9	-	-	-	-	11.1
	<u>Alnus jorullensis</u>		1.2	1.4	1.2	-	-	-	-	3.8
	<u>Acacia</u> spp		0.2	0.2	0.1	-	-	-	-	0.5
	Sub-total		13.9	12.6	5.5	-	-	-	-	32.0
	TOTAL BROADLEAVED PLANTATIONS		14.8	13.5	5.9	0.1	-	-	-	34.3
Conifers	<u>Cupressus lusitania</u>		10.1	6.9	5.2	3.4	-	-	-	25.6
	<u>Pinus patula</u>		15.5	8.9	3.1	0.7	-	-	-	26.9
	<u>Pinus radiata</u>		2.4	1.5	0.8	0.5	-	-	-	5.2
	Other conifers		1.4	1.5	0.6	0.2	-	-	-	3.7
	TOTAL CONIFER PLANTATIONS		27.4	18.8	9.7	4.8	-	-	-	60.7
	TOTAL INDUSTRIAL PLANTATIONS		42.2	32.3	15.6	4.9	-	-	-	95.0

TABLE No. 30

Annual raw material requirements 1975-1995 in Colombia (thousand m³)

Year	P R O D U C T S								TOTALS
	Sawnwood	pulp and paper	Panels	posts, poles treated	Tanin	firewood and charcoal	construction roundwood	mine timber	
1975	2 885	840	190	23	40	6 000	110	200	10 288
1980	3 642	1 500	270	35	40	6 000	115	280	11 882
1985	3 639	2 200	315	46	40	6 000	130	393	12 763
1990	4 112	2 990	400	69	40	6 000	150	575	14 336
1995	4 200	4 100	480	92	40	6 000	170	806	15 888

SOURCE: INDERENA

2. MECHANICAL PROCESSING INDUSTRY

2.1. Primary processing

The primary processing industry in Colombia is represented by sawmilling and wood-based panels (veneer, plywood, particle board and fibreboard).

2.1.1. Sawmilling

Sawnwood is produced in Colombia in two different ways: by sawmills, and in pit-saws, where sawing is by hand. In Colombia all sawmills are called "mechanized sawmill" even if the only powered equipment is the saw or saws.

In 1976 Inderena registered a total of 302 sawmills but in 1980, on the basis of information from its regional offices, it counted only 215 sawmills.

TABLE No. 31

Distribution of sawmills according to
the Inderena Regions (1980)

region	nº of sawmills	%
Antioquia	2	0.93
Arauca	1	0.46
Atlantico	8	3.72
Bajo Atrato-Urabá	4	1.86
Cundinamarca	11	5.12
Chocó	64	29.77
Guajira	1	0.46
Hila-Caquetá	3	1.40
Llanos Orientales	10	4.66
Magdalena	1	0.46
Marifio-Putumayo	1	0.46
Pacifico Norte	16	7.44
Pacifico Sur	79	36.74
Santander	14	6.51
TOTALS	215	100.0

According to information from Inderena, in 1980 there were six sawmills, with an output of capacity in an 8 hour shift of more than 25 cubic meters, 98 with a capacity between 10 and 24,9 cubic meters, and 111 sawmills with a capacity of less than 9,9 cubic meters.

Most of the sawmills are equipped with circular headrigs. According to a census of 1971, 80 % of the sawmills were so equipped, and 14 % were equipped with a band headrig. Presently there is no information about the equipment.

The production of the sawmilling industry in 1979 is estimated at 600.000 m³, only for the "mechanized sawmills".

It is estimated that there were from 4.000 to 5.000 pitsaws with an average annual production of 80 cubic meters, producing a further 320.000 cubic meters in 1979. The total sawnwood production in 1979 is estimated at 920.000 cubic meters.

In Colombia most species maintain their common names only in the places of harvesting and processing, but in the consumption centers they are grouped, in groups with similar appearance; only the most known conserve their identity. The most common groups are the "amarillos" (Yellowish) and the "ordinarias" (Ordinary) the less valuable ones.

In the Atlantic Coast cativo (Prioria copaifera) represents 47 % of the total output, guino 23 %, abarco (Carimiana pyriformis) 17 %, virola (Virola surinamensis) 4,3 %, Coracoli (Anacardium excelsum) 3,0 % and other species 6,7 %. On the Pacific Coast the more utilized species are cuagare (Dialyanthera gracilipes), virola (Virola surinamensis) and sajo (Camnosperma panamensis).

The main sawmills of the Atlantic Coast are supplied with logs from the forests of the Atrato-Urabá, middle Magdalena (Cimitarra) and smaller part from the Guajira region. The transport from Atrato-Urabá to the sawmills includes fluvial and maritime transport, from the middle Magdalena it includes fluvial transport, and from Guajira maritime transport is necessary.

The sawmill industry is estimated to employ directly about 3.330 workers. Pitsawing is estimated to give work for 12.000 people.

Productivity in 1979 was inferior to that of 1971. The large sawmills have an average productivity between 1,03 and 1,34 m³ per man/day, others vary from 0,31 to 0,77 m³/man/day.

2.1.2. Wood based panels

The wood based panel industry in Colombia comprises 10 firms and 16 plants. This sector's production has fluctuated in the last years due to the temporary or permanent closing of some plants and the opening of others. The main causes for the closing of plants has been management and financing. However, in the last years there have been problems of shortage of raw material due to changes in the policy of forest resource management.

The fall in production caused the necessity to import panels from abroad, mainly plywood from the Taiwan Province of China, Peru, Ecuador and Bolivia.

Table no. 32 shows the production of wood based panels from 1965 to 1980.

Table no. 33 shows the annual production capacity, and the production in 1980. It can be inferred that there is a low utilization of the installed capacity, mainly in the plywood sector.

TABLE No. 32

Production of wood based panels 1965-1980 in m³

Products	1965	1974	1976	1977	1979	1980
Veneer	3 000	4 000	4 000	4 000 ^{e)}	7 348	9 800
Plywood	54 000	63 500	75 000	80 000	45 897	56 465
Fibreboard	10 000	15 000	12 000	7 000	12 000 ^{e)}	12 000
Particleboard	11 000	10 000	16 200	20 000	30 400	51 500
TOTALS	78 000	92 500	107 200	111 000	95 645	129 765

e) estimated

SOURCE: FAO/PNUD RLA/77/019 la Industria de los Tableros de Madera en los Países del Grupo Andino, Inderena survey 1980.

TABLE No. 33

Annual production capacity and production in 1980, m³

Products	annual production capacity	production	utilization
Veneer	12 600	9 800	78%
Plywood	93 700	56 465	58%
Fibreboard	14 000	12 000	86%
Particleboard	68 500	51 500	75%
TOTALS	188 800	129 765	

SOURCE: Estadística de la Industria de Paneles de Colombia, Inderena, 1980.

Colombia has only one fibreboard plant located in Barranquilla in the north of the country on the Atlantic Coast. It is a plant installed in 1957 but apparently adequate to the local conditions. The raw material is a mix of native species in form of bolts or residues from sawmills and plywood mills.

Two main limiting factors are the supply of raw material and the small domestic market. Presently 92 % of the product is sold in the domestic market and 8 % is exported.

There is one wood based particle board plant. There is another plant that produces particle board from bagasse. The wood based one has two forming and press lines. The raw material is a native species mix, both as bolts or plywood residues.

The wood panel industry employed in 1980 directly 1.940 workers and 340 clerks, administratives, staff, etc.

Table no. 34 shows the exports and imports of wood based panels in the period 1976-1979. It is possible to observe that from 1979 there was a persistent deficit in the international trade of panel products. This is at least theoretically avoidable or can be diminished since there is unused installed capacity.

Apparently raw material is the main bottleneck of the panel industry. Naturally the plywood sector is the one which suffers most.

2.2. Secondary wood processing

2.2.1. Wood in construction

In spite of the building sector being the main outlet for wooden products in Colombia, the intensive use of wood in housing is limited almost exclusively to heavily forested areas.

In the modern construction sector there is general reluctance to accept wooden materials in buildings in urban areas. The main causes for this are the general low quality of lumber found in the market and the abundant and low priced cement blocks and bricks. Wood is usually used for plywood flush-doors, built-in furniture and formwork. Parquet is used only in expensive houses, and there is some use of wooden walls and ceiling panels.

Bamboo has been utilized in some mountain regions as a construction material, in walls, roof structure and in the scaffolding of high rise buildings.

The use of pitsawn wood is common in regions near forested areas.

TABLE No. 34

Value of exports and imports of panels 1976-1979, US\$

Products	1976		1977		1978		1979	
	exports	imports	exports	imports	exports	imports	exports	imports
Veneer	829 802	83 744	479 767	704 294	382 186	588 099	247 378	464 941
Plywood	107 867	6 936	16 876	2 573 331	23 734	5 500 354	36 058	4 547 756
Particleboard and fibreboard	558 181	238 880	62 580	694 725	76 495	219 197	571 826	868 502
TOTALS	1 495 850	329 560	559 223	3 972 350	482 415	6 307 650	855 262	5 881 199
BALANCE	+ 1 166 290		- 3 413 127		- 5 825 235		- 5 025 937	

SOURCE: Inderena, Estadísticas de la Industria de Paneles, 1980.

2.2.2. Wood in furniture

Presently there is a tendency of the small companies and workshops to produce low cost furniture, while the large companies furnish the more expensive ones.

Some basic woodworking equipment is made in Colombia like band saws, thicknessers, planers, circular saws, etc. All specialized equipment needs to be imported.

Furniture manufacturers of Colombia employ very experienced woodworkers, carvers and cabinet makers that do a very good job in old style carved furniture. This advantage permits fine furniture to be produced in Colombia cheaper than in more developed countries. However, in the production of low-cost furniture, the Colombian industry spends more time to do the job in comparison to plants with more mechanization.

The main obstacles to the development of the furniture industry are:

1. Low quality of sawwood on the market. Most of the large or medium furniture plants need to have resaws, lumber yards and dry kilns in order to prepare the wood for use.
2. The above require high investments in wood inventory which are prohibitive, due to high interest rates.
3. The high cost of sawwood on the market, comparatively higher than in the U.S.A. for example.
4. High cost of panels, about four times more expensive than in the U.S.A.
5. High customs rates on imported equipment,
6. Because of the relatively small size of the market, most of the plants have several lines of products, resulting in inefficient processes.

3. MARKET AND TRADE

The wood and wood products industry has been oriented mostly towards the domestic market. However a surplus of sawwood has been exported on the international market. Table no. 35 shows the international trade of sawwood in the period 1974-1979.

Table no. 35 and table no. 34 show for the period 1976-1979 a change from a surplus to a deficit in primary wood products foreign trade.

TABLE No. 35

Sawnwood international trade 1974-1979, US\$

Year	E X P O R T S			I M P O R T S		
	Conifers	hardwood	total	Conifers	Hardwoods	total
1974	931 053	5 404 612	6 335 665			
1975	286 035	4 672 167	4 958 202			
1976	95 887	9 416 523	9 512 410	37 652		
1977	24 800	5 517 811	5 542 611			
1978	33 494	942 929	976 423			
1979	26 650	2 700 396	2 726 046			

SOURCE: PROEXPO, INCOMEX, INDERENA.

The main constraints to the development of markets for Colombian wood products are:

1. High prices, due to high costs of transportation because of lack of infrastructure, inefficient conversion.
2. Low quality (mainly sawnwood) due to poor equipment and inefficient processing.

4. CONCLUSIONS

Colombia has relatively abundant forest resources, but a major part is tropical Amazon forest, presently inaccessible. Lack of infrastructure in most forest regions does not permit the installation of processing industries in the forest, increasing this way the transport costs.

The pressure for agricultural lands has provoked the change of large areas of forest land to other uses diminishing the forest resources in accessible areas. Reforestation programs are smaller than is desirable.

The prevailing conditions have led to the development of intensive pilsawing, which aside from inefficient use of human labour, produces a low recovery. Mechanical sawmills are also relatively inefficient with intensive use of obsolete circular headsaws.

Because of the inefficient sawmilling sector, the furniture industry, the main branch of the secondary wood processing industry, is supplied with very expensive and low quality lumber. The furniture industry needs to reprocess lumber in order to put in into production.

GUYANA

1. WOOD AS A RESOURCE AND AS A RAW MATERIAL

1.1. Forest resources

The following major forest formations are recognized in Guyana:^{1/}

Closed broadleaved forests

- a) Rain forest. It occurs on well drained sites, from the flat plain to broken areas on brown sands, loams or red earth.
- b) Seasonal forest. It is found on well drained sites, with a marked seasonal distribution in rainfall.
- c) Dry evergreen forest. It occurs where excessive drainage or excessive evaporation exists.
- d) The montane forest. It is two storeyed with a canopy between 24 and 36 m a lower storey between 6 and 18 m. It occurs on Mount Roraima, in the southern upland region, where bulletwood and other species dominate.
- e) The marsh forest. It is characterized by marked seasonal fluctuations in the moisture conditions from very dry to water-logged.
- f) The swamp forest. Has an almost permanent wet soil. It occurs on all year round water-logged sites.
- g) Mangroves spread along the Atlantic coast in brackish waters, the canopy varies from 12 to 25 m.

1.1.2. Open broadleaved forests and scrub vegetation

The palm marsh known as itesavanna (Mauritia flexuosa) is widespread in the coastal region.

The savannas are classified as intermediate (lowland), far interior and upland (Pakaraima plateau). The intermediate savannas extend from the Demerara river to the Courantyns. The far interior savannas are located in Rupumumi. They form part of the Brazilian Rio Branco Savannas.

^{1/} This part is summarized from the report of the Proyecto de Evaluación de los Recursos Tropicales. FAO/PNUMA, 1981, p. 157.

1.2. Present situation of woody vegetation

The estimates of the areas of the different categories of forests, that cover about 84 % of the country are: a) closed broadleaved productive unmanaged intact forest 12,12 million hectares; b) closed broadleaved productive unmanaged exploited 1,34 millions hectares. The total of closed broadleaved productive forest is 13,46 millions hectares.

There are 5,01 million hectares of closed broadleaved unproductive forest of which 12 thousand has is a National Park.

Secondary forests are estimated at 200.000 ha. There are 25.000 ha of tree and grass formations, and 115.000 ha of shrubs and grass formations.

According to FAO PNUMA, the total of industrial plantations is estimated at the end of 1980 at 1.200 hectares, basically Pinus caribaea, most of it planted after 1971. Presently most of these plantations are abandoned, shrubs and bush species occupy the area, commercial plantations are not being made, and plans for commercial plantations in the future are not known.

1.2.1. Present situation of the growing stock

The growing of the closed broadleaved productive unmanaged intact forests is estimated at 210 m³/ha, a total of 2.060 million cubic meters of gross volume at 20 m³/ha, and a total of 242 million cubic meters of acutally commerciable species. The growing stock of the closed broadleaved, productive unmanaged exploited forest is estimated at 170 m³/ha and a total of 168 million cubic meters of gross volume.

No information was found on increments in natural forests.

The mean annual increment in plantations lies between 3,8 m³/ and 7,7 m³/na depending on the site (10) (FAO/PNUMA).

Presently one specie, greenheart (Ocotea rodiaei), accounts for about 50 to 60 per cent in volume of the species removed from the forests. Other species which are being utilized industrially at the present time are purpleheart (Peltogyne pubescens), kabukalli (Goupia glabra), crabwood (Carapa guianensis), mora (Mora excelsa) tauraniro (Humiria balsamifera),

tatbu (Diploporis purpurea), Kurokai (Protium decandrum), kereti (Ocotea spp), dukalli (Parahancornia amapa), simarupa (Simaruba omare), balli (Virola surinamensis), locust (Hymenaea spp). There are several other species which are being utilized in the country and others are exported.

Guyana has a large number of hardwoods which are widespread in the closed forest, with a potentiality to increase their very modest participation on the international market. The main species having possibilities due to their appearance, properties and availability are: tauroniro (Humiria balsamifera) crabwood (Carapa guianensis) aromata (Clathrotropis brachy-petala), Purpleheart (Peltogyne pubescens), greenheart (Ocotea rodiaei), locust (Hymenaea courbaril), wa,ara (Swartzia leiocalycina).

1.2.3. Management status

Presently there are 12.300.000 ha under productive forest management in Guyana (4), but the existing harvesting system is of selective logging for high output. Probably the best term to define the status of that forest area in Guyana would be "area under control", since no silvicultural actions are carried out in order to change the composition, or to increase the production of desirable species.

1.2.4. Forest accessibility

Guyana is a country with a very limited road network. Most of all-year roads are in a narrow strip near the Atlantic Ocean, but a series of navigable rivers penetrate in the forests reaching variable distances, depending on the presence of rapids and falls. About five million hectares of productive forests are presently accessible for harvesting.

1.3. The uses of forest products

According to information from the Guyana Forest Commission the timber production in 1980 was:

Logs, greenheart	m ³	69.807
Logs, other species	m ³	71.656

Charcoal	t*	1.296
Firewood	t	40.446
Piles, posts, poles	m ³ **	41.348
Shingles	pieces	480.750

* t = metric ton = 1.000 kg

** 1 m³ = 53.51 lineal feet, 1 lineal foot =
approx. 0,66 of 1 cubic foot

According to FAO/PNUMA, fuelwood production in 1973 was over 10.000 m³, and charcoal production amounted to 345 ton, it follows that the production of these commodities has increased four times in seven years. The FAO Year-book of Forest Products shows the following production figures of veneer and saw logs for Guyana.

Average annual production of saw logs and veneer logs
(in thousands of m³)

Period	1966-1970	1971-1975	1976-1977
Average annual production	208	214	211

Information from Collins (2) on the production for sawnwood in the period 1971-1978 is shown in the Table No. 36.

TABLE NO. 36

Production of sawnwood for the years 1971 - 1978

Year	volume of wood consumed in m ³ (1)	volume of lumber in m ³ (1)	n ^o of persons employed (2)
1971	212 971	83 649	not available
1972	222 286	87 308	2 689
1973	236 279	92 804	3 083
1974	267 160	104 933	2 863
1975	275 896	108 364	2 682
1976	265 334	104 216	2 943
1977	220 720	86 693	3 748
1978	210 689	82 753	not available

Note: 1- These figures are based on those supplied by the industry

2- These figures are estimates, not based on a census

SOURCE: Forest Department Reports

The forest industries of Guyana use mainly oil for energy. Industries located in Georgetown and surroundings are supplied with energy generated by thermoelectrical plants, burning fuel oil, and industries located in the interior usually use diesel engines to generate the energy needed. Some old mills work with steam powered gang saws. Generalized shortage of capital is an obstacle to the use of steam-powered turbines or steam-reciprocating engines.

1.4. Prospective supply of roundwood

The forested area of Guyana does not present many variations in its size because of the pressure by agriculture due two main reasons: the population of the country is relatively small and the soils are not suitable for agriculture. Most of the present forested areas are sand soils. The change in the composition of the forests, due to selective logging, will limit the production of the species presently utilized. In the future the species mixture will have to change or harvesting will have to diminish in about ten to fifteen years.

1.5. Harvesting

In Guyana most if the forest land is owned by the State, under two different categories, the state forest area (totaling 8.780.000 ha according to FAO/PNUMA), and state lands which cover an additional 8.730.000 ha. According to (4) their "area under productive forest management" is 12.300.000 ha. All productive forests are owned by the state, and are controlled by the Forestry Commission, through the issue of Timber Sales Agreements, for the removal of forest produce.

The common way of obtaining harvesting licences and control is through Timber Sales Agreements, by which the licensee obtains exclusive rights over the forest area. The Agreement includes the management of the area and the duration depends on the capacity of the forest concern. In addition to the timber sales agreement there is a system of "Permits" for small loggers with fixed volume, species and duration.

Some concerns have their own harvesting operations and transporting systems. Others buy the logs at the mill. Logging practices vary very much, depending on the size of the enterprises and on the degree of integration. In the integrated operations there are reasonably mechanized systems with

the use of skidders, equipment for roadbuilding and maintenance, chain saws, trucks for hauling to the industries on to the embarkation points where the logs are shipped in barges, which transport the logs to the plants or to overseas vessels through transshipment. According to some entrepreneurs there is lack of technicians in the field of logging, and a consequent deficiency in the selection of equipment.

2. WOOD PROCESSING INDUSTRY

The wood processing industry in Guyana is presently confined to sawmilling and plywood manufacturing, as well as manufacturing secondary wood products. For many years the main produce was hewn greenheart.

2.1. Primary processing

2.1.1. Sawmilling

The primary processing industry in Guyana consists of sawmilling and a plywood plant inaugurated in 1981. The sawmilling industry provides almost all the wood raw materials required for direct use by the building industry, and the raw material base for the secondary wood processing industries.

According to Collins (2) the sawmilling industry has not shown much growth over the past ten years, and he estimated the number of sawmills at between 70 and 80. According to information from the Guyana Forest Commission, the present number of sawmills is 110. The sizes vary from small circular mills, employing about 10 persons, to large band mills employing more than 500 persons, including those working in logging, transportation and office works. Table no. 36 shows the annual production and the number of persons employed in this sector. The product of the sawmills consists of lumber, scantling and beam sizes, railway cross-ties, lumber for boat building, bridges, marine work, soft drink boxes, concret forms, etc. Sawwood is much used in construction since most of the houses in Guyana are built of wood.

According to Collins (2) the typical small sawmill consists of a log winch a circular headrig and carriage, and edger and a cross-cut saw. The typical medium size mill has a log winch, a circular headrig and carriage, a gang saw, an edger, a cross-cut saw, a planer and moulding machine. Some of them have several gang saws and few sawmills have four gang saws. The larger sawmills have one or two 6 ft band headrigs, a gang saw, band resaw, edgers, and a complete system for conveying logs, blocks, lumber and wood residues, as well as planers and moulders.

Some companies have been recently improving the efficiency of the saw-mills by installing log turners, log and lumber conveying equipment and other equipment.

One of the worst problems of the sawmilling industry is the maintenance of the machinery, spare parts have never been readily available in Guyana, but presently the situation is critical resulting in frequent breakdowns and plant downtime.

Most of the sawmilling industry is private owned, but there are also state-owned companies.

2.1.2. Wood based panels

The only wood-based panels manufacturing plant in Guyana is a plywood plant, located near Georgetown. The mill has been recently inaugurated and is producing 8' x 4' panels.

The equipment is predominantly Italian and German; the layout is quite simple but apparently adequate to the local conditions.

The company employs 91 persons in two shifts. The production varies from 400 to 1.000 panels per shift, depending on the thickness, which varies from 6 mm to 15 mm. About 80 % the production is exported and 20 % sold in the domestic market.

2.2. Secondary processing

2.2.1. Wood in construction

Most of the houses in Georgetown area are constructed of wood. It is common to see large buildings like ministry offices, libraries, or churches made of wood. Most of these buildings are based on a wood structure and the sidings are made of drop bevel or are tongue and grooved. Before the development of the sawnwood industry in Guyana, most of the lumber used in buildings was softwood imported from U.S. and Canada. Presently all wood for building is produced in the country. Most of the buildings are constructed on site. There is one company that produces prefabricated homes and another company is planning to manufacture them. This is a very artisanal industry in Guyana, the only factory working does not have an adequate layout for an effective production. This is a field that warrants improvement.

Aside from prefabricated housing, the following products are manufactured: windows, doors, panelling, strip and parquet block flooring, building components, shingles, etc. Joinery manufacture also needs improvements in processing through more standartization, better product design, more production planning, more use of dried wood, more adequate wood machining and improvements of finishing.

2.2.2. Wood in furniture

It was not possible to get adequate statistical information about the furniture industry in Guyana. Imports of furniture are not permitted, and the local industry must satisfy the domestic demands and also exports part of its production.

Most of the furniture industry is located in Georgetown or surroundings. The size of the plants is very small by international standards, the largest one has about 70 workers in the wooden furniture section.

The equipment is mostly imported from Europe or the U.S.A., and is very basic.

Certain basic principles of wood technology and wood processing are not well understood. For example no control of the moisture content of the wood being utilized is made and the way the green wood is stacked does not permit drying to progress. The absence of chip and dust exhaust systems is dangerous. Tool maintenance is poor.

From the above, it may be inferred that there is scope for improvement without large expenditures or investments and without introduction of any sophisticated technology.

Apparently there are few cases of division of work. It is possible to see cases where workers are entrusted of building completely a certain piece of furniture, in a very artisan way. Productivity is therefore very low.

The design of furniture is another aspect that must be considered, generally the existing designs are poor most of the furniture is copied from foreign models without taking into account the characteristics of Guyana's wood species, and the context of the country's way of living.

The technological level of furniture is characterized by a lack of line production, very little use of jigs and devices for mounting, and a complete lack of mechanization.

According to the managers, the main constraints to the development of the furniture industry are the difficulty to get hardware, tools, good material for finishing, glue, spare parts, etc. The prices of such material are very high. Lack of capital limits seriously the capacity of acquisition of equipment; as a consequence the use of undersized, inadequate or obsolete equipment, machinery or tools is common.

In spite of the relatively large forest resources, there are claims that very few species of wood are adequate for manufacturing, according to the traditional criteria of evaluation: low to medium density, facility to work, low shrinkage coefficients, easy to finish, etc;

3. MARKET AND TRADE RELATIONS

3.1. Domestic market

The main factors that have constrained the development of domestic market of wood products in Guyana seem to be:

1. The size of the market constrains the establishments of large scale manufacturing concerns.
2. Because the above the products are expensive and, frequently, of low quality.
3. The dependence on imports for ancillary material for joinery and furniture, and the limitations to such imports worsen the situation.

3.2. International trade

In 1973 the Guyana Timber Export Board was created and it was given the responsibility for the export of all wood and wood products from Guyana. Secondary wood products may be exported independently from the Board, but foreign trade of this type is negligible. Table No. 37 shows the volume of timber exported from Guyana for the period 1970-1979.

Table no. 38 illustrates the product mix of exports in 1981 and table no. 39 shows exports by countries in 1981.

The range of species exported in 1981 is presented in table No. 40. It can be seen that nine species account for 98 per cent of the volume and 98 per cent of the value; two species, greenheart and wallaba, account for about 80 per cent of the volume and 83 per cent of the value.

TABLE No. 37

Exports of forest products from Guyana in
1970 - 1979

Year	volume m ³	value G\$ million	value US\$ million*
1970	27 400	2 449	0.83
1971	30 900	3 149	1.07
1972	42 500	3 765	1.28
1973	n.a.	4 300	1.46
1974	41 690	5 400	1.83
1975	40 470	8 264	2.80
1976	35 440	9 547	3.24
1977	35 590	9 096	3.08
1978	37 560	10 918	3.70
1979	50 950	14 400	4.88

* calculated using a rate of G\$ 2.95 per US dollar

SOURCES: Forest Department Annual Report 1977-1979 estimated by the
Forestry Commission

1970-1972 Statistic Office, 1974-1979 GTEB records

TABLE No. 38

Exports in 1981

products	units	quantity	value US\$*
Sawn wood	m ³	6 072	1 643 006.73
Dressed sawnwood	m ³	4 600	1 273 352.44
Hewn wood	m ³	3 564	604 278.18
Piles	m	798	164 873.84
Poles	m	17 006	875 729.13
Posts	m	8 285	92 662.35
Shingles	m ³	172	60 918.51
Logs	m ³	5 776	567 325.93
		TOTAL	5 282 147.11

* Converted at the rate of G\$ 2.95 per US dollar

SOURCE: Guyana Timber Export Board

TABLE No. 39
Exports by species 1981

Species	volume ¹⁾ m ³ *	value US\$**
Greenheart	14 386	3 364 471.46
Purple heart	2 625	412 039.78
Tatabu	1 543	171 463.52
Crabwood	436	49 763.53
Wallaba	12 880	1 029 309.67
Determa	650	66 282.77
Locust	381	40 462.19
Kurokai	334	34 950.25
Iteballi	325	15 862.21
Others	637	95 541.74
TOTALS	34 197	5 282 147.12

1) for simplicity volumes of sawnwood, dressed wood, hewn wood, piles, poles, posts, shingles and logs were added

* Conversion:

1 m³ = 35.31 cubic foot

1 m³ = 53.51 lineal foot of piles, poles and posts

** 1.0 US \$ = G\$ 2.95

According to the Guyana Timber Export Board (7), there are problems of tariffs. Guyana faces a freight cost disadvantage in shipping to the major world markets. For instance, in 1979 the cost of shipping 1 cubic meter of greenheart to the United Kingdom was 47 % more than yellow, coming from W. Malaysia, and 57 % above Opepe and Azobe (Ekki) from W. Africa, greenhearts most important competitors in end use. In order to offset this differential in freight costs 77 per cent of the timber is sold to the U.K. by Charter vessels with a saving of approximately 10 per cent in freight costs compared to shipping by Conference Lines. The disadvantages of freight costs from Georgetown can be attributed to smaller volumes of cargo handles, and the bar restriction on the size of vessels.

4. CONCLUSIONS

Guyana has relatively large forest resources, but the share of the wood processing industry in the national economy appears to be insufficient. The main causes for the relative weakness of the wood processing industry are:

1. An almost complete lack of infrastructure in most forest areas.
2. Shortage of trained people at all levels.
3. An extreme dependency on imports for all woodworking equipment and parts, tools, ancillary material for furniture and joinery.
4. High consumption taxes are levied on some intermediate products like plywood. This affects both the producers and users.
5. Exports are hampered by high freight rates as well as by a poor harbour infrastructure.
6. The furniture industry is characterized by poor design and processing resulting a relatively expensive product with little appeal on external markets.
7. The Guyana Forest Commission has a very small technical team (presently only three professionals). This limits its action.

MEXICO

1. WOOD AS A RESOURCE AND AS A RAW MATERIAL

1.1. Forest types

The main forest types are as follows:

a) Closed hardwood forests

- Broadleaved forests: comprises the encino (Quercus spp) forests and "deciduous forest" vegetation.
- "Selvas altas": are the closed forests of complex composition and vigorous vegetation of tropical climates. The most important species are mahogany (Swietenia macrophylla), cedro rojo (Cedrela mexicana), and bari (calophyllum brasiliense).
- "Selvas medianas": are mixed forests of warm and moist climate similar to "Selvas altas", but with smaller height.
- "Selvas bajas": are forests with an average height between 5 and 10 m.
- Manglares (Mangrove forests): occur in both coasts, the most important species are: Rhizophora mangle, mangle blanco (Lagunaularia racemosa), puyeque (Avicennia nitida) and botoncillo (Conocarpus erectus).
- Mezquitales: trees formed by different species of mezquite (Prosopis spp).

b) Open broadleaved forests

Includes only the "mezquitales" which are open formations and the "pastizales", a scrubby formation with sparse vegetation.

c) Conifer forests

They are forests of cold climate, with a few dominant species with pre-dominance of conifers as Pinus spp and Abies spp, associated with Quercus spp, in some places Curpressus spp and Juniperus spp. There are 35 species of Pinus in the country. About 90 % of the pine forests are situated between 1.500 and 3.000 m of altitude and an average annual rainfall of 600 to 1.000 mm, the balance 10 % corresponds to tropical pines. Other conifer forests are that of oyamel (Abies religiosa) and other species.

- Scrub formations.
- Part of "Selvas bajas".
- The "chaparrales", formations of 2 to 3 m high, occur in zones of transition to arid climate.

- "matorrales", "matorral rosetofo", "matorral microfo", "xerophitic",
"matorral crasicaule".

1.2. Present situation

1.2.1. Natural forests

Table no. 40 shows the area of natural forests estimated at the end of 1980, from which it appears that the total productive forest comprises 24,3 million ha of which 12,78 million ha are intact and 11,52 million are exploited.

Regarding the growing stock, table no. 41 gives the standing volume of natural forests at the end of 1980. The actual commercial volume is estimated at 185 million cubic meters, while the total gross volume of productive forests is estimated at 1.170 million cubic meters.

The annual increment has been estimated at 1,4 m³/ha for all forests (broadleaved and conifers), and the total annual increment at 33,15 million cubic meters per year.

1.2.2. Man-made forests

Man-made forests are resumed in table no. 42. There are 72 thousand ha of industrial and 87 thousand ha of non-industrial plantations. There is no information about the annual increment for these plantations.

1.3. Changes in the forest area

It is estimated (FAO/PNUMA) that the annual average deforestation is about 160.000 ha for the forests (broadleaved and conifers). About 16.000 ha of "Selvas" and 4.500 ha of forests are afforested per year. According to the same source the trend is towards increased deforestation because of the demographic pressures. Deforestation is caused mainly by shifting agriculture in the "Selva".

Aside from deforestation there are several causes of degradation: fire, insects, diseases, fungi, parasites, mispractices, overgrazing, wind storms, etc., in 1975 forests fires affected 250.000 ha. There is not enough information to estimate forests affected by other causes. Man-made forests are expected to register changes in area, new plantations according to the projection made in the FAO/PNUMA study, will be of 10.000 ha per year of industrial forests and 12.200 on non industrial ones.

TABLE No. 40

Areas of natural forests estimated at the end of 1980
(thousand of ha)

BROADLEAVED	CLOSED PRODUCTIVE UNMANAGED			CLOSED UNPRODUCTIVE			TOTAL
	intact	exploited	total	due to physical causes	due to legal causes	total	
Forests	3 950	300	4 250	2 770	200	2 970	7 220
Selvas altas and medianas	8 330		8 330	5 760	10	5 770	14 100
Selvas bajas deciduos				2 580		2 580	2 580
Manglares				660		660	660
Mezquitales				2 010		2 010	2 010
TOTAL BROADLEAVED	12 280	300	12 580	13 780	210	13 990	26 570
CONIFERS	500	11 220	11 720	7 810	150	7 960	19 680
TOTALS	12 780	11 520	24 300	21 590	360	21 950	46 250

SOURCE: FAO/PNUMA, ROMA/1981.

Regarding management status of the forests the information available indicates that there are no significant areas under intensive management in Mexico.

TABLE No. 41

Estimated standing volume at the end of 1980
(total in million m³)

BROADLEAVED	PRODUCTIVE UNMANAGED						UNPRODUCTIVE	
	INTACT				EXPLOITED			
	gross volume		commercial volume		gross volume		gross volume	
	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total
Broadleaved forests	85	335	20	80	65	20	55	165
Selvas altas and medianas	85	710	10	85			60	345
Selvas bajas deciduos							20	50
Manglares							30	20
Mezquitales (closed)							30	60
TOTAL BROADLEAVED		1 045		165		20		640
CONIFERS	250	125	40	20	75	842	65	517
BROADLEAVED AND CONIFERS		1 170		185		862		1 157

SOURCE: FAO/PNUMA, ROMA/1981.

TABLE No. 42

Area of plantations established at the end of 1980
(in thousand of ha)

CATEGORY	SPECIES	Years	76-80	71-75	66-70	61-65	51-60	41-50	before 41	TOTAL
		Age class	0-5	5-10	11-15	16-20	21-30	31-40	> 40	
Industrial	Broadleaved non rapid growth		12	4	3	2	1			22
	Broadleaved rapid growth		7	3	2	1				13
	Total Broadleaved		19	7	5	3	1			35
	Conifers		20	7	5	4	1			37
	Total industrial plantations		39	14	10	7	2			72
Non Industrial	Broadleaved non rapid growth		14	6	4	2	1			27
	Broadleaved rapid growth		9	3	2	2				16
	Total Broadleaved		23	9	6	4	1			43
	Conifers		24	8	6	4	2			44
	Total non industrial		47	17	12	8	3			87
TOTALS			86	31	22	15	5			159

SOURCE: FAO/PNUMA,

1.4. The use of wood forest resources

The production of roundwood in 1980 is estimated at 9,05 million cubic meters. In this volume all wood products, including firewood and charcoal are included.

The total standing commercial volume is estimated at 185 million of cubic meters (table no. 41). If maintained at the same annual harvesting level, the growing stock is sufficient for about 20 years. This is a simplistic conclusion since some industries can utilize wood from "non-commercial" natural forests and also from plantations.

1.5. Forest ownership

In Mexico there are seven different types of forest ownership; "private", "industrial", "ejidal", "communal", "national", "state", and "municipal". It is, however, very difficult to understand the differences between certain types of ownership, for example between ejidal and communal. In the FAO/PNUMA report the several types were concentrated in three general types: public, communal and private. The participation of each one varies according to the source, the public varies from 5 % to 10 %, the communal from 20 to 55 % and the private ownership from 40 to 75 %.

1.6. Harvesting

In order to cut timber in Mexico a permit is needed both for persons and corporations. Even if a private landowner wishes to cut his own timber he must first obtain such a permit. They are of two types; a) unique, and b) permanent. The "permanent" permit refers to those given to forest industries to harvest on a perennial basis. The "unique" permit refers to a permit given to extract a certain specie in a particular area and for a specified period of time.

2. WOOD PROCESSING INDUSTRY

In 1979 wood and wood products represented 2,1 per cent of the country's manufacturing sector which accounts for 27 % of the entire national economy (not including the oil sector products). Therefore wood and wood products represent 0,57 % of the Gross National Product.

2.1. Primary wood processing industry

2.1.1. Sawmilling

According to the information from CNIDS (2) in 1980 Mexico had 1,396 sawmills, with a installed capacity of 6.500.000 cubic meters of logs per year. The production was 5.336.000 cubic meters, which means an utilization of 82,1 %. The number of persons employed is estimated to be 30.000.

Table no. 43 shows the production of sawnwood for the period 1967-1980. The distribution of species used in sawmilling in 1980 is shown in the table no. 44. About half of the sawmills have circular headrigs and the other half have band headrigs.

TABLE No. 43

Production of sawnwood in the period 1967-1980
(thousand cubic meters of log inputs)

year	production (logs input)
1967	2 907
1968	2 928
1969	3 251
1970	3 442
1971	3 068
1972	3 199
1973	3 826
1974	4 236
1975	4 045
1976	4 405
1977	4 530
1978	4 739
1979	5 339
1980	5 336

SOURCE: CNIDS. Cámara Nacional de las Industrias Derivadas de la Silvicultura, with data from Departamento Técnico y de Estadística Subsecretaría Forestal y de la Fauna, SARH.

According to the SPP (Secretaría de Programación y Presupuesto) the main barriers that limit the establishments of new firms in sawmilling industry are: a) the excessive regulations; forest harvesting is subjected to concessions by the Federal Government, and under the stipulations of the Forest laws and the Agrarian Reform, b) the lack of infrastructure and difficulty of access to the forest zone.

TABLE No. 44

Distribution by species of sawnwood produced in 1980

Species	
Pinus (<u>Pinus</u> spp)	87.3
Oyamel (<u>Abies religiosa</u>)	3.1
Other conifers	0.2
Encino (<u>Quercus</u> spp)	1.7
Other broadleaved	0.6
"Precious" species (Mahogany, cedro rojo, etc.)	1.6
"Current"	5.5
Others	0

SOURCE: CNIDS with data from the Dirección General de Información y Sistemas Forestales, Subsecretaría Forestal y de la Fauna, SARH.

2.1.2. Wood based panels

Mexico's wood based panel industry has 38 plants. According to the ANAFATA (National Association of Wood Panel Manufacturers), the total installed capacity will be 1,135,000 m³ in 1982.

The number of employed by this sector in 1980 was 10,115 of which 7,750 were workers, 1,815 clerks and 550 technical people.

Table no. 45, 46 and 47 show the production, imports, exports and apparent consumption of plywood, particle board and fibreboard respectively in the period 1971-1980.

TABLE No. 45

Production, imports, exports and
apparent consumption of plywood 1971-1980
(1.000 m³)

year	production	imports	exports	apparent consumption
1971	115.9	8.6	0.4	124.1
1972	123.6	11.5	0.6	134.5
1973	119.1	9.3	0.9	127.5
1974	130.5	15.1	0.3	145.3
1975	160.0	7.6	0.2	167.4
1976	163.4	12.2	-	175.6
1977	170.5	4.6	9.2	165.8
1978	187.5	4.8	13.9	178.4
1979	211.3	9.5	2.1	218.7
1980	253.5	15.1	-	268.6

SOURCE: Dirección General de Estadística, Secretaría de Programación y Presupuesto and Asociación Nacional de Fabricantes de Tableros de Madera, AC.

TABLE No. 46

Production, imports, exports and
apparent consumption of particle board 1971-1980
(1.000 m³)

Year	production	imports	exports	apparent consumption
1971	75.3	0.7	-	76.0
1972	72.2	0.6	-	72.8
1973	71.7	0.9	-	72.6
1974	88.7	19.1	-	107.8
1975	114.3	5.7	-	120.0
1976	150.7	16.2	-	166.9
1977	154.8	18.3	0.3	172.8
1978	161.9	13.9	0.4	175.4
1979	198.8	43.5	-	242.3
1980	316.2	32.3	-	348.5

SOURCE: Dirección General de Estadística, Secretaría de Programación y Presupuesto and Asociación Nacional de Fabricantes de Tableros de Madera, AC.

TABLE No. 47

Production, imports, exports and
apparent consumption of fibreboard 1971-1980

Year	production	imports	exports	apparent consumption
1971	20.5	-	2.6	17.9
1972	24.3	-	2.5	21.8
1973	28.0	-	1.6	26.4
1974	29.0	-	1.2	27.8
1975	30.0	1.7	2.0	29.7
1976	28.7	0.9	3.6	26.0
1977	30.0	-	3.3	26.6
1978	28.2	0.4	1.8	26.8
1979	24.0	-	-	24.0
1980	26.0	6.8	-	32.8

SOURCE: Dirección General de Estadística, Secretaría de Programación y Presupuesto and Asociación Nacional de Fabricantes de Tableros de Madera, AC.

2.2. Secondary wood processing

2.2.1. Wood in construction

The deficit of housing is estimated at 2,77 million units and the annual volume of construction should grow at an average of 4 % in order to satisfy the demand (3).

Traditionally houses in Mexico are constructed with mud, straw and clay; this is the most common type of building, the second is brick or concrete blocks, and the third type is wood. Rustic wooden houses are found in rural areas mainly in forested regions.

Wooden panels and flooring are used to a limited extent in very expensive housing, however the use of wood products is normally confined to concrete formwork, doors and built-in furniture. As a whole the use of wood in housing is declining steadily.

The cost of wood products in construction is presently estimated to range from 4,0 % to 7,4 % depending on the type of construction (3).

Residential and non residential building, which represent 68 % of the total construction sector of the country are the most important outlet for wood products (3).

2.2.2. Wood in packaging

The number of packaging manufacturing plants in Mexico is 455 units, of which 437 produce nailed packages and 18 produce wired ones. The annual capacity is estimated at 60 million units. The demand of roundwood is estimated at about 200.000 cubic meters per year. The number of people employed is estimated at 5.350.

2.2.3. Wood in furniture

The wooden furniture industry represents 0,36 per cent of Mexico's manufacturing gross product and 17,3 per cent of the wood industry (data from 1979) (2).

The furniture industry in Mexico is tremendously diversified and varies from very updated plants with up to 350 workers to small workshops having three to five workers.

Office furniture plants are said to be the leading in size and overall modernization. There are about seven companies having from 200 to 350 employees. Home furniture plants are generally smaller and less well equipped than the office furniture ones. It is estimated that there exist more than 2.000 furniture plants and workshops in the country.

The large factories have imported equipment, generally from Italy, Germany or Spain and with the equipment they receive assistance to develop the process and train the operators. Most of these industries are said to be very efficient and are in condition to compete on the international market, mainly in the U.S.A. There are some joint-ventures with Italian and Spanish groups in this sector.

Small plants or workshops claim that raw material is excessively expensive, pine in boards is sold by Mexico City retailers at US\$ 713,00 per cubic meter. Valuable hardwood like mahogany and "cedro rojo" was said to be more expensive and very difficult to find. This is said to occur because of the lack of infrastructure and lack of investments in harvesting, chiefly in the selva region, and because the concessions are such that it is very risky to make investments; the terms of concessions may be changed before the expiration of the signed agreement.

The tendency in large industries is to increase the use of veneered particle board in furniture.

3. MARKET AND TRADE RELATIONS

3.1. International trade

International trade for the period 1977-1980 is shown in table no, 48, From table no. 48 it can be inferred that external trade is marginal and that the deficit has grown steadily in the period 1977-1980. The major imports are primary products such as sawnwood, sleepers, etc.

Apparently the low export performance is due more to a lack or deficiency in production than to marketing limitations.

TABLE No. 48

Imports and exports of wood products, 1977-1980
(US\$ thousand)

Years	imports	exports	balance
1977	25 274	2 953	22 321
1978	32 365	3 028	29 337
1979	52 426	3 716	48 710
1980	92 026	2 411	89 615

Products considered: sawnwood, sleepers, panels, mouldings, package cases, doors and windows.

4. CONCLUSIONS

Mexico is a country with a large forest potential, with many ecological conditions which permit to develop temperate and tropical forests; however, it appears that the resources are not being effectively managed. A comprehensive national plan of forest management does not exist.

The main constraints to the development of wood processing industries are:

- Lack of sufficient investments in infrastructure, silviculture, forest investigation.
- Low efficiency in primary processing industry which produces intermediate products at high cost and of relatively low quality.
- Shortage of trained people in most segments of the wood processing industry.

PARAGUAY

1. WOOD AS A RESOURCE AND AS A RAW MATERIAL

1.1.1. Forest types

The information given here is based mostly on the work of the Proyecto de Evaluación de los Recursos Forestales Tropicales, Los Recursos Forestales de la América Tropical (1).

a) Closed broadleaved forests

The humid tropical (sub-tropical) forest of the eastern region constitute the most important forest type of the country. The best examples of this forest type is found in the north and east of the eastern region. In a forest inventory of the forests on the south of paralel 24°S, 192 tree species were found.

The most important species of this forest are: Cedro (Cedrela fissilis), Lapacho (Tabebuia spp), Peroba (Aspidosperma plymenron), Guatambu (Balfanrodendron riedelianum), Incienso (Myrocarpus frondosus), Peterewy (Cordia trichotoma) and Yuyra-ró (Pterogyne nitens).

b) Transition forests

In the region of the west bank of the Paraguay river, there exist formations of closed forests. It is a transition between the humid forests of the east and the dry forest of the "chaco". It is called by Hueck "dry to semi-humid forest of the eastern chaco". The most important commercial specie known in this forest is the "quebracho colorado" (Schinopsis balansae).

c) Open broadleaved forests

They cover most of the western region (north, center and west). The formation changes westwards, the diameters of the trees are smaller, the trees are poorer, and the density of the forest decreases, diminishing the economic value of the forest. This type of vegetation is not completely known nor reasonably mapped. The most important species of these formations are: "quebracho colorado" (Schinopsis balansae), "quebracho blanco" (Aspidosperma spp), "quebracho macho" (Schinopsis lorentzii), "guayacan" (Caesalpinia paraguayensis), "koranda" (Prosopis kuntzei) and "mistol" (Zizyphus mistol).

d) Palm savannas

Situated in the south of the eastern region, and in the region limited by the rivers Paraguay and Pilcomayo these savannas have been classified as open broadleaved and unproductive forests. The well drained parts have several arbustive species and the palm "yatai" (Butia yatay), the poorly drained areas are occupied by the palm "caranday" (Copernicia cerifera).

e) Coniferous forests

There are some very small areas of Paraná pine (Araucaria angustifolia), near the Paraná river, but because of the small size these areas do not have economic importance.

1.1.2. Potential of known and lesser known species

The high forest of the western region, covering about 59 % of the 6,35 million hectares of forest inventoried during the period 1967-1972, represents the most important part of the natural forest resources of the country.

Mainieri (2) grouped the most common species which occur in Paraguay in the following five groups according to their present value and potential.

1. Species quality "A" - Species with present value in the national and international market

<u>Common local name</u>	<u>Family</u>	<u>Botanical name</u>
Cedro	Meliaceae	<u>Cedrela</u> sp
Guatambú	Rutaceae	<u>Balfourodendron</u> sp (riedelianun)
Incienso	Leguminosae	<u>Myrocapus</u> sp
Kurupa'y	Leguminosae	<u>Piptadenia</u> sp (macrocarpa)
Lapacho	Bignoniaceae	<u>Tabebuia</u> spp (ipé and others)
Peterevy	Boraginaceae	<u>Cordia trichotoma</u>
Taperyvá guasú	Leguminosae	<u>Fereira spectabilis</u>
Urunde'y mí	Anacardiaceae	<u>Astronium</u> sp (urundueva)
Yvyrá ró	Leguminosae	<u>Pterogyne nitens</u>

2. Species quality "B" - Species with present value in the national and international markets, but in limited quantities and lower prices than "A".

<u>Common local name</u>	<u>Family</u>	<u>Botanical name</u>
Cancharana	Meliaceae	<u>Cabranea</u> sp (cangerana)
Kirandy	Apocynaceae	<u>Aspidosperma quirandy</u>

Kurupa'y rã (Anchico)	Leguminosae	<u>Piptadenia</u> sp (rígida)
Laurel aju'y	Lauraceae	<u>Ocotea</u> sp
Laurel guaicá (Guaicá)	Lauraceae	<u>Nectandra</u> spp
Tatajyvá (Mora)	Moraceae	<u>Chlorophora tinctoria</u>
Timbó	Leguminosae	<u>Enterolobium</u> spp (timbouva and others)
Yvirá peré (Grapia)	Leguminosae	<u>Apuleia praecox</u>
Yvirá ro mí (Peroba)	Apocynaceae	<u>Aspidosperma australe</u>

3. Species quality "C" - species with possibilities to enter the international market and increase sales on the national market

<u>Common legal name</u>	<u>Family</u>	<u>Botanical name</u>
Caroba	Bignoniaceae	<u>Jacaranda</u> spp (semiserrata)
Colita	Boraginaceae	<u>Cordia</u> spp (salicifolia)
Chipa rupá	Euphorbiaceae	<u>Alchornea</u> spp (triplinervia)
Guajayví	Boraginaceae	<u>Patagonula</u> spp (americana)
Jata yvá	Leguminosae	<u>Hymenaea</u> spp
Kupa'y	Leguminosae	<u>Copaifera</u> spp
Laurel cancla	Lauraceae	<u>Ocotea</u> spp
Laurel hũ	Lauraceae	<u>Nectandra</u> spp
Laurel morotí	Lauraceae	<u>Ocotea</u> spp
Manduvirá	Leguminosae	<u>Geoffroea</u> spp
Marmero	Polygonaceae	<u>Ruprechtia</u> spp
Tata yvá	Lecythidaceae	<u>Cariniana estrellensis</u>
Urunde'y pará	Anacardiaceae	<u>Astronium</u> spp (fraxinifolium)
Yvá ró (Persiguero)	Rosaceae	<u>Prunus</u> spp (sphaerocarpa)
Yvopé (espina de corona)	Leguminosae	<u>Gleditsia</u> spp
Yvirá oví	Rutaceae	<u>Helietta longifolia</u>
Yvyrá pepé (Alecrin)	Leguminosae	<u>Holocalyx balansae</u>
Zota caballo	Tiliaceae	<u>Luehea</u> spp

4. Species quality "D" - Species presently of limited local use, but with possibilities to enter the national market

<u>Common local name</u>	<u>Family</u>	<u>Botanical name</u>
Aguaí	Sapotaceae	<u>Chrysophyllum gonocarpum</u>
Amba'y	Moraceae	<u>Cecropia</u> sp (adenopus)
Amba'y guazú	Araliaceae	<u>Didymopanax</u> sp

Amores secos	Tiliaceae	<u>Heliocarpus</u> sp (americanus)
Canelón pytá	Myrsinaceae	<u>Rapanea</u> spp
Cedrillo	Meliaceae	<u>Guarea</u> spp
Tembetary, Kuratú rá	Rutaceae	<u>Fagara</u> spp
Jaguá rata'y	Sapindaceae	<u>Cupania</u> sp/ <u>Matayba</u> sp
Ka'a tí	Styracaceae	<u>Styrax</u> sp
Kamba aká	Sterculiaceae	<u>Guazuma</u> <u>ulmifolia</u>
Loro blanco	Malvaceae	<u>Bastardiopsis</u> <u>densiflora</u>
Marinero	Meliaceae	<u>Guarea</u> sp
Mbawý	Flacourtiaceae	<u>Banara</u> spp
Pakuri	Guttiferae	<u>Rheedia</u> sp
Palo amargo	Simarubaceae	<u>Aeschrion</u> sp
Palo blanco	Rubiaceae	<u>Calycophyllum</u> sp (crenata)
Para para'y	Araliaceae	<u>Pentapanax</u> sp (warmingiana)
Pykasú rembiú	Sapotaceae	<u>Chrysophyllum</u> sp (marginatum)
Quina	Apocynaceae	<u>Rauwolfia</u> sp
Tarumá	Verbenaceae	<u>Vitex</u> spp
Ysayp'y pytá	Leguminosae	<u>Machaerium</u> sp (brasiliensis)
Yvyrá jú	Leguminosae	<u>Pithecolobium</u> sp
Yvyrá katú	Annonaceae	<u>Xylopia</u> sp
Yvyrá piu (maría preta)	Sapindaceae	<u>Diatenopteryx</u> sp

5. Species quality "E" - Species that presently do not have commercial value and with minimal chances to enter the market

<u>Common local name</u>	<u>Family</u>	<u>Botanical name</u>
Aratikú	Annonaceae	<u>Annona</u> spp/ <u>Rollinia</u> spp
Ceibo	Leguminosae	<u>Erythrina</u> spp
Guapo'y	Moraceae	<u>Ficus</u> spp
Guavijú	Myrtaceae	<u>Eugenia</u> spp
Guavirá	Myrtaceae	<u>Campomanesia</u> spp
Ingá	Leguminosae	<u>Ingá</u> spp
Jakarati'a	Caricaceae	<u>Jacaratia</u> spp
Ka'a (Yerba mate)	Aquifoliaceae	<u>Ilex</u> <u>paraguayensis</u>
Mboreví ka'a	Rubiaceae	<u>Faramea</u> spp
Nandypá guasú	Rubiaceae	<u>Genipa</u> spp
Ombú	Phytolaccaceae	<u>Phytolacca</u> spp
Rabo itá	Leguminosae	<u>Lonchocarpus</u> spp
Rabo mole	Leguminosae	<u>Lonchocarpus</u> spp
Samu'u	Bombacaceae	<u>Ciorisia</u> <u>speciosa</u>

1.1.3. Management status

There is practically no natural forest under management. Most of the forest is exploited like a mine or is simply clear felled for agricultural uses. Most of the productive forest areas are under some sort of private ownership.

The government, worried about the long-term forest supply, introduced in 1975 the concept of "Permanent Industrial Forest Units" (PIFU) in the Decree 11681, that regulates the Forestry law (no. 422, art. 27-31), aiming at the management of certain areas on a long-term sustained-yield basis. In spite of the initially positive reaction, there has been very little progress towards the establishment of the "PIFU", mainly because the owners of the forest land do not believe that it is to their benefit to put their lands under long-term management plans, specially due to the accelerated increase in the value of lands, potentially suitable for agricultural use. There are some companies that have some sort of plan for harvesting, that make possible the supply of their plants for a number of years, but they are far from a sound management plan based on silviculture, that could give a permanent sustained yield.

1.1.4. Long-term regeneration policy, replantation

There exist very limited tentatives of forest regeneration, due to its characteristics and to the almost complete lack of knowledge of the dynamism of the dense humid forest. Some regeneration occurs in the exploited areas, where the big trees of the more valuable species were withdrawn, but very little is known about the quality of such regeneration.

Replantation with native species seems to be negligible in the country. According to FAO/PNUMA there exist approximately 100 ha of land reforested with native species. The total plantations in 1980 were of 3.667 ha, approximately 60 % with Pines, 37 % with Eucalyptus, and 3 % with native species. About 43 % of the plantations had less than 4 years, 17 % between 5 and 9 years, 23 % between 10 and 15 years, and 23 % had more than 16 years.

For the period 1977-1981 it was planned to reforest 21.300 hectares, in 1978 that number was reduced to 7.900 hectares. The actual reforested area is quite inferior to the planned figures. In 1973 a law was enacted

that gave fiscal incentives for reforestation, it appears that the fiscal exemptions and incentives have not been sufficient to motivate the possible candidates to invest in reforestation and plantations.

1.1.5. Accessibility of forest for their economic exploitation

According to the FAO/PNUMA Report the situation of the areas of woody vegetation is as follows:

<u>Type of forest</u>	<u>Area</u> (ha x 1.000)
Closed, broadleaved, productive, unmanaged, undisturbed	560
Closed, broadleaved, productive, unmanaged, exploited	2.480
Closed, broadleaved, productive, unmanaged	3.040
Closed, broadleaved, unproductive	1.030
Closed, broadleaved	4.070
Secondary forests	3.270
Open broadleaved, productive	11.050
Open broadleaved, unproductive	17.590
Open broadleaved	28.640

The area of closed, productive forests is only of 3,04 million hectares, and the area of closed productive unexploited forest of only 560.000 ha. This indicates that in the near future no undisturbed forest will be left. The area of open broadleaved productive forests, 11,05 million hectares, is comparatively extensive, but it seems that this kind of woodland is very poor in terms of economic wood production. The unproductive closed broadleaved forests, 1,03 million hectares include 940.000 ha unproductive for physical reasons, and 90.000 ha for legal reasons.

Infrastructure is not a limitant factor for accessibility of the forest resources. In spite of a limited road and railroad network the access to the eastern region is reasonably assured all over the year. The western region is less accessible, but the forest resources of this region are commercially of minor importance.

1.2. The uses of forest products

Firewood is the largest single item of wood consumption, representing about 68 % of the total harvested in 1979. Firewood will increase in next year due to the demand for charcoal needed as a reduction agent for the steel plant being built in the country. The steel plant will need about 100.000 ton of charcoal per year that is approximately 400.000 m³ of roundwood per year.

The harvesting of roundwood for the period from 1970 to 1979 is presented in table no. 49.

TABLE No. 49

Annual volume of forest harvesting in Paraguay 1970-1979

(metric ton x 1000)

ITEM	Y E A R S									
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Logs	595.6	589.6	566.8	656.6	784.2	913.9	809.5	930.3	1110.0	1420.0
Poles	141.8	145.3	148.4	185.2	205.3	235.4	246.0	254.5	261.0	270.8
Sleepers	6.1	7.1	4.7	6.6	7.6	7.5	4.3	3.1	4.0	5.3
Firewood	1649.3	1775.1	1873.3	1974.6	2118.2	2254.8	2391.7	2554.8	2605.1	2662.7
Palm:	17.9	16.3	14.4	11.8	15.1	16.7	15.2	16.0	17.0	22.0

SOURCE: Banco Central del Paraguay, Division de Cuentas Nacionales, Cuentas Nacionales 1970/1979 - Asunción, Paraguay.

1.3. Prospective supply of roundwood

1.3.1. Changes in forest area

The main changes in the forest area in Paraguay are the areas cleared for agriculture. The area annually cleared is estimated to be from 80.000 to 180.000 ha. According to FAO/PNUMA (1) in the period 1976-1980, an annual average of 175.000 ha were deforested as follows: 140.000 ha of closed broadleaved productive forest, 20.000 ha of closed broadleaved unproductive forest and 15.000 ha of open broadleaved unproductive forests. For the period 1981-1985 the following figures are projected: a total of 210.000 ha deforested per year, 170.000 ha of closed broadleaved productive forests, 20.000 of closed broadleaved unproductive forests and 20.000 ha of open broadleaved productive forests. There are indications through satellite images taken in 1972-1973, (1) that every year 50 % of the colonized areas are abandoned, which develop secondary forests. This information should be checked, because it seems unlikely that such a rate of abandonment should occur. Apart from deforestation, there exists degradation of forests, because of the cutting of commercial timber species and sizes, as well as burning and excessive grazing.

2.3.2. Growing stock

There is an almost complete lack of information about the growing stock of the forests of the country. The survey-inventory over 6.400.000 ha of the eastern forest region (1) has been the main source of data. In the table no.50 are presented the estimated figures for growing stock at the end of 1980. From the figures it is important to note that the gross volume is estimated at 80 m³/ha, while the commercial volume is estimated at only 10 m³/ha, because of the selective harvesting. The annual gross increase based on data from Argentina is estimated to be from 3 to 5 m³/ha. From this figures the annual gross increase in the closed broadleaved productive forests can be estimated between 9,12 million and 15,2 million cubic meters. The annual commercial increase per hectare is estimated to be between 0,17 and 0,45 m³/ha, and the total annual commercial increase may be estimated between 516.800 m³ and 1.368.000 m³. These figures need to be considered with reserve since they are based on

the total area of closed forests of the country (intact and exploited).

If an annual increase of $15 \text{ m}^3/\text{ha}$ is assumed for the planted forest an annual increase of about 55.000 m^3 can be estimated for the plantations.

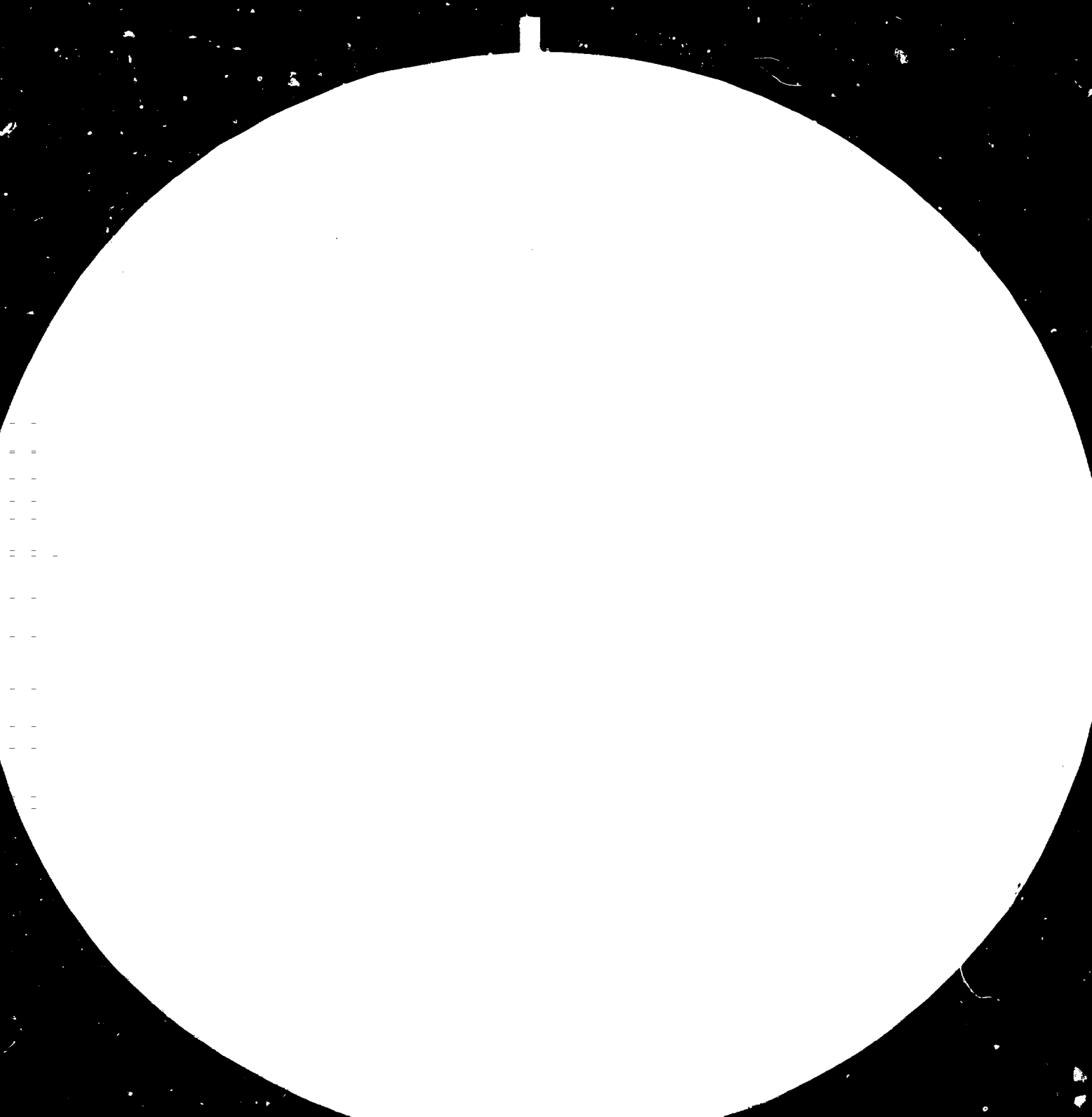
The total roundwood removals are presented in table no. 49. Logs production has grown from 595.600 metric tons in 1970 to 1.420.300 metric tons in 1979, assuming a rough coefficient of conversion of $1 \text{ t}/\text{m}^3$. The log volume harvested in 1979 was about 1.42 million cubic meters. This figure is well above other sources that estimate an annual harvesting of 700.000 or 800.000 m^3 . If the removals of logs are compared with the annual increases of commercial timber, estimated from 0,52 to 1,37 million of cubic meter it would be reasonable to infer that the removals are quite similar to the increases. Estimations on the time needed for complete clearing of the closed forests of the eastern region of Paraguay vary from 17 to 57 years, depending the on assumptions on the rate of deforestation, and the present existing forests.

Emil Jones (3), estimated, based on the remaining forested area, the commercial stock per hectare, and the present demand for logs, the time that the log supply will be menaced by complete depletion. He concluded that with the present demand, Paraguay will have problems of supply in 10 to 15 years.

2.4. Extraction

Presently most of the forest land is of private property. In 1972 the Rural Welfare Institute (Instituto de Bienestar Rural) owned 11.823.000 ha of land, but only 520.000 ha of it were located in the eastern region, where the most important commercial forests are; no information on nationwide distribution of forest land property was found. Because of the type of forest ownership, there is no overall planning of harvesting which depends on the particular decision of each landowner. The government has tried to have some control over harvesting with initiatives like to establishment of "Permanent Industrial Forest Units" but so far without success. Another mechanism of control is the "Harvesting Permit", which is a formal licence in order to set the documents for transport of forest products. Through the document of transport "guias", the government imposes a tax on the harvested logs. Each log being hauled needs to have a "guía" and each "guía" is taxed

1951





2.8



3.2



3.6



4.0



4.5



20. American National Standards Institute, Inc., 11 West 42nd Street, New York, N.Y. 10018

21. ANSI Z39.18-1968, American National Standard for Test Methods for Determining the Resolution of Radiographic Systems

22. ANSI Z39.18-1968, American National Standard for Test Methods for Determining the Resolution of Radiographic Systems

TABLE No. 50

Growing stock estimated at end 1980
(totals in millions m³)

	Closed broadleaved productive intact forests				Closed broadleaved productive explored forests		Closed broadleaved unproductive forests	
	gross volume		actual commercial volume		gross volume		gross volume	
	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total
Eastern region	80	21	10	2.6	60	140	35	29
Western region	80	24	10	3.0	60	9	35	7
TOTAL		45		5.6		149		36

SOURCE: (3)

by a fixed amount, independent from the volume of the log, and the specie of timber. There is no obligation of reforestation for the wood industries, the only obligation is the "guía" which includes a tax destined to the National Forest Service.

Logs are extracted in Paraguay either by the companies or by small contractors.

Company operations generally are more mechanized than contractors. Some companies utilize rubber tired skidders and crawler tractors for pre-hauling and, crawler tractors for road construction and maintenance and semi-trailers for log hauling. Only very few companies have a reasonable road planning. Company operations normally belong to a wood industry, sawmill or plywood mill.

Other type of logging operations are the contractors or independent loggers, generally a crew of three or four people, with a truck, a chain saw and some manual tools. They prepare the strips in the bush, and the truck goes up to the stump, where it is loaded through a serie of reels mounted on it. Part of the loggers have contracts with sawmills, or other wood industries, and all their production is destined to them. Others are independent and sell the log, to who ever pays better prices or has interest in the kind of wood the loggers have.

Productivity is generally well below the level of industrialized countries, because of the lack of training of operators and deficient planning of operations. No quantitative informations on logging productivity have been found.

3. WOOD PROCESSING INDUSTRY

The wood processing industry in Paraguay has had rany changes in the last decade. One of the causes of these changes is the banning of log exports, enacted by the government in 1972. Most of the present industrial capacity was set up after that date. The wood industry is concentrated almost exclusively in sawmilling and plywood manufacturing, there are very limited cases of some kind of processing after sawmilling.

3.1. Primary wood processing

3.1.1. Sawmilling

Sawmilling is the most important sector of the wood processing industry. About 1.000 sawmills exist presently in Paraguay according to the latest information available. According to a survey carried out in 1975 there existed at that time 489 sawmills; This means that in five years the number of plants practically doubled.

The equipment utilized in sawmilling is quite variable depending on the size of the enterprise. There are sawmills equipped with a horizontal sash saw, powered with 10 HP diesel engines, producing one to three cubic meters per day, depending on the specie and dimensions of the output. The bulk of sawnwood is produced in band headrigs, generally with flywheels of diameters of 1.20 to 1.60 m, very few have a bigger size wheel. Most of the sawmills have not mechanized log loading operations, this may be judged as a lack of technology and a misspractice, but in some remote areas the maintenance of a conveying system is more difficult and expensive than to move the material by hand. Some sawmills with very basic equipment, but with a reasonable lay-out have been found to work smoothly and economically.

Sawmills are generally located near the source of raw material, but some are moving progressively farther, because of the depletion of the forests; others, located in larger cities, are up to 400 km far from the source. These sawmills have problems of supply and the cost of logs is dramatically increased by the cost of hauling.

In Paraguay the productivity of the sawmilling industry is generally very low. In the survey of sawmilling industry carried out in 1973/74 the average productivity was 0.986 cubic meters of log per man/day. The main causes for such a low productivity are: lack of mechanization, deficient saw doctoring, inadequate lay-out, lack of training for sawyers, edger operators, and trimmer operators.

In 1974 the total capacity of this sector was of 330.455 cubic meters of logs: after 1974 the number of sawmills has doubled, and the quality of equipment probably has improved, increasing the national capacity, but unless there are some productions that are not controlled, the production did not reach the capacity of 1974. Table no. 51 shows the production, consumption and trade of sawnwood in the period 1965/1977.

The number of persons employed in the sawmill industry is estimated to be more than 10,000, but it was not possible to get updated information on the subject.

Sawmilling in Paraguay is concentrated on very few species. According to Emil Jones (3) three species: "Lapacho" (Tabebuia sp), "Cedro" (Cedrela sp) and "Peroba" (Aspidosperma polynenron), represent 76.5 % of the volume processed. Table no. 52 shows the species processed (the source does not mention the period).

TABLE No. 51

Production, consumption and trade of sawnwood 1965 - 1977
(thousand m³)

Year	production	imports	exports	apparent consumption	per caput consumption m ³
1965	139	00	44	95	0.047
1966	133	00	38	96	0.046
1967	133	00	27	107	0.050
1968	150	00	43	108	0.049
1969	210	00	73	138	0.061
1970	210	00	86	124	0.054
1971	210	00	84	126	0.053
1972	220	00	122	98	0.040
1973	256	00	149	107	0.043
1974	315	00	197	118	0.046
1975	330	00	149	181	0.063
1976	340	00	97	243	0.089
1977	375	00	146	229	0.082

SOURCE: PMUD/FAO Grupo de Planificación y Desarrollo de Industrias Forestales en América Latina EIA/77/019.

TABLE No. 52

Species of wood processed in Paraguay

common local name	S P E C I E S	
	Botanical name	
Lapacho	<u>Tabebuia</u> sp	29.5
Cedro	<u>Cedrela</u> sp	27.4
Peroba	<u>Aspidosperma polyneuron</u>	19.6
Petereby	<u>Cordia trichotoma</u>	4.6
Ybyraro	<u>Pterogyne nitens</u>	4.3
Guatambú	<u>Belfanrodendron riedelianun</u>	4.0
Ybyrapytá	<u>Peltophorum dubium</u>	3.2
Incienso	<u>Myrocarpus</u> sp	1.9
Timbó	<u>Enterolobium</u> sp	1.2
Laurel	<u>Nectandra</u> sp	1.1
Cancharana	<u>Cabrales cangerana</u>	0.2
Kurupay	<u>Pitadenia macrocarpa</u>	0.4
Guaicá	<u>Nectandra</u> sp	0.7
Other species		1.9

SOURCE: PNUD/FAO RLA/77/019 Grupo de Planificación y Desarrollo de Industrias Forestales en America Latina.

3.1.2. Wood based panels

Information about panels is very poor. According to reports of the PNUD/FAO/SNF project PAR/76/005 there exist in Paraguay about 31 plants of veneer and plywood, working at a 50 % of their capacity. Production of veneer was estimated at 14.000 m³ and that of plywood and blockboard at 2.000 m³ in 1979. According to verbal information the main specie utilized for veneer and plywood is the "Cedro" (Cedrela sp).

A company producing plywood and flush doors was found to have quite adequate equipment for Paraguay conditions. The company is operating presently below the installed capacity and the raw material is basically "cedro" (Cedrela sp). It seems that a major constraint to this type of industry is the increasing cost and decreasing quality of logs for peeling.

Paraguay had a particle board plant but presently it is not working, it was dismantled, because the place it occupied will be inundated by the lake to be formed by the Itaipu dam. It had a capacity of about 6,000 m³ per year but the production used to be about 2,000 per year. The size of national market was the main cause of the small utilization of the capacity.

3.2. Secondary processing

3.2.1. Wood in construction

Paraguay, with a population of about 3,250,000 and a population growth of 3.3 % per annum in the period of 1970 - 1980, in order to eliminate the housing deficit, would need about 30,000 units annually. About 6,000 units were erected in 1975 and there are no informations on the rate of housing in the last years. Despite its abundance, wood has had very little use as a building material in Paraguay. Only in the countryside has there been any traditional use of wood in housing. In present day housing, the materials mainly employed are bricks, gravel, sand lime and cement, while the use of wood is usually confined to doors, frames, rafters and joints, although the use of parquet flooring is now increasing. Estimates indicate that wood products represent only about 10 per cent of the cost per square meter of a house, in the economic price range.

Tentatives have been made to produce all-wooden houses in the last years, but until now, according to the available information, the results have been very limited both technically and quantitatively.

3.2.2. Wood in packaging

There is a complete lack of statistical data about wood in packaging, there is information that wood packaging is both a salvage operation in a number of sawmills and the main objective of some small enterprises located mainly in Asunción.

3.2.3. Wood in furniture

The paraguayan furniture industry is characterized by a very small number of industries, and a relatively large number of small workshops. The exact number of industries was not obtained. The number of industries employing more than 30 persons is not more than 10, the total number of small workshops, only in Asunción is estimated at four or five hundred. The number of employees can be estimated at around 2.000 to 3.000 in Asunción. In the larger plants the wood technology is not completely understood mainly in the aspects of drying process, the industry is using almost exclusively only one specie, the Cedro (Cedrela sp). The woodworking equipment imported from Europe is quite artisanal. There is no mechanized conveying equipment, nor any kind of automatic operation. According to industry the internal market is very small, and there is severe competition from the small workshops and from imported furniture.

The international market is very difficult to enter due to two main facts: the cost of freight, which is very high from Paraguay, (about US\$ 30.00 per cubic meter to get to Brazilian or Argentinean ports; and the "ad valorem" tax levied over exports (about 12 %).

Research and development on low cost machinery, is nonexistent or insignificant. In 1975 a group of experts of UNIDO, FAO and members of INTN (National Institute of Technology and Standards) and from mechanical industry of Paraguay started studies to produce in Paraguay woodworking machinery that included: thin band saws, resaws, single circular saws, multiple circular saws, thickness planers and spindle moulding machine. There is no information on results about that tentative but the lack of mention of progress in the last report of the UNDP/FAO project leads one to believe that the tentative did not succeed.

In the furniture industry as was already mentioned, there is a lack of complete understanding of wood technology, however the INTN has conditions to assist industry in the basic questions of applied wood technology. The INTN claims that it has had little requests of its services from the woodworking industries.

4. MARKET AND TRADE RELATIONS

4.1. Domestic trade

The main characteristic of the domestic market is its small size, due mainly to the limited population and the lack of tradition in the use of wood

in housing. The furniture industry which is working well below capacity is suffering from the competition of foreign products because of its high costs. On the other hand, the marginal furniture industry is less burdened by fiscal pressure, than are the normally established. One aspect that needs to be considered is the extreme concentration on two species: "Cedro" (Cedrela sp) in furniture and doors and "Lapacho" (Tabebuia sp) in other housing parts. In Paraguay, as in other countries of the continent, the engineer architect and builders pay a minimal attention to the use of wood in housing. Apparently there is little information on the mechanical and physical properties of wood that can be advantageously used in tropical and subtropical countries. Another aspect is the generally low quality of wooden products put on the market, normally not dried or preserved and poorly machined.

4.2. International trade

Paraguay is a supplier country of wood and wood products. Table no. 51 gives the production, consumption and trade of sawnwood in the period 1965 - 1977, table no. 53 shows the volumes and values of exports of wood products in the period 1978 - 1980, and table no. 54 shows the value of wood product exports, and of total exports of Paraguay for the 1970 - 1980 period; from these tables it is possible to infer that Paraguay did not import solid wood products in the period 1965 - 1977. In the period of 1978 - 1980 the exports of wood products have grown in terms of volume, of total value and of value per ton. According to verbal information the total of wood products exports in 1981 was about 40 million US dollars, i.e. very inferior to those of 1980. The wood product exports share of total exports has increased from 6,66 % in 1976 to 21,57 % in 1980, which is very significant.

Argentina, Brazil and Uruguay take about 90 % of Paraguay's exports of wood products, in volume and in value. Argentina and Uruguay buy sawnwood and products of more expensive species while Brazil imports less valuable species. These three countries do not have strict requirements of quality, almost all sawnwood sold to these countries is unseasoned, but other countries, specially Europeans and North American are more quality conscious.

TABLE No. 53

Exports of wood and wood products in the period 1978-1980

Products	1978		1979		1980	
	volume metric	value 1000 US\$	volume metric	value 1000 US\$	volume metric	value 1000 US\$
Sawnwood	99 793	14 675	187 981	32 167	207 358	50 935
Veneer	16 860	3 448	28 018	5 639	47 221	9 479
Parquet	2 859	846	4 966	1 510	2 843	1 752
Plywood	2 173	966	2 811	1 671	2 865	2 379
Doors	168	262	401	945	847	1 783
Others	550	145	902	311	563	577
TOTALS	122 403	20 342	225 079	42 243	261 697	66 905

SOURCE: Boletín Estadístico no. 273 y Estadística y Compilación Mecanizada Banco Central del Paraguay (Año 1980).

TABLE No. 54

Value of forest products exports and total Paraguay exports in the period 1970-1980 in millions of US dollars

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Wood Products exports	12.6	10.4	9.5	11.9	24.7	27.9	12.1	19.9	20.3	42.1	68.8
Total exports	64.0	65.2	66.2	126.9	169.8	176.7	181.8	279.0	257.0	305.1	319.2
Participation of wood as percent of total exports	19.7	15.9	11.0	9.3	14.5	15.8	6.6	7.1	7.9	13.8	21.5

SOURCE: Boletín Estadístico no. 264 del Banco Central del Paraguay.

One of the main constraints to exports of Paraguayan woods is its land locked situation. The cost to get ships in Brazilian or Argentinian ports is about US\$ 30.00 per cubic meter. The conference freights are very high (about US\$ 122.00 per cubic meter to Europe and US\$ 70.00 the United States) chartered vessels would cost much less (US\$ 35.00/m³ FIO) from Brazil and Argentina, but the minimum volume is 6.000 m³, too large for a single exporter. Apparently the joint utilization of a chartered is not easy to arrange in Paraguay.

Other barriers to more exports, according to the lumbermen are the export duty of 12 % over the fiscal prices, plus about 3 % over the FOB value for consular fees, bank commissions and other small expenses, as well as the official rate of exchange maintained constant by the government at 126 guaranies per US dollar. All these factors affect negatively the competitiveness of the Paraguayan wood industry in the international market.

Presently, because of the economic problems of the two main importers of Paraguayan wood products (Brazil and Argentina), a significant part of the wood industries have stopped production or are working at a very low level, according to some information, 80 % of the sawmills are not working. This happens because of the extreme dependence on the Brazilian and Argentinean markets. To change of this situation is not simple because the species and the kind of product sold to those markets, is adapted to specific uses. For instance Peroba (Aspidosperma polineuron) the main species destined to the Brazilian market is traditionally used in construction, and is extremely dependent on the rate of housing in Brazil. There are small chances that the Brazilian market will demand bulk volumes of other species, because other sources of substitutes for Peroba are being developed in that country.

In spite of the relative success in forest products exports in the period 1978 - 1980, the results of 1981 were about 35 % less than 1980. The present situation shows that the external market is very concentrated and that efforts need to be made to change that dependence by broadening the number of importers of Paraguayan wood products and increasing the number of species and products offered by the wood industry.

Presently the international marketing is done separately by the export companies, it seems to be clear that there is a lack of marketing competence to reach the markets of industrialized countries. Probably the only way to succeed is by linking the producers under a professionally competent marketing association.

5. CONCLUSIONS

Paraguay is a country with quite large forest resources to its population, but are strongly threatened by depletion. If the rate of land clearing and selective logging goes on, in a few years Paraguay will not have anymore precious woods. Paraguayan authorities have decide as soon as possible, how they are going to assure the future supply of wood, from native, or man-made forests or from a mixture of both.

It is probable that man-made plantations will not provide the type of wood to replace cedrela (Cedrela sp), lapacho (Tabebuia sp), or peterevy (Cordia trichotoma). The demand for prime lands for agriculture will increase progressively since the lands of eastern Paraguay where the best species grow are also, generally the best soils for coffee, soya bean, wheat, corn and other crops.

Ownership complicates the dilemma since most of their lands are in private ownership. One of the solutions, already preconized by FAO experts, is to proceed more rapidly in the classification of soils and potential land use. With the forest land classified it would be possible to put aside areas having a forest vocation, for sustained yield, the remaining of the demand would be satisfied by man-made forests.

Paraguay, apparently has enough sawmilling capacity to process the volume based on the annual allowable cut. Veneer and plywood plants are presently working at about half capacity, therefore investments in these areas should not be encouraged. Wood nousing should be encouraged since wood is one of the best materials for the climate of Paraguay. It is not used more widely, probably due to idiosyncratic prejudices against wood and lack of information about the properties of wood as a building material.

The furniture industry, at least the part of it that produces relatively expensive furnishings, has excess capacity. It is likely that if these plants made products more accessible to local purchases their capacity would be better utilized. The use of more species, not only "Cedrela" would help to lower furniture prices.

Forests of Paraguay like most tropical ones are exploited very selectively utilizing only very few species, having then a very low volume of commercial species per unit of area, efforts need by made as soon as

possible in order to avoid the loss of massive volumes of non commercial species in land clearings.

The constraints to the development of the wood processing industry are:

- The domestic market is very limited to permit the absorption of the production of an efficient furniture of joinery industry, it is necessary to open an external market.
- The more desired species have been exploited excessively putting the assurance of future supply into doubt.
- Exports are affected by the additional cost to reach the ports in the Atlantic Ocean or the River Plate.
- There is a lack of tradition and expertise in exports of manufactured products.
- Exports to Brazil which are mostly sawwood for construction, are very dependent on the construction level in that country.

PERU

1. WOOD AS A RESOURCE AND AS A RAW MATERIAL

The most important forest region in the country is the Selva both with respect to area as well as in the species it has.

1.1 Forest types

1.1.1. Closed broadleaved forests

- Alluvial class I forest

It has an area of 3.611.000 ha, situated in the Selva region mainly in the departments of Loreto, Madre de Dios, Huanuco, Junín y Pasco. It is situated on the river banks and bottomlands subject to periodic inundations. It has easy access and plain topography as well as species of high commercial value. The upper canopy attains 35-40 m and open undergrowth. It presents a gross volume of 92 m³/ha with more than 40 cm dbh ^{2/}. The main species are given in table no. 55.

- Alluvial class II forest

It covers an area of 7.375.000 ha, situated in the Selva region, mainly in the departments of Loreto, Madre de Dios, Puno and Huanuco. It is an important source of timber with good physical accessibility. The upper canopy reaches 30 and 35 m. The number of trees with bdh greater than 40 cm is estimated at 35, and the gross volume of the trees with diameter greater than 40 cm is estimated at 74 m³/ha. The list of the more important species is given in table no. 56.

- Alluvial class III forest

It covers 5.071.000 ha, all in the Selva region, in the departments of Loreto, Madre de Dios, Amazonas and Puno. It is easily accessible through the rivers, and has been exploited intensively under selective timber harvesting. It is also affected by intensive agricultural activity. In the region of Supay 31 trees were found with more than

^{2/} bdh: diameter breast height

40 dbh per ha, and a total of 220 trees with a dbh greater than 10 cm, table no. 57 presents the main species of this forest type.

TABLE No. 55

Lift of important species of alluvial class I forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Cumala	<u>Virola, Yryanthera</u>	Myristicaceae	6.8
Machimango	<u>Eschweilera</u>	Lecythidaceae	5.6
Shimbillo	<u>Inga</u>	Mimosaceae	5.1
Quina Quina	<u>Lucuma</u>	Sapotaceae	3.9
Chimicus	<u>Perebea</u>	Moraceae	3.6
Moena	<u>Aniba</u>	Lauraceae	5.0
Uvilla	<u>Pourouma</u>	Moraceae	3.1
Copal	<u>Protium</u>	Burseraceae	3.8
Quinilla	<u>Manilkara</u>	Sapotaceae	2.1
Pashaco	<u>Schizolobium</u>	Caesalpinaceae	2.0
Mashonaste	<u>Clarisia</u>	Moraceae	less than 2
Huayruro	<u>Ormosia</u>	Papilionaceae	"
Quillobordón	<u>Bombax</u>	Bombacaceae	"
Cetico	<u>Cecrocia</u>	Moraceae	"
Shiringa	<u>Hevea</u>	Euphorbiaceae	"
Apacharama	<u>Licania</u>	Rosaceae	"
Requia	<u>Guarea</u>	Meliaceae	"
Marupá	<u>Simarouba</u>	Simaroubaceae	"
Carahuasca	<u>Guatteria</u>	Annonaceae	"
Pacuna caspi	<u>Dialyanthera</u>	Myristicaceae	"
Rifari	<u>Anisomeris</u>	Rubiaceae	"
Tamamuri	<u>Ocoteia</u>	Moraceae	"
Uchumullaca	<u>Trichilia</u>	Meliaceae	"
Caimitillo	<u>Peuteria</u>	Sapotaceae	"

SOURCE: FAO/PNUMA/ROMA 1981

TABLE No. 56

List of main species of alluvial class I forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Moena	<u>Aniba, Ocotea</u>	Lauraceae	4.6
Cumala	<u>Virola</u>	Myristicaceae	6.5
Machimango	<u>Eschweilera</u>	Lecythidaceae	6.6
Quinilla	<u>Sideroxylon</u>	Sapotaceae	3.2
Shirbillo	<u>Inga</u>	Mimosaceae	3.2
Chicua	<u>Perebea</u>	Moraceae	3.2
Uvilla	<u>Pourouma</u>	Moraceae	2.2
Parinari	<u>Heisteria</u>	Olacaceae	less than 2
Shiringa	<u>Hevea</u>	Euphorbiaceae	"
Quina Quina	<u>Zschokkea</u>	Apocinaceae	"
Espintana	<u>Anaxagorea</u>	Annonaceae	"
Ucshaquiro	<u>Sclerolobium</u>	Caesalpiniaceae	"
Uchumullaca	<u>Trichilia</u>	Meliaceae	"
Copal	<u>Dacryodes, Protium</u>	Burseraceae	"
Huayruro	<u>Ormosia</u>	Leguminosae	"
Pashaco	<u>Schizolobium</u>	Caesalpiniaceae	"
Pucuna caspi	<u>Lucuma</u>	Sapotaceae	"
Tangarana	<u>Coccoloba</u>	Polygonaceae	"
Azúcar huayo	<u>Hymenaea</u>	Caesalpiniaceae	"
Caraña	<u>Trattinickia</u>	Burseraceae	"
Tushmo	-	Sapotaceae	"

- Hilly class I forest

It occurs in elevations that do not permit seasonal inundation. It covers 12.754.000 ha, mainly in the departments of Loreto, Madre de Dios, Pasco, Huanuco, San Martin and Junin, in a rolling terrain.

It presents storeys perfectly differentiated, with open undergrowth. The vegetation is generally vigorous, but where the rainfall is too abundant the strength decreases.

This forest is estimated to have 120 trees with more than 25 cm dbh per ha. The gross volume for trees with more than 40 cm dbh is estimated at 108 m³ per ha. Table no. 58 gives a list of the more important species in this forest type.

TABLE No. 57

List of main species of alluvial class III forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Shimbillo	<u>Inga</u>	Mimosaceae	6.2
Carahuasca	<u>Guatteria</u>	Annonaceae	4.0
Cumala	<u>Virola</u>	Myristicaceae	3.1
Uvilla	<u>Pourouma</u>	Moraceae	3.0
Causho masha	<u>Sapium</u>	Euphorbiaceae	2.8
Mashonaste	<u>Clarisia</u>	Moraceae	less than 2
Sapote	<u>Matisia</u>	Bombacaceae	"
Renaco caspi	-	Moraceae	"
Requia	<u>Guarea</u>	Meliaceae	"
Palo azufre	-	Guttiferae	"
Huimba	<u>Ceiba</u>	Bombacaceae	"
Pashaco	<u>Schizolobium</u>	Caesalpinaceae	"

- Hilly class II forest

It covers an area of 16.169.000 ha distributed mainly in the Selva region of the departments of Loreto, Madre de Dios, Cuzco, Amazonas, San Martín, Huanuco and Pasco.

This type of forests has been subjected to selective harvesting of the most valuable species, and in some places of the departments of San Martin and Pasco, there is intensive agricultural activity with consequent forest destruction. The number of trees with dbh larger than 25 cm is 120 per ha, and the gross volume of trees with dbh larger than 25 cm is 162 m³ per hectare. Table no. 59 gives a list of main species of this forest type.

TABLE No. 58

List of main species in hilly class I forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Caimito	<u>Pouteria</u>	Sapotaceae	8.4
Guabe	<u>Inga</u>	Mimosaceae	7.5
Shiringa	<u>Hevea</u>	Euphorbiaceae	6.1
Copal	<u>Protium</u>	Burseraceae	3.3
Cumala blanc	<u>Iryanthera</u>	Myristicaceae	2.9
Moena	<u>Aniba</u>	Lauraceae	2.6
Roble	(various)	Lauraceae	2.5
Vilco		Mimosaceae	2.2
Curala colorada	<u>Iryanthera</u>	Myristicaceae	2.1
Caimitillo	<u>Pouteria</u>	Sapotaceae	2.0
Sapote	<u>Matisia</u>	Bombacaceae	less than 2
Cumala	<u>Virola</u>	Myristicaceae	"
Cetico	<u>Cecropia</u>	Moraceae	"
Pashaco	<u>Schizolobium</u>	Caesalpinaceae	"
Cascarilla	<u>Cinchona</u>	Rubiaceae	"
Manchinga	<u>Brosimum</u>	Moraceae	"
Carapacho		Myrtaceae	"
Tornillo	<u>Cedrelinga</u>	Mimosaceae	"
Caucho	<u>Sapium</u>	Euphorbiaceae	"
Cacahuito	<u>Herrania</u>	Sterculiaceae	"

TABLE No. 59

List of main species of hilly class II forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Guaba	<u>Inga</u>	Mimosaceae	10.2
Caimito	<u>Pouteria</u>	Sapotaceae	9.3
Shiringa	<u>Hevea</u>	Euphorbiaceae	4.3
Vilco		Mimosaceae	3.8
Cumala	<u>Virola</u>	Myristicaceae	3.5
Cumala blanca	<u>Iryanthera</u>	Myristicaceae	3.1
Uvilla	<u>Pourouma</u>	Moraceae	3.1
Cetico	<u>Cecropia</u>	Moraceae	2.6
Moena	(various)	Lauraceae	2.5
Roble	(various)	Lauraceae	2.4
Carahuasca	<u>Guatteria</u>	Annonaceae	2.1
Tulpay	<u>Clarisia</u>	Moraceae	2.0
Loro micuna		Moraceae	less than 2
Requia	<u>Guarea</u>	Meliaceae	"
Copal	<u>Protium</u>	Burseraceae	"
Barbasco	<u>Guarea, Trichilia</u>	Meliaceae	"
Carapacho		Myrtaceae	"
Sapote	<u>Matisia</u>	Bombacaceae	"
Caucho	<u>Sapium</u>	Euphorbiaceae	"
Manchinga	<u>Brosimum</u>	Moraceae	"

- Hilly class III forest

It covers an area of 9.841.000 ha, mainly in the Selva region of the departments of Loreto, Madre de Dios, San Martin, Amazonas, Cuzco, Junin, Huanuco, Pasco y Puna. The strength is relatively low, the number of trees with a diameter greater than 25 cm dbh is 119 m³/ha, and the gross volume of the trees with more than 25 cm dbh is 127 m³/ha. Table no. 60 gives the list of main species of this type of forest.

TABLE No. 60

List of main species of billy class III forest

Local name	Genus	Family	average number of trees per ha having a dbh of more than 25 cm
Guaba	<u>Inga</u>	Mimosaceae	7.2
Shiringa	<u>Hevea</u>	Euphorbiaceae	5.7
Sapote	<u>Matisia</u>	Bombacaceae	5.4
Cumala blanca	<u>Iryanthera</u>	Myristicaceae	3.4
Copal	<u>Protium</u>	Burseraceae	3.3
Cetico	<u>Cecropia</u>	Moraceae	3.0
Cumala	<u>Iryanthera</u> , <u>Virola</u>	Myristicaceae	2.9
Tushmo		Sapotaceae	2.6
Ojé	<u>Ficus</u>	Moraceae	2.5
Cumala colorada	<u>Iryanthera</u>	Myristicaceae	2.1
Leche caspi	<u>Couma</u>	Apocinaceae	2.1
Mashonaste	<u>Clarisia</u>	Moraceae	2.1
Caimitillo	<u>Pouteria</u>	Sapotaceae	2.0
Carahuasca	<u>Gutteria</u>	Annonaceae	2.0
Pashaco	<u>Schizolobium</u>	Caesalpinaceae	less than 2
Chimicua	<u>Perebea</u>	Moraceae	"
Papaya caspi	<u>Jacaratia</u>	Caricaceae	"
Mobna negra	<u>Nectandra</u>	Lauraceae	"
Shihuahuaco	<u>Coumarouna</u>	Papilionaceae	"
Uvilla	<u>Pourouma</u>	Moraceae	"

- Protection forests

This type of forest, classified according to its function, occupies 13.858.000 ha. In spite of their importance as protection forests they have been affected seriously by the action of men.

There are other forest types, but because of the size, the composition or degree of devastation, they are considered to be of

relatively lesser importance.

The present situation of the natural forest is shown in table no. 61.

TABLE No. 61

Areas of natural woody vegetation estimated at the end of 1980

(in thousand ha)

	productive untouched	productive exploited	non productive	total
Broadleaved	10 160	4 500	1 270	15 930
Hilly forests	27 160	1 500	9 600	38 260
Protection forests	-	-	13 510	13 510
Closed dry forests	-	-	525	525
"Aquajal"	-	-	1 050	1 050
"Manglar"	-	-	28	28
"Quinual"	-	-	7	7
TOTAL BROADLEAVED	37 320	6 000	25 990 *)	69 310
Conifers	-	-	-	-
Podocarpus forests	180	-	190	370
TOTALS	37 500	6 000	26 180	69 680

*) of which approximately 850 ha are National Parks

SOURCE: Proyecto de evaluacion de los recursos tropicales. Los Recursos Forestales de la America Latina. FAO/PNUMA.

1.1.2. Growing stock

The growing stock estimated at the end of 1980 is given in table no. 62.

TABLE No. 62

Growing stock estimated at end 1980
(totals in million m³)

BROADLEAVED	CLASS OF FORESTS							
	CLOSED BROADLEAVED FORESTS						CLOSED BROADLEAVED UNPRODUCTIVE	
	INTACT				EXPLOITED			
	gross volume		commercial volume		gross volume		gross volume	
	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total	m ³ /ha	total
Alluvial forests	140	1 420	5	50	130	585	90	115
Hilly forests	215	5 840	15	410	185	280	180	1 730
Protection forests	-	-	-	-	-	-	190	1 350
Closed dry forests	-	-	-	-	-	-	40	20
"Aquajal"	-	-	-	-	-	-	n.a.	n.a.
"Manglar"	-	-	-	-	-	-	30	1
"Quinual"	-	-	-	-	-	-	25	0,2
TOTAL BROADLEAVED	-	7 260	-	460	-	865	-	3 215
CONIFERS	65	12	25	5	-	0	45	9
BROADLEAVED & CONIFERS		7 272		465		865		3 224

1.2. Man-made forests

The distribution of plantation areas at the end of 1978 in the natural regions of the country was 6.3 % in the Coast, 92 % in the Mountain, and 1.7 % in the Selva.

In the Mountain, 95 % of the plantations are of the Eucalyptus glabulus, specie which has been well adapted to the soil and climatic conditions of this region. The remaining 5 % are mainly other Eucalypts and Pines, like Eucalyptus viminalis, Eucalyptus camaldulensis, Eucalyptus bicostata and Pinus radiata. Table no. 63 shows the areas of all plantations established at the end of 1980. Plantations of other species than Eucalyptus are negligible.

TABLE No. 63

Areas of established plantations estimated at the end of 1980
(in thousands of ha)

SPECIES	year	76-80	71-75	66-70	61-65	51-60	41-60	before 41	total
	age class	0-5	6-10	11-15	16-20	21-30	31-40	40	
Eucalyptus spp		22	28	8	5	8	8	5	84

SOURCE: FAO/PNUMA

Until 1963 the plantations were basically due to private initiative, (the mining companies), and with a limited technical support from the Government. After 1964 the initiative became essentially public, through technical assistance and credit. The peak of reforestation was reached in 1974. Since 1975 the rate of reforestation decreased chiefly because of the increase in interest rates.

The average annual increment in plantations is estimated at 10 m³/ha/year over bark, particularly for Eucalyptus glabulus.

1.3. Management status

In Peru there is no private property of natural forests, nor of soils with "forest vocation", but if an area covered with forest is declared as agricultural due to its "greater agricultural potential", it can be turned to private ownership.

The natural forests are divided in four different categories:

- protection forest
- conservation units (national parks, national reserves, national sanctuaries, historic sanctuaries)
- national forests
- freely available forests

The protection forests can be managed only by the government. The freely available forests will be ceded to third parties through harvesting contracts in areas that do not exceed 100.000 ha, and in renewable periods of 10 years. Harvesting is not possible in national parks and sanctuaries.

In 1977, 28.337.000 ha covered with forests in the Selva region were declared freely available forests. These forests have been declared apt to the permanent production of timber, other forest products, and wild fauna. About 22.096.000 ha are considered productive forests, 4.342.000 are under protection, and 1.699.000 ha are presently used for agricultural purposes. The harvesting of these areas are controlled through a "Permit". The duration of permits depends on the area and volume to be harvested. Management, meaning activities to improve the forests or to increase their yield is practically non existent in natural forests.

Presently the normal practice is selective harvesting, where the commercial species are logged and the remaining is left in the forest. There are projects to develop management practices for natural forests.

1.4. Accessibility of forests

Most of the Peruvian productive forests are situated in the east side of the Andes Mountains. The "Selva" region is characterized by a hot, wet climate with very high precipitation. There are many obstacles of access to the "Selva" forests. The rivers flow eastward while the main markets and the better ports are to the west, and the roads network reach just a very

small fraction of the productive forest area. Road construction is very expensive in the Amazon area, because of the excessive rainfall, the scarcity of laterite, and in some areas the great number of rivers and creeks require lots of bridges and other constructions.

It is possible to say that most of the timber resources are economically inaccessible with the present level of technology and available infrastructure. Other severe limitations to a more efficient use of the timber resources is the scarcity of capital.

1.5. The uses of forest products

Table no. 64 presents a summary of timber used in Peru in the years 1968, 1973 and 1977. With the exception of particle board all other uses or products showed some growth during the decade.

1.6. Prospective supply of roundwood

The deforestation in the Selva region is estimated at approximately 5,1 million hectares in the last 50 years, about 100,000 ha per year. In spite that deforestation affected all forest types, the Hilly forests, and the Protection ones are the most affected by agriculture.

Most of the deforestation has happened in the last 20 years after the construction of accessible roads to the Selva caused mainly by the migrants from the Mountain region. The present rate of reforestation is estimated at around 250,000 ha per year. The yearly deforestation in the year 2000 is projected to be 340,000 ha, which will have a deforested area of 11 million hectares by the end of the century. Considering that the deforested areas are the more accessible ones in the region, the future supply of timber will be threatened.

It is very difficult to predict the forthcoming events on wood supply from the data available today, because there is a number of variables influencing the changes.

TABLE No. 64
Roundwood production (in m³) by end use

Use or product	Y E A R S		
	1968	1973	1974
Sawnwood	490 175	706 944	863 052
Parquet	20 086	41 325	25 204
Veneer	27 931	59 016	49 275
Plywood	27 441	59 149	90 004
Particleboard	11 881	10 423	1 489
Decorative veneer	1 539	3 006	4 585
Sleepers	2 830	2 533	3 513
Fuelwood	2 082 000	2 437 000	2 640 000
Charcoal	28 000	24 000	114 000
Other industrial wood	269 000	338 000	381 000
TOTALS	2 960 883	3 681 396	4 172 122

SOURCE: Oficina de Estadística y Patrimonio Forestal, Dirección General Forestal y de Fauna.

1.7. Harvesting

Timber harvesting is a very important subject to the wood industry in Perú since it represents one of the more limitant factors to the development of forest industry.

The difficulty of logging in Peru is due to the very adverse conditions of climate, soil, infrastructure, forest type, prevalent in the regions with more potential for timber production.

Harvesting practices differ according to the natural conditions. Frisk (7) has distinguished four zones with well differentiated logging practices. These zones are: Iquitos, Pucallpa, Hucayacu and Oxapampa-Satipo.

The Iquitos zone is characterized by a climate with about 3,170 mm of annual rainfall, plain topography, and large areas of alluvial soils. Most of the log supply in the Iquitos region comes from small contractors, which have extraction contracts of less than 1,000 ha. The felling equipment is axe or power saw. If the log is in a place subjected to seasonal inundation the logs are pre-hauled through channels dug in the alluvial soil. If the place

is not subject to flooding, the logs are hauled to a river or creek by hand or through a hand powered reel, where they are embarked in barges or tied together to form rafts, to be transported to the mill. The operation takes months, generally the felling is made in the dry season, and the hauling in the rainy period.

Usually a large sawmill, a veneer or a plywood mill may need as many as 30 contractors or even more.

Skidders have not been introduced successfully in this zone.

Iquitos is located on the left bank of the Amazon river, and can receive vessels of until 6.500 tons dw. It is linked to Lima and the Pacific Coast by air or through Pucallpa, from Iquitos to Pucallpa by river and from Pucallpa to Lima by road.

The Pucallpa zone, located on the left bank of the Ucayali river, has the following main characteristics: average annual rainfall of 1.900 mm, it is linked to the national road network, the topography is less subject to inundation than in Iquitos.

Few industries in Pucallpa have their own logging operations. Most of the industries depend on contractors.

The Pucallpa zone consists of two different harvesting areas, the most important is located in the region of influence of the Ucayali river and its affluents, the other is the area of influence of the road Pucallpa-Lima and secondary roads. The chief difference between these regions is the method for transport to Pucallpa, in the first it is made through the river in rafts or barges, in the second by trucks through the roads.

Most part of logging is made by independent loggers. Felling is done by power saw, pre-hauling, by crawler or wheel skidders, by hand, hand reel, through flotation along the banks of the rivers.

The main limitation to the use of mechanical equipment for skidding is the impossibility to operate it in the rainy season.

The regions of Aucayacu and Oxapampa-Satipo have more favourable climate conditions and log transport made by trucks. There is significative participation of industry operations.

The logs are measured upon receipt at the factories by representatives of the National Authority of Forestry and Fauna, in order to calculate the "royalty". The royalty varies according to the actual value of each specie.

2. WOOD PROCESSING INDUSTRY

The wood processing industry is very small if related with the country's total forest resources. Peru, with a total forest area of about 70 million ha and a growing stock of about 11.360 million cubic meters, has a wood processing industry that converted about one million cubic meters in 1977. The commercial actual volume of the Peruvian forest is estimated at 465 million cubic meters. So the yearly harvesting is about 0,2 % of the growing stock of commercial species.

2.1. Primary wood processing industry

2.1.1. Sawmilling

Sawmilling as an industry is comparatively recent in Peru. The harvesting and sawing of valuable species as Cedro (Cedrela odorata) and Mahagony (Switenia macrophyla) promoted originally the growth of the sawmill industry. But after the imports of lumber started to be restricted by the government at the beginning of the 70's and with the construction of roads through the Andes that linked the region of Pucallpa in the east, with Lima on the coast, the production of sawnwood in the Selva was made economic. Table no. 65 shows the production, imports, exports and apparent consumption in Peru in the period 1969-1978.

TABLE No. 65

Production, imports, exports and consumption of sawnwood
(in thousand cubic meters)

Year	production	imports	exports	apparent consumption
1969	266	39.1	2.8	302.3
1970	312	41.3	10.0	343.3
1971	380	38.0	0.7	417.3
1972	380	42.2	3.0	419.2
1973	388	37.0	12.3	412.7
1974	465	51.0	9.2	506.8
1975	514	56.3	1.8	568.5
1976	497	23.6	6.8	511.8
1977	474	8.2	9.3	472.9
1978	476	8.7	17.4	467.3

SOURCE: Oficina de Patrimonio y Estadística, Dirección General de Foresta y Fauna.

In 1978 the existing number of sawmills was 451. In 1977, 344 sawmills employed 4.230 persons. The production of sawnwood in 1978 was about 476.000 m³, plus 4.000 m³ of sleepers. Table no. 66 presents the volume of production and value of sawnwood for the period of 1969-1978.

TABLE No. 66
Volume of production and value of sawnwood
(period 1970-1978)

Year	volume m ³	value US\$
1969	266 000	n.a.
1970	312 000	18 900 000
1971	380 000	24 500 000
1972	380 000	26 000 000
1973	388 000	28 100 000
1974	465 000	63 600 000
1975	514 000	87 100 000
1976	497 000	57 700 000
1977	474 000	30 700 000
1978	476 000	43 700 000

SOURCE: Oficina de Patrimonio y Estadística, DGFF.

From Table no. 66 it is possible to conclude that since 1974 the sawnwood production has not varied much except in the year 1975, which represents an historic high for the sawmilling industry.

Table no. 67 shows the production of sawnwood per species in the period 1969-1978.

It is important to note the large volumetric share of Eucalyptus in sawnwood production, if it is considered that this specie is an exotic one with about 84.000 ha planted mainly in the Mountain region. It is possible to infer the difficulty of obtaining the native hardwoods. Other important aspects are the small share of Caoba (Swietenia macrophylla) that have been maintained relatively steady in the period considered.

TABLE No. 67

Production of sawwood by specie in the period 1969-1978

SPECIES	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Alfaro	4 904	6 525	6 438	3 834	6 330	10 210	7 890	7 451	5 908	3 521
Caoba	17 386	16 752	20 201	21 176	22 207	16 821	26 094	24 839	27 247	22 268
Catahua	174	32	1 156	105	8	1 677	7 220	6 955	2 244	6 058
Cedro	70 530	70 668	89 820	83 997	84 408	55 347	88 513	85 444	70 761	63 012
Congona	1 543	3 390	2 512	-	2 983	4 231	5 135	4 968	3 099	2 679
Copaiba	3 545	3 951	4 852	2 292	5 057	7 567	17 898	17 387	13 500	11 270
Cumala	2 268	5 829	2 820	13 311	504	13 900	10 780	10 432	10 531	14 919
Diablo fuerte	2 803	4 397	4 501	3 637	2 876	2 987	3 088	2 981	3 913	1 692
Ishpingo	1 264	1 517	1 686	1 538	1 369	1 173	3 783	3 974	5 633	5 527
Lupuna	(1)	(1)	99	8	1 373	4 360	1 665	1 490	7 584	5 460
Marupá	228	523	1 121	11 814	82	433	1 330	1 490	271	923
Moena	4 599	5 828	12 585	11 814	14 150	17 685	20 753	19 871	37 500	24 773
Nogal	1 947	2 064	1 487	1 258	1 577	1 986	1 827	1 987	1 279	1 333
Roble amarillo	4 635	8 115	8 400	7 084	6 727	8 480	7 467	7 451	2 274	3 316
Roble corriente	64 373	28 088	13 663	13 797	45 812	70 841	108 608	104 819	51 908	66 276
Yornillo	9 052	20 159	30 325	30 003	37 313	50 268	59 263	57 129	68 472	70 296
Ulcumano	3 411	3 263	4 147	3 884	5 551	6 455	4 398	4 471	1 043	1 357
Eucalipto	22 463	40 429	63 497	67 026	78 651	142 041	85 047	82 464	86 324	75 740
Others species	51 200	90 323	110 459	114 812	71 453	48 502	52 881	51 167	74 894	95 361
TOTALS	266 345	311 853	379 769	379 626	388 431	464 964	513 640	496 770	474 205	475 781

SOURCE: Oficina de Patrimonio y Estadística, DGFF.

The annual capacity of production was estimated by Schrewe (2) in 1978 at 860.000 m³ of sawnwood, the capacity utilization being 55 %. Minaya (5) estimated an utilization of 71 % for the existing 344 mills in 1977. In 1978 there were in Peru 100 sawmills equipped with band headrigs and 351 with circular headrigs. According to Schrewe (2), the capacity of production of the sawmills equipped with band headrigs was 475.000 m³ per year, it follows the installed capacity of the 100 band headrig sawmills was roughly sufficient to produce the volume of sawnwood produced in 1978.

Peru's sawmilling industry is very heterogeneous, the equipment is different as well as the process, and the management.

Table no. 68 shows the distribution of the production capacity per sawmill category.

The circular sawmills are generally very primitive, but quite solid, some have more than 20 years of operation. Most of these mills do not have felling equipment. The sawmills are generally composed of the circular headrig, a single circular edger, and a cross cut saw. The headrig has a blade of 152,4 cm (60 inches) of diameter, the kerf is generally over 8,7 mm (11/32"). The technique of tensioning is deficient or completely unknown. Mechanization is practically non existent, waste and residues are withdrawn from the sawmill generally by hand. The main source of energy are diesel engines, most of them of second hand and in precarious condition.

The band headrig sawmills are generally newer than the circular headrig ones, and most of them are made in Brazil. The preference for Brazilian made equipment is because of the low price, and easiness to operate and to maintain. The wheel diameter is usually under 150 cm. The carriages are usually moved by cable and set manually, but some are electric-pneumatic actuated. Most of the band headrigs are driven by electric motors. A band headrig sawmill generally is combined with a winch, a multiple edger and a cross cut saw. Some of the sawmills have some mechanization. Very few have mechanical elimination of wastes and residues. A practice that is comfortable, but not correct because of the negative environmental effects, is the elimination of sawdust through a flow of water pumped from the rivers, the flow carries the sawdust to the rivers.

Some sawmills are equipped with exhaust systems for elimination of sawdust, but very few have burners, as a consequence mountains of sawdust are formed.

TABLE No. 68

Distribution of capacity of production per category of sawmills

Category	installed capacity per sawmill	number of sawmills	total installed capacity	
			m ³ /shift	%
Very large	more than 35.4 m ³	10	550	16
Large	23.6 to 35.4 m ³	13	369	11
Average	11.8 to 23.6 m ³	77	1 088	32
Small	2.4 to 11.8 m ³	216	1 280	37
Very small	less than 2.4 m ³	135	144	4
TOTAL		451	3 431	100

SOURCE: Oficina de Patrimonio y Estadística, DGFF.

The manufacturing of sawmilling equipment in Peru is practically non existent, some tentatives to manufacture bandsaws and portable mills were made, but until now they did not succeed.

The main problems and deficiencies that affect and hamper the growth of sawmilling industry are:

- a) Raw material - The lack of good logs is the foremost obstacle to the development of the sawmilling industry. Log shortages are due less to the exhaustion of the resources, than to the methods of harvesting. Presently the logs that reach the sawmills are usually very poor presenting insect and fungi attack as well as splitting, unsound heart, etc.
- b) Location - Many sawmills, both old and new are located in places too far from the source of raw material, making the log supply difficult and increasingly expensive.
- c) Equipment - The majority of the sawmilling equipment, particularly the circular mills, are obsolete and inadequate, another problem is the lack of auxiliary equipment such as conveying systems and waste disposal.
- d) Lay-out - Very few sawmills have an adequate lay-out that gives a normal flow on the floor.

d) Drying and preservation - Almost all the wood destined to the domestic market is not dried or protected against fungi and insects. In Pucallpa, for example, usually trucks are loaded for hauling to Lima, with lumber just produced in the sawmill. The majority of sawmills in that region do not have a lumber yard for air drying. Very few sawmills have kiln drying equipment, it is estimated that the present kiln drying capacity is about 19,000 m³ of sawnwood of which 70 % is exported.

According to Schrewe (2) there is a number of specific deficiencies of technical character that are symptomatic for the sawmilling industry of the country, the main ones are:

- saw doctoring
- leveling and alignment of equipment
- sawing techniques
- power
- velocity of blade and feed speed
- general maintenance

Because of the lack of information, it is difficult to determine how well the domestic sawnwood market is satisfied by the present supply. Schrewe (2) presumed that it is difficult to get in the local market the quantity and quality of lumber required to satisfy the demand,

There are no grading rules for sawnwood in the country, there are proposed standards for allowances and dimensions, but these standards are not officially issued and consequently cannot be enforced. It seems unrealistic to expect a tangible improvement in lumber quality, before the internal market is satisfied and the sawmills enter in competition.

2.1.2. Wood based panels

The wood based panels industry in Peru is represented by plywood, and a small production of blockboard.

There is a particle board plant located in Huanuco with a capacity of 10.000 m³ per year, but it is not working since 1976 because of financial and supply problems.

Presently there are nine plywood plants operating in Peru. with a capacity of 81.000 m³ per year, most of the plants are in the region of

Iquitos and Pucallpa, including a floating plant with a capacity of 20.000 m³ per year.

The production of plywood was 39.132 m³ in 1977, 37.849 m³ in 1978, and 37.913 m³ in 1979. The utilization of the installed capacity has been below 50 %. The main reason is, apparently, the lack of a continuous supply of logs.

Most of the logs are obtained from contractors, but some of the plants have their own harvesting operations.

Lupuna (Ceiba spp) is the specie more utilized for plywood manufacturing (about 90 % of total production), Copaiba (Sclerolobium sp) is the second with about 3 %.

The equipment of most of the plants is relatively new and seems to be very adequate to the environment they operate in, where it is very difficult to get trained personnel at all levels because of the land-locked condition and the moist tropical weather prevalent in the production zones. Another main problem is to get spare parts.

In 1977 there were three decorative veneer plants in Peru that produced 2.413 m³. According to Minaya (5) the main problems of this sector are the lack of a regular log supply and the lack of knowledge of slicing parameters to increase the number of species utilized.

The most important species are: Coaba (Swietenia macrophylla), Ishpingo (Amburana cearensis), Azucar guayo, Tornillo (Cedulinga catenaeformis) and Mogal (Nectandra spp).

2.2. Secondary wood processing

2.2.1. Wood in construction

Peru is a country with a large deficit in housing. It is estimated that in order to house the increase in population, eliminate overcrowding and replace obsolete dwellings within the foreseeable future, at least 100.000 new housing units should be constructed annually. No information was found on the present housing, but apparently the total construction is below the needs, the predominant building materials are based on adobe, for exterior walls "uincha" (a wooden frame work filled with mud and straw reinforced laterally with strips of bamboo or cane) is also used, brick or concrete blocks. About 5 per cent of the houses are timber framed. The

roofs are of "totora" (a special type of straw) or cane, cement, tiles, metal sheeting, and about 10 % are wood or asbestos cement with mud binder. Most of the floors are of earth, followed by brick, cement wood and asphalt tiles.

In modern housing in the western urban areas, the use of wood is confined to formwork, some flooring and joinery. Metal windows are widely used and metal formwork is slowly being introduced, specially in large serial scale construction.

There is no information about the volume of wood used in construction, it is likely that this volume is between 100,000 and 150,000 m³ of lumber, to which about 7,000 m³ must be added of Parket flooring, about 15,000 m³ of plywood.

The relatively low consumption of wood and wood products is due to several factors, among which are the cultural tenets, lack of knowledge by the people of the attributes of wood as a construction material and the low quality and associated high prices due to inefficient processing and marketing.

No information was found about joinery industry, apparently there are no industries specialized in doors or windows. These products are produced, generally under special order, by carpentry shops or furniture factories.

There are about 10 firms, most of them in Lima that produce pre-fabricated wooden buildings, most of which are offices, schools, hospitals and housing demanded by government in construction works, in remote areas and by mining enterprises.

Each prefab factory can produce from 50 to 1,000 units per year, of sizes that vary from 50 to 100 m².

One important aspect of wood utilization in housing is the use of unprocessed wood. It was estimated that a volume of 381,000 m³ of such wood was used in 1977. In some particular surroundings of Lima it is possible to see large quantities of wood pole with diameters of about 8 to 20 cm, and lengths from 4 to 7 meters for sale for construction purposes.

2.2.2. Wood in packaging

Presently there are about 100 firms that produce wooden boxes, some produce directly from round wood, like the 30 firms existing in the north of the country, others utilize residues from the sawmill industry.

2.2.3. Wood in furniture

The furniture industry is traditional in Peru; there are plants and workshops that produce excellent and very valuable pieces of reproduction furniture using solid mahogany. Some manufactures are already exporting small quantities and others are willing to start to export their production in the future.

The number of furniture plants is very difficult to assess because of the large number of marginal workshops. In Lima there are about 12 furniture plants with more than 40 employees and workers. The largest one employs about 300 people. In 1978 furniture factories with more than five people employed 5.938 persons, and the total remuneration was US \$ 7.081.090. The number of people employed represented 2,23 % of the country's work force and the total remuneration was 1.51 %, which means wages inferior to the average of the country.

The more common wood species are mahogany (Swietenia macrophylla), ishpingo (Amburana cearensis) and tornillo (Cedrelinga catanaeformis)

Furniture plants in Peru are, in general, labor intensive, there are no automated plants, most of them do not have mechanization and the more advanced furniture plants have relatively adequate processing equipment, mostly from Europe, but the lack of mechanization and production planning is evident; manual operations are characteristics of some furniture plants, mainly in the reproduction furniture production. It is understood that craftsmanship increases the value of the product, but it is likely that improvement in the processes would increase productivity without decreasing the quality and consequently the value.

According to people producing reproduction furniture, there is no problem of market for their products, however, the production is apparently very low and the costs high.

The main obstacles to the development of the sector are:

- a) Raw material; sawnwood in Lima market is generally unseasoned and roughly sawn.
- b) Shortage of trained workers.
- c) Shortage of capital and lack of long term financing.
- d) Lack of expertise in furniture design.
- e) Competition from independent craftsman and small workshops that are not affected by fiscal pressure and high fixed costs.
- f) Shortage and high price of hardware, glues, finishings, wood-working tools, sanding belts, etc.

3. MARKET AND TRADE RELATIONS

3.1. Domestic trade

Forest resources in Peru occur mostly in the east of the Andes in the selva and the consumption is almost all to the west of the mountain. The primary industry is installed almost exclusively in the selva, the secondary industry prevails near the markets. Plywood is manufactured in the selva and reaches the market generally ready for use, however this does not happen to sawnwood which is shipped to the Lima region just after leaving the saws, generally the truck loads are a mix of several thicknesses varying from 25 to 100 mm.

The distance by road from Pucallpa, presently the one of the largest supply regions, to Lima is 930 km, a mainly hilly or mountainous region, the trip takes from 4 to 5 days in favorable conditions. If the lumber is produced in Iquitos it takes a week to go to Pucallpa, where it is loaded on trucks to be transported to the west. In Lima, the sawnwood is unloaded and piled in a wholesale yard. Some wholesalers have resaws where the wood is resawn to the thicknesses desired by the buyer. It is evident that these operations increase significantly the cost, and the user generally receives unseasoned lumber. These facts, added to the almost permanent shortage of wood in the west stimulates speculation and makes the final price almost prohibitive. This explains the relatively very low level of sawnwood consumption in some areas of Peru. Table no. 69 shows approximate estimations made by Booth (1), of sawnwood consumption in some areas of Peru. The differences are evident in consumption because the localization is relative to forest areas.

TABLE No. 69
Sawnwood consumption, m³/1.000 capita

region	yearly consumption (m ³)/1000 capita
Lima - Callao (west)	23
Arequipa (Southwest)	9
Tacna (Southwest)	5
Iquitos (Amazonia)	50
Peru	26

3.2. International trade

Exports of wood products are shown in table no. 70. Based on the period considered it is not possible to infer any clear trend. Imports are shown in table no. 71; here it is possible to see a clear decrease in imports of sawnwood since 1976. Imports until 1976 used to be greater in value than exports. In 1977 there was a small surplus. This surplus is due mainly to the reasonable performances in exports of plywood, sawnwood and to a tangible decrease in sawnwood imports which have been controlled by the government. According to table no. 65, in 1978 the volume of sawnwood exports was 17.380 m³, almost two times the exports of 1977, the imports of sawnwood in 1978 increased with reference to 1977.

Table no, 72 shows a summary of international trade of wood products in 1979.

Fiscal barriers to the development of exports were not detected, instead there are incentives for increasing exports.

Most of the shipments are made under "liner" conditions, most of the shipments to the USA and other countries of Latin America are made from Iquitos, in the Amazon river, the shipments to Europe are made from Callao on the Pacific Coast. Most of the sales are made individually by industries or traders, there is no exporters association. This according to Booth (1), is a noticeable weakness in the structure of exports. This makes the attainment of better prices and the acceptance of large orders to be divided between several producers difficult. The lack of an association for the exports makes the marketing of lesser known species and the opening of new markets very difficult.

TABLE No. 70

Exports of wood products

PRODUCTS	1973		1974		1975		1976		1977	
	m ³	US\$	m ³	US\$	m ³	US\$	m ³	US\$	m ³	US\$
Logs	-	-	4	668	28	5 511	38	14 489	284	14 673
Sawnwood	12 285	630 037	10 211	959 861	1 815	155 711	8 814	883 822	9 309	1 047 268
Veneer	12 263	1 101 337	7 599	785 875	3 231	336 488	6 232	710 967	13 423	1 455 179
Plywood	226	111 272	163	84 032	18	5 888	29	11 404	2 408	495 452
Wood manufactures	159	77 040	143	81 958	97	20 911	53	24 539	151	67 975
TOTALS	24 933	1 919 686	18 120	1 912 394	5 189	524 509	15 166	1 645 221	25 575	3 080 547

SOURCE: Ministerio de Comercio. Oficina de Informatica (Direccion General de Aduaria).

TABLE No. 71

Imports of wood products

PRODUCTS	1973		1974		1975		1976		1977	
	m ³	US\$	m ³	US\$	m ³	US\$	m ³	US\$	m ³	US\$
Logs	20 985	1 386 745	4 325	197 096	5 331	1 043 577	3 629	318 098	2 692	179 775
Sawnwood	36 959	2 962 425	51 034	2 249 493	56 311	4 647 000	23 631	1 380 988	9 793	526 273
Sleepers	-	-	846	86 221	26 093	1 772 600	1 077	86 347	1 107	98 563
Parquet	-	-	138	33 064	781	206 511	748	3 993	211	754 041*
Veneer	-	-	1	4 124	32	8 044	-	-	-	-
Plywood	704	173 674	826	233 433	511	235 333	2	176 275*	174	12 075
Fibre board	896	109 958	847	134 470	1 077	168 844	1 111	1 881 745*	-	-
Wood manufactures	2 391	1 490 825	2 391	1 214 400	2 993	2 598 288	2 602	109 733*	1 876	1 788 118
	61 935	6 123 627	60 408	4 152 301	93 129	10 680 197	32 800	3 959 179	15 853	2 858 845

SOURCE: Oficina de Patrimonio y Estadística, DGFF.

* data probably wrong but as in original

TABLE No. 72

International trade of wood products in 1979

PRODUCTS	EXPORTS		IMPORTS	
	volume m ³	value US\$	volume m ³	value US\$
Logs	-	-	83	23 640
Hewnwood	-	-	458	39 943
Sawnwood	15 443	3 299 487	8 342	1 003 779
Sleepers	-	-	5 245	504 171
Plywood	5 338	1 638 086	-	-
Veneer	8 475	2 201 961	-	-
Parquet	1 066	298 740	-	-
Wood manufactures	1 111	182 454	1 663	1 641 822

SOURCE: Oficina de Estadística del Ministerio Industria, Comercio, Turismo y Integración. Ministerio de Economía y Finanzas (La Aduana del Callao). Ministerio de Agricultura y Alimentación. DGFF. Oficina de Patrimonio y Estadística.

4. INTERNATIONAL COOPERATION

The government of Peru, recognizing the small share of the forest industry in the economy of the country, concluded that the technical and financial international cooperation would be a way to develop the forest and the wood industry. At the beginning of 1980 the governments of Peru and Canada agreed to develop a programme of collaboration that would be financed by Canada.

The general objectives of the programme are:

- To increase the forest production and generate economic and social benefits to the related people.
- To increase the conservation of forest resources. The Canada-Peru Forest Development Programme includes three projects:

- Project of development of Forest Industry
- Project of creation of a Programme of graduated studies (Master Level) in Forest Sciences in the National Agricultural University "La Molina"
- Project of Institutional support to the Forest sector of Peru.

The objective of the project of Development of Forest Industry is to modernize the forest industry of Peru and to increase its production capacity by means of a provision of equipment and professional services inherent to the transfer of technology. The project will assist the harvesting and mechanical wood processing industries of the Peruvian "Amazonia" and of the man made plantations of the Andes.

The project will permit:

- To give credit to small and medium size forest enterprises.
- To buy, to install and to start the equipment required to the functioning and/or the modernization of the beneficiary enterprises.
- To qualify the personnel of the beneficiary enterprises in order to operate efficiently, maintain and repair the equipment, as well as to the management of the enterprises.
- To create a fund for forest development, constituted by funds coming from the reimbursement (principal and interests) of the credits. This fund will permit to give credits to industrialists of the sector, as well as to local organisms for reforestation activities.

The Canada-Peru Forest Development Programme will cost 35 million Canadian dollars given by the Canadian government to the government of Peru, of which 20 million will be a credit under very favorable conditions and 15 million a donation.

The programme will last five years and it is expected that it contributes to a general improvement in all levels of forest economy.

5. CONCLUSIONS

Peru is a country with vast forest resources which have not been used to their capacity in the population's benefit. Lack of infrastructure in forest regions is the most serious constraint to the development of an efficient wood industry.

The main constraints to the development of the Peruvian wood processing are:

1. Lack of sufficient by trained people in primary wood processing industry, mainly sawmilling.
2. Geographical location of forest resources: very far from populated and developed areas.
3. Lack of infrastructure, mainly road network in forest areas.
4. The marketing system for sawnwood is deficient involving transport of green wood over long distances and involving excessive handling.
5. Because of the characteristics of forest soils, lack of roads, distances etc., a significant part of the logs reaches the processing mill in a severely deteriorated condition.

Annex

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