

REPORT
ON
THE SURVEY FOR THE DEVELOPMENT PLAN
OF THE FOREST RESOURCES IN PARAGUAY

APRIL 1965

OVERSEAS TECHNICAL COOPERATION AGENCY
TOKYO, JAPAN

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P r e f a c e

The Government of Japan, in response to a request from Paraguayan Government, entrusted to the Overseas Technical Cooperation Agency (OTCA) the task of conducting a Preliminary survey in Paraguay to help the implementation of the Development Plan of the Forest Resources. The OTCA fully realizing the importance of the Development Plan of the Forest Resources in Paraguay organized a four-member team of experts and dispatched it to Paraguay on February 2, 1965 for about 20 days on-the-spot survey under the leadership of Mr. H. Imai, Staff member of Sanyo Pulp Company.

The OTCA which was established on July 1, 1962 serves as an executing agency of the Japanese Government to conduct Japan's Government-level technical cooperations to Asia, Near and Middle East, Africa and Latin America. Its principal activities are acceptance of overseas trainees, assignment of technical experts, establishment of overseas technical cooperation centers and conduction of preliminary surveys for development projects.

It is my sincere hope that this report will prove to be useful in the field of the Development Plan of the Forest Resources in Paraguay and will also help to foster closer technical ties and better understanding between Paraguay and Japan.

Lastly, on behalf of the OTCA, I wish to take this opportunity to express our greatest appreciation and sincere thanks to the various agencies of Paraguayan Government for their Precious help and cooperation given to the Survey Team, without which it would not been possible for the Team to conduct smoothly the survey on the spot.

April, 1965

Shinichi Shibusawa

Director General



Overseas Technical Cooperation Agency



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I. Introduction

Paraguay has vast forest resources throughout the country, which are one of the most important national resources in this country. In relation to their exploitation, however, it is not too much to say that only the export and other specific woods are lumbered at the present stage. In exploiting these forest resources most effectively and increasing their contribution to the national economy, therefore, many problems remain unsettled.

In connection with the above, Paraguayan Government requested our Government in 1964 to dispatch a survey team to make a fundamental survey of the possibilities of the development of wood utilizing industries in its country, investigate the current condition of tung oil industry, which had grown up to the present, and take proper measures for its development in future, because our country is technically on a high level not only in the paper and pulp manufacturing industries but also in general wood utilizing industries, especially experienced and skilled in utilizing the broad-leaved trees.

In reply to the above request, Japanese Government has decided to dispatch a survey team of the following members:

Organization of the survey team

Team head (in charge of general affairs and the market researches), Hiroshi Imai

Team member (in charge of forest), Yutaka Takahashi

Team member (in charge of lumbering, furniture, plywood and other wood processing industries), Jun Hirasawa

Team member (in charge of the paper and pulp manufacturing industries),

Ichiro Tsubokawa

Team member (in charge of tung oil industry), Shunzo Kasahara

The above survey team conducted its survey activities in Paraguay for 21 days from 2 Feb. to 23 Feb. 1965.

We hereby express our hearty thanks to Minister of Agriculture and Stock

Raising, E.G. Alsina, Minister of Commerce and Industry, J.M. Gonzalez, Director of the Economic Planning Agency, F. Mandelburger and other Government officials who were so friendly to make special arrangements for the survey work, various officials in charge and Mr. L. Tortorelli, stationed member of the FAO who closely co-operated with the survey team.

Our survey team is sure that the wood utilizing industries would be shortly fostered, and their products could come into the world market, because Paraguay is abundant in bulky forest resources, and preserves a huge quantity of excellent woods. In this connection, we esteem it a great honor that our Survey Team could make a forest survey of Paraguay for the first time. At the same time, we hope that this report should be useful for the economic development of Paraguay.

Note: Survey report on the tung oil industry shall give in a separate copy.

II. Forest Resources

1. General Condition

Forest areas in this country consist of the following two natural forest areas: Hilly district approx. 500 m above the sea level between the Paraguay river flowing from north to south in the lat. 58°S area, and the Alto Parana river flowing from east to west in the lat. 55 -- 59°S areas, and the low district generally called the "Chaco Boreal" district is a rainy subtropical zone covered with large forests, while the western district is a zone mostly covered with shrubs and bushes.

It can be, therefore, considered that most of forest resources are in the above eastern district.

Meanwhile, the population also concentrates in this eastern area, where the major cities with large population including the capital, Asuncion are mostly located. The forests there have been partially exploited.

a) Forest area

According to the data of this country, the forest area of this country totals approx. 21,000,000 ha. including approx. 16,000,000 ha. in the Chaco district and approx. 5,000,000 ha. in the eastern district.

The above total accounts for approx. 51% of the territorial area, 40,675,000 ha. It is estimated that approx. 30% of the above total, approx. 6,000,000 ha. could be exploited. But most of these forests are covered with broad-leaved trees.

In addition, these forests belong not only to the Government but also to the people, mostly large landowners. As no data upon the land ownership is made available, the ratio of possession is unknown. But the major large forest owners are as follows:

La Industrial Paraguaya (Jewish)	1,118,000 ha.
Ine Barthe (Argentinean)	640,000 ha.
Fassardi Y Cia Ltda (Italian)	372,000 ha.
Guillermo Shouten	128,000 ha.
Union Paraguaya S.A.	119,000 ha.
C.I.P.A	115,000 ha.
Matl Larangeira	86,000 ha.
Federico Dohen	79,000 ha.
Credito T. Sudamericano	78,000 ha.
Orlando William	74,000 ha.

Total: 2,809,000 ha.

b) Forest reserve and phase

According to the data of the country, as mentioned above, the area of forests in the western district (generally called the chaco district) is about 3 times as large as that of those in the east. As the forests in the west exhibit rough bushes, however, the forest reserve per ha. is small.

From a geographical viewpoint, too, it seemed difficult to exploit the forests there for the present.

Of the forest area, approx. 5,000,000 ha. in the eastern district, the forest reserve along the Parana river and in the whole Alto Parana district is understood to be the largest. The reserve of standing timber on the outskirts of Yguazu, on which our survey team laid stress in its survey work, was estimated at approx. 200 m³ per ha.

But the trees, which have so far been cut as the useful wood materials, are Lapacho, Cedro, Timbo, Petereby, etc. Approx. 15 -- 20 sorts of these woods (which slightly vary with the districts) seem to be cut at the rate of approx. 20 m³ per ha.

As for the forest phase, there are found dense forest areas partially in the western area, while there are many coarse bushes in the north-west district. On the highlands, a considerable reserves of the Quebracho woods, which are used for making the tannin, seem to be growing.

In relation to the forest phase in the Alto parana Yguazu district, on which our survey team laid stress in its survey work, there are found many coconut palms. But the height of useful trees is mostly approx. 20 -- 25 m.

As for the forest constitution, two sorts of trees, Laurel-Negro and Roba are largest in number and account for approx. 20% of the whole. As the Roba is little used, however, it is not so much cut.

c) Sort of the useful trees

Lapacho, Tayi (Jabebuia Ipe)

Its specific gravity is 0.88 -- 0.98. Wood is yellow-and-black-striped, or dark black, and very hard. It has been used for the furniture, fixture, keels and ribs of the vessels, railroad ties, etc. In export, meanwhile, it ranks next to the Cedro.

Cedro (Cedrela Tubiflora)

Its specific gravity is 0.53 -- 0.62. Wood is light-brown, relatively soft, and similar to the heart of Japanese cedar in grains. It has been used as

the furniture, wooden products and plywood material. In this country, it has been made the most of, and is at the top of the wood export.

Iby raro (*Pterogine Nitens*)

Its specific gravity is 0.83 -- 0.92. Wood is light-brown, and has been used for making the deck and outer boards of vessels, and the rolling stock.

Curupay-ra (*Piptandenia Rigida*)

Its specific gravity is 1.08 -- 1.18. Wood is brown, hard, and has been used as the house-building and furniture materials.

Petereby (*Cordia tri chotoma*)

Specific gravity is 0.65 -- 0.73. Wood is brown, and has been used for the house-building, fixture (window frames and doors) and furniture materials.

Guatambu (*Bulfoursdendram Riedelianum*)

Specific gravity is 0.84 -- 0.90. Wood is light-yellow, and has been exported in the log as the plywood material, and used as the furniture and fixture materials.

Guaica (*Ocotea nuberia*)

Specific gravity is 0.82 -- 0.88. Wood is dark-yellow, and has been used as the furniture, fixture and packing materials.

Ybyraplyta (*Peltophorum Dubrium*)

Specific gravity is 0.84 -- 0.90. Wood is light-purple, and has been used as the furniture, fixture, packing and house-building materials.

Quebracho Blanco (*Aspidosperma*)

Specific gravity is 0.76 -- 0.84. It has been made much of as the tannin material, and is large in number in the Chaco district. Wood is not suitable for the application of structure, and could be utilized for making the pulp in future.

- d) Sorts of the trees which could be utilized for making the paper and pulp
- In connection with the above, records of the pulping test of the trees in primeval forests along the Parana river, which was made by the Regie Pulp mfg., Co., Ltd., France in 1962, shall be given hereunder.

According to them, the following trees accounting for approx. 86% of trees in primeval forests can be pulped:

	Constitutional percentage in quantity
Laurel Negro (<i>Ocotea Suaveolens</i>)	24.0
Rabo (<i>Lonchocarpus Leucanthus</i>)	16.2
Laurel Ajuy (<i>Nectandra Sanguinea</i>)	10.3
Caabuza (<i>Lonchocarpus Muhlbergianus</i>)	6.8
Laurel Amarillo (<i>Nectandra Falcifolia</i>)	5.1
Grapia (<i>Apuleia Praecax</i>)	5.1
Aguai (<i>Chrysophyllum Maytenoides</i>)	4.7
Loro Blanco (<i>Bastardiopsis Densiflora</i>)	4.7
Guayavi (<i>Potagolula Americana</i>)	4.5
Maria Prata (<i>Dialenspterye Sorbifolia</i>)	4.5
Isapy y Blance (<i>Machaerium Stipitatum</i>)	3.5
Anchico Colarado (<i>Piptadenia Rigida</i>)	2.8
Ivaporosity (<i>Muycengenia Daporetis</i>)	2.2
Alecrin (<i>Holocalyx Dalanse</i>)	2.2
Kancharana (<i>Gabralea Cangerana</i>)	1.5
Koku (<i>Allophylus Edulis</i>)	1.5
Parsigvero (<i>Symplocus Pubescens</i>)	1.8
	100.0%

e) Wood-cutting work

i) Lumbering method

Wood is generally cut during the period from February to July every year. In the Alto Parana district, however, the wood is usually not cut for ten days from the new moon day, because it is said that the wood is cracked after the sawing during this period. Meanwhile, no saw is used, but only the axes are used for wood cutting, because it is generally understood that the trunk of trees would be lengthwise cracked.

Most axes used are German-made, and approx. 2,250 kg each in weight.

Wood axing skill is generally high. In cutting the tree of breast diameter, more than 1m., the cutting width of the axe into the trunk of tree is 10 -- 15 cm. Wood-cutters make a trio, and employ a rotation system, according to which one cutter takes always a recess. As for the cutting time, it takes approx. 1 hr. and 40 min. to cut a Lapacho Nagro (so hard a tree as to be equivalent to the yew tree in Japan) of breast diameter, approx. 1 m.

In some German and Japanese settlements, hand-driven saws or chain saws are used.

Immediately after the cutting, wood is logged. Logs are carried by carts or tractors to the truck road, and then trucked to the harbor or sawmills.

ii) Lumbering cost

Lumbering work is conducted on the basis of a contract system.

Though there may be some difference among the districts, according to our survey in the Alto Parana and Yguazu districts, the lumbering cost for the export wood (such as the Lapacho, Cedro, etc.) is roughly estimated as follows:

Cutting, logging and barking	U.S.\$ 1.61/m ³
Hauling (mean distance, 100m)	U.S.\$ 2.7/m ³
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Total:	U.S.\$ 4.3/m ³

The lumbering cost for the wood other than the export is approx. 10 -- 20% lower than the above cost.

iii) Selling system, and the payment for wood

The price of the standing useful timber varies with the road and traffic condition, and the forest ownership, government-or private-owned. In case of the private forests in the Yguazu area, however, bid system has been also employed on the

basis of specification for the cutting time, number of the trees, cutting area, etc. But most of the sales seem to have been conducted on the basis of individual contract as occasion demand.

Selling price for the government-owned forest in approx. U.S.\$ 2.1/m³, while that for the private approx. U.S.\$ 3.75/m³.

(The reason why there is a great difference between the government-and private-owned forests in price lies in the fact that the road condition of the government-owned forests is worse than that of the private forests)

f) Freight and others

Most of the woods are carried by trucks (of 8 -- 10 tons capacity each).

The freight is as shown hereunder:

Yguazu - C'nel Oviedo, 140 km	U.S.\$ 6.33/m ³
Yguazu - Franco harbor 48 km	U.S.\$ 2.1/m ³

In addition, the rafting cost in Franco harbor, for example in case of the Cedro, is approx. U.S.\$ 1.61/m³.

g) Quotation of the wood

At present in this country, wood price varies remarkably with the hauling situation in districts, demand, etc. there is no wood quotation applicable over a wide range. In most cases, extremely speaking, the woods are sawed to order of the customer, who is in need of a sort of wood of a certain size. Woods seem to be seldom cut, reckoning upon a rise in price. In case of the cedro wood, for instance, it is quoted at U.S.\$ 18.3/m³ in C'nel Oviedo, and U.S.\$ 21.5/m³ in Franco harbor (FOB price for export).

h) Afforestation

Eucalyptus trees have so far been planted, not over a wide area but almost on a test scale. In many cases, 5 -- 30 eucalyptus trees have been planted around the stock farms, residential areas, etc.

In the meantime, the eucalyptus has been partly used for the electric-light

pole, but chiefly for the firewood, packing case for fruits, etc.

In addition, the Araucaria, Angustifolia and Pinus Elliotti (Celulosa Negro) have been tentatively planted in the Japanese settlement, etc.

In this connection, the Government seems to have the intention of extending their plantation scale.

III Paper and Pulp Industry

1. Present Condition

In relation to the paper, this country is fully dependent upon the import from overseas. In Fassardi approx. 250 Km off Asuncion, capital of this country, there is a paper mill with its nominal capacity of 5 tons. Though its production is stated in various statistics, actual production is at a standstill.

According to the account of the custodian of this paper mill, no paper has not been manufactured by reason that no engineer came, when a complete set of paper making machines was laid four years ago, the made paper was too weak to be used, a canning factory, which had been expected to be a customer of this paper mill, purchased the paper from England and the mill lost its market, etc. After the machines were installed, the mill has made only small quantity of paper on trial. As a matter of fact, therefore, there is no paper and pulp industry in this country.

For a reason of itinerary and for making an inspection of paper mills along the Parana river, we have visited a pulp plant, La Cellulosa Argentina in Misiones County, Argentine, which has used the Parana pine, eucalyptus as the material, employed a sulfite process and produced the pulp, 100 tons daily. 40 -- 50% of the total production is cellulose pulp. This Company has invested a considerable fund in the plantation of Parana pine trees (covering 8,000 ha.) to secure the material source, additionally planted the American pine trees, and said that the American pine would be pulped in future. This Company has planned to build a kraft process plant in this area, and been active in starting the production of

short-fiber pulp by means of natural forest resources (broad-leaved trees). Such a trend has had a delicate effect upon the inhabitants along the Parana river on the Paraguayan side, and excited their interest to supply the material woods from the Paraguayan side. In the meantime, This Company has assumed an attitude that she is considerably interested in making inroads on the industry in Paraguay.

2. Demand and Supply, and the Market of Paper

Paper consumed in this country has been mostly imported from outside. As for the home-made product, only the cardboard has been manufactured on trial.

Of the imports, such processed products as the letter paper, envelope, etc. have been imported chiefly from Argentine, Brazil, etc. Meanwhile, the paper in general has been imported from Sweden and others.

The paper consumption per head of the people in this country, together with that in Bolivia, is the lowest of that of the countries in Latin America, only 4.9 lbs. yearly.

Imports in terms of the sorts of paper

(Quantity : ton, and the sum of money : US\$)

<u>Description</u>		<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>
Wrapping paper	Quantity	667	824	879	755	882
	Sum of money	140	165	166	162	190

Newsprint	Quantity	1,251	1,028	1,069	1,104	1,293
	Sum of money	196	161	151	157	187

Cigarette paper	Quantity	35	57	10	44	51
	Sum of money	28	40	8	36	28

Writing paper	Quantity	276	393	364	427	431
	Sum of money	71	101	99	130	120

<u>Description</u>		<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>
Cardboard	Quantity	160	239	188	181	581
	Sum of money	36	55	39	38	138

Cardboard product	Quantity	178	321	333	472	30
	Sum of money	48	100	97	133	16

Paper Product	Quantity	174	227	147	224	181
	Sum of money	129	174	133	234	156

Book paper	Quantity	51	100	61	85	113
	Sum of money	21	44	38	62	112

Other paper	Quantity	173	248	169	112	171
	Sum of money	91	91	87	72	78

Total	Quantity	2,965	3,437	3,218	3,404	3,733
	Sum of money	760	931	817	1,024	1,025

Reference : Data of the Commerce and Industry Ministry of Paraguay

consumption per head in the countries of South America (in 1962)

Argentina	69.5 lbs
Venezuela	63.8
Uruguay	41.0
Chili	36.0
Brazil	22.1
Colombia	28.0
Peru	17.3
Ecuador	8.5
Paraguay	4.9
Bolivia	3.8

Reference : World Review Number, Pulp & Paper 1963

In relation to the prospects of the paper demand, it is expected that the demand for printing and writing paper would gradually increase chiefly due to the spread of school education, and that the demand for such industrial paper as the wrapping paper would also gradually increase with the development of industries. As the population is less than 2,000,000, and the paper market is subsequently so small, however, much increase in demand cannot be expected in near future.

According to the estimate of paper demand in Paraguay prepared by the FAO, the paper demand in 1975 would reach the following level:

Newsprint	2,000 tons
Printing and writing paper	1,000 "
Other paper and cardboard	3,000 "
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Total	6,000 tons

From the actual increasing rate of annual paper consumption in the past as well as the comparison with the mean forecast demand in the countries of Latin America, such an increasing rate as mentioned is naturally conceivable.

Estimate of the annual paper and cardboard demand in the countries of Latin America

1955 -- 57 (mean value)	1,956,000 tons
1965	3,501,000 "
1975	6,659,000 "

IV Wood Processing Industry

1. General Condition

When the current condition of the wood processing industry in this country is observed, the total production is extremely small because of the low domestic demand. When individual product is observed, however, not a few products

have reached the international level in work.

In the furniture of high grade, wood-carved art objects, etc., for example, works of high level are found. But their cost seems to be approx. 1.4 -- 1.8 times as high as the international standard cost of the products of the same kind.

Meanwhile, the reason why the wood processing industry has not developed lies in the facts that alike other countries of South America, there is no custom to use the wood for house-building, and that the purchasing power for the furniture and fixture is very small because of the low living standard of the people.

In order to promote the wood processing industry, therefore, it is desirable to make efforts to develop the export commodities.

Though Paraguay is an inland country, the following routes are, fortunately, opened for export: route from Asuncion harbor to Buenos Aires via Paraguay river, route from Encarnacion to Posadas, Argentine, and that to San Paulo, Brazil, via the international bridge at Youazu, which is slated to be opened to traffic in April of this year.

As these export articles must pass through Argentine or Brazil, however, the customs, transit duty and other expenses are added to their cost. Due to the higher cost, consequently, the export has become inactive.

In this connection, it is advisable for the Paraguayan Government to negotiate with the governments of the above two countries for the reduction of customs and transit duties.

As the survey of the forest resources in this country is under way, their reserve, distribution of useful woods, etc. are unknown. It is, however, estimated that there is a reserve of useful wood, approx. 1,000,000,000 m³ inclusive of the exploitable area.

Above all, the Cedro, Ybyrapyta, Timbo Ybybraro, Guatambu, etc. seem to be most suitable for making the furniture, fixture and building the houses,

Meanwhile, the Cuayayby is a wood equal to the noble wood produced in South Seas.

As the data of the wood demand, the production of housing material, furniture and wooden articles, etc. necessary for the survey and analysis of the wood processing industry are said to be under examination by the organs concerned of this country, they were not made available to us. Though we cannot, therefore, analyze the current condition numerically, we shall hereunder describe in relation to our survey data and on the basis of the existing data of this country.

2. Sawing Industry

i) Present condition

Most sawmills located in the primeval forests are equipped with one circular saw (approx. 150 cm) and one hand timber feed wheel respectively. The Stroessener Sawmill in the Yguazu district is provided with 1 48"-automatic -equipped band saw, 1 lug circular saw, 1 28"-band saw and 3 12"-circular saws. Its sawing skill has reached the international level. Its daily sawing capacity in terms of plank, 2" thick is approx. 350 m³. The raw wood is 700 -- 1,200 m/m, breast diameter. Most of the woods are Cedro, Lapacho, Guatambo, etc. The supervision over the technique is also complete.

The reason why the daily production is small in the above facility lies in the short duty hours (6 hr. from 6.00 a.m. to 12.00 p.m.) of workers in summer.

In relation to the wage system in this workshop, no contract system has been employed, but the daily and monthly pay system has been employed. Skilled sawer is payed U.S.\$ 97.22 -- 111.11, and the assistant sawer U.S.\$ 41.66 -- 50 monthly.

As mentioned above, most sawmills in the primeval forests are respectively provided with 1 circular saw (with a hand timber feed wheel), and have 8 workers (2 sawers, 2 assistants and 4 porters). These workers live in a hut, approx. 6 -- 10 m² on a corner of the workshop, which is built of residual wood. They are given board by their foreman. Most of them are said to be daily paid approx. \$ 0.83 -- 1.4.

The monthly working days of this workshop are 20 -- 25 days, and the duty hours are 8 hr. Though few of them have their dependents, the skilled sawer supporting his dependents seems to be paid approx. \$ 97.22.

The sawing skill in this country has reached so high a level that little unevenness is found in the sawed products.

In a section where the circular saw of thick blade was used, however, the sawed grain has become coarse. In case of the plank, 2 inch, thickness inequality, approx. 3/16 inch is found. Such a yield loss as in case of the Japanese sawed products is not found.

ii) Prospect and the measures for the development of sawing industry

(1) Even the woods of excellent quality are mostly sawed crosswise of the grains. Especially as the woods such as the Guayayby, Lapacho, Laurel, Trebol, etc. are noble woods, or equal thereto, more researches are required for the sawing method. According to the sawing method, the laurel, etc. could become noble woods or general timber.

As the straight-grain sawing method has also several sawing angles, it is desirable for the sawing operators to make further studies more positively.

(2) In this country, the wood has been gradually used for the structure of house-building. Though its demand is small at present, it is necessary to make researches in the application of wood to the house-building in co-operation with architects.

(3) In developing the sawing industry, stress should be laid on the production of export woods, because the domestic demand for wood is small.

(refer to the item, Complex of the wood industry)

3. Plywood Manufacturing Industry

i) Present condition

There is found a plywood workshop, which has, however, stopped its production because the product was bad in quality because of its low technical standard, and its cost was higher than that of the imported plywood (Though

we made efforts to examine the cost constitution of the above product to survey the reason for high cost, no data have been made available, as the person concerned was unknown)

In connection with the above, all the plywoods for some building construction, furniture and packing have been imported from Argentine and others. Though their actual figures are unknown because of the lack of import statistics, it is conceivable from the scale of wood processing industry in this country that 4,000 -- 5,000 sheets of plywood have been yearly imported in terms of dimensions, 5 m/m x 1,200 m/m x 2,200 m/m. Though the above imports are very small, they seem to be natural, considering the living standard and the population in need of the furniture in this country. Not only that, the plywoods have lost their popularity among the general public as the plywoods of had quality were imported to this country. In relation to the furniture of over medium grade, therefore, the plywoods have been used only the lining boards, drawer bottoms, etc. Accordingly, such plywood furnitures as found in Japan, and Western countries have been seldom manufactured because of their unpopularity among the people.

- ii) Prospect and the measures to be taken for the development of plywood industry.
 - a) As the rapid growth of domestic demand cannot be expected, the export must be increased at any cost. In this case, however, much cannot be expected from private undertaking. If any government-managed company or public corporation is organized to foster the plywood industry, there would be possibilities of its growth, because much excellent woods for the use of plywood are reserved in this country.
 - b) There is a plywood manufacturing company called the "SALAY & CIA IND Y COM, SA" in a point close to the Parana river approx. 125 Km off Pasadas, approx. 300 Km. south-south-west of Pto Aguirre

harbor, Argentine, 10 Km south of the international bridge over the Parana river to Brazil at Yguazu. Though the plant of this company is the smallest plywood making workshop of continuous production system, it has a monthly production capacity of approx. 10,000 -- 12,000 sheets including the general and special (dressed) plywood (one sheet is calculated in terms of 5 m/m x 1,200m/m x 2,200 m/m) The major woods are the Guatambu, Yvyraro, Guaica, Torebol and Parana pine. Especially the Parana Pine plywood has been reportedly exported to U.S., as its grain is fine and beautiful.

The sort of plywood is 5 m/m, 10 m/m and 20 m/m, and the size is generally 1,200 m/m x 2,200 m/m. The plant is equipped with the following machines:

- | | |
|--|--------|
| (1) Vat (in which the raw wood is digested into soft material) | 1 unit |
| (2) Crane | " |
| (3) Rotary veneer machine | " |
| (4) Clipper | " |
| (5) Dryer | " |
| (6) Jointer | " |
| (7) Casein mixer | " |
| (8) Casein spreader | " |
| (9) Hot press | " |
| (10) Double saw | " |
| (11) Drum seader | " |

As for the raw wood, the Parana Pine has been cut out of the government-owned forests. Its breast diameter is mostly 0.7 -- 1.1 m., and its age is approx. 100 years. Other wood is approx. 40 -- 80 cm. Wood has been cut from the primeval forest within 80 Km off the plant, and trucked thereto.

According to the management of the company, it has exported to Paraguay, and has the intention of establishing a plywood plant somewhere

in Paraguay.

If the above program is realized, the above plant could not only satisfy the domestic demand for plywood in Paraguay but also export the plywood products, because the plywood making skill of the company has reached the international level. In this case, however, no domestic enterprise would grow, while large quantities of excellent wood for plywood would be lost. It would be, consequently, necessary to examine carefully such an industrial encroachment of foreign firms.

4. Furniture Manufacturing Industry

i) Present condition

Though they are very small in number, pieces of furniture of very high technical standard (inclusive of beds, chests, cabinet, etc.) have been manufactured. But their cost is 1.5 -- 2 times as high as that of the Japan-made products of this kind. They seem to be the order-made products for the upper class.

The furniture of the people of higher than middle-Class living in Asuncion, Encarnacion and other cities is composed of relatively rigid articles. Most of them have been used for 5 -- 10 years after the purchase. Their style varies from the Spanish to the American. In the residences following the type in the colony age, the furniture of Spanish style is large in number.

The major materials for the furniture are the Petereby, Guatambo, Torebol and Cedro. As for the coating, spirit varnishing and clear lacquer finishing are mostly used. Finishing technique is high. Above all, the straight grain of the heart of Torebol is so beautiful that the cut and sawn veneer of this wood would be made much of on the international market.

When chairs are upholstered, coil spring, kapock, rubber, etc. are mostly used as the stuff materials. Most of the chairs are covered with vinyl leather. As for this vinyl leather, small quantities seem to have been imported

from the DuPont, U.S.A and others. Its purchasing price of the furniture making companies seems to be approx. 3 times as much as the retail price in Japan.

ii) Other Wood Processing Industry

In the residences of the people of lower than middle-class, doors (including the windows) are mostly made of wooden board. Glass is so expensive (one case, "100 ft²" of the 3 m/m transparent glass is quoted at US\$ 50 -- 60) that no windowpane is found in the houses of the low-class people.

Even in the dwelling houses of the middle-class people, 1/2 -- 2/3 of window surface is mostly covered with board frames. In some stores in the civic centers, too, glass work is so much saved as would not disturb the display.

In this connection, the board door work has made advance. As for the materials, such less warping wood as the Timbo, Ybyrapyta etc., which are naturally seasoned in the outdoor yard, have been used.

As the statistics of the annual building area of this country is not made available to us, the demand for the flooring and other floor board is unknown. Even in general residences of the people of higher than middle-class, their floor is mostly tiled. Together with the concrete-placed floor, the tiled floor accounts for 2/3 of the total floor area. The rest, 1/3 of the whole seems to have been worked into flooring and other materials.

As mentioned above, the woods for use in architecture are some beam, column and rafter materials for the construction, plinths, door and window frames for the indoor use, and some flooring materials.

Such being the case, there seems to be no room for the development of the wood processing industry of this kind.

iii) Wooden industrial art objects

Though the industrial art objects and folk handicraft articles are finely wrought with Lapacho wood, their cost is high, while the sense and skill of workers are excellent. Even if any art value is added to the material and manufacturing costs in relation to such art objects, their cost seems

to be approx. 50 -- 80% higher than the common price level.

Thus the buyers, sellers and manufacturers seem to have made mistake in evaluating the wooden industrial art objects of this kind.

iv) Prospect and the measures to be taken for the development of wood processing industry

(1) Problem for the present

Something common to the furniture making and all other wood processing industry is that there is little prospect of the industry being promoted by introducing new technique and facilities from foreign countries, because the domestic demand is so small. If any economically justified undertaking program is put into practice, the supply would instantly exceed the domestic demand and subsequently the plant would be forced to shut down its operation.

In order to use the home-made useful woods effectively to promote the domestic and export industries, it is, therefore, indispensable for the government to take the protective measures for fostering the industries.

In this country, for instance, no match has been made of wood. Though the wood suitable for the matchwood is in excess in this country, yarncore has been used in place of matchwood, because there is no matchwood making machine. As this yarn-core-made match is high in cost as compared with the international level, the wooden match has been smuggled from Argentine, Brazil, etc. and overflowed the market. In consequence, no match making industry has so far been developed. In the meantime, there is no fund enough to introduce the matchwood making machine and produce the wooden matches. Even if the production is started, the product could not compete with the products, which are mass-produced at low cost in Argentine and Brazil. In relation to the match, therefore, it is necessary to promote the match industry under the protection of the government as found in Bolivia, take measures

to curb the match import, and achieve an annual production enough to meet the demand of the people so that the product may be sold at a price lower than the international level. Such protective measures should be taken not only for the match industry but also for all fields of the industry within a limit where no trouble is made with other countries.

(2) Long-range program for the wood processing industry

Because it is difficult to promote the wood processing industry for a short period as mentioned above, a long-range (10-year) program should be worked out to foster the industries. Some instances of the program shall be enumerated hereunder:

1. Wood reserve and the useful trees of the primeval forests in the Itapua and Alto Parana districts shall be surveyed. Chiefly in the Encarnacion area of the Itapua district, and in the Hernandrias area of the Alto Parana district, industrial highways (8 m wide) and forest roads (6 m wide) shall be planned.

In the continuous work for 5 years, industrial roads (150 Km long each) and forest roads (230 Km long each) shall be built.
2. The road between Asuncion and Encarnacion, approx. 350 Km shall be paved so that the truck may run for approx. 6 - 7 hours. As there is no bridge midway and all the cars are ferried across the rivers, bridges shall be built. If such construction as mentioned above is completed, the useful wood, approx. 270,000 -- 320,000 m³ (estimate) in both districts would be utilized for industries.
3. In the above two districts, the reforestation of Parana Pine shall be positively promoted. In this connection, various priority measures for the enhancement of the afforestation will of planters shall be taken: Low-interest and long-term loan, exemption from taxation, etc., because the Parana Pine would be indispensable to the pulp

making, if a newsprint producing plant is built in this country. The promotion of paper and pulp industry in this country shall not be here described, as it is detailed in another item. The reason why it is repeated in the above is that if the exploitation of primeval forests in the above two districts is realized, the woods could be secured for the pulp manufacturing and wood processing industries, and that the woods could be more effectively utilized.

2) Building of a complex of wood using industries

If the articles are trucked from Hernandrias and Encarnacion to Asuncion for no more than 6 - 7 hours, it would be possible to build concentratively the pulp plant, paper factory, sawmill, plywood workshop, furniture and fixture factories (refer to another item)

At the beginning, a pulp plant of daily production, approx. 5 - 10 tons shall be built. On the basis of this capacity, paper, plywood and other wood processing workshops shall be additionally designed and built.

The made products would not only satisfy the domestic demand but also be sent to San Paulo, Brazil through the Yguazu international road or to various places in Argentine via Posadas across the Parana river from Encarnacion.

At present, however, the Yguazu international road is not completed on the Brazilian side. If this section is paved, the articles could be trucked for approx. 40 - 45 hours between Yguazu and San Paulo.

3) Export of the processed wood products

a. Production and export of the useful woods

Even if a paper and pulp plant is built, it would be difficult for the time being to export its product. It is, however,

possible that the standard products (square timbers with their section, 2" x 4" and 4" x 8") of Petereby, Guatambo, Cedro, Trebol, etc. would be artificially seasoned and exported as the furniture and fixture materials.

It is, meanwhile, also possible that the Guayayby, which is little reserved in this district, would be carried from other area in the log, cut lengthwise of the grains, and processed into sheets, which could be exported as the surface materials of the furniture.

b. Production and export of the half-finished goods

It is also possible that the wood would be half-finished (cut, finished but not combined) into the window frames, in-and outlet frames, doors, etc., which could be further processed in accordance with the domestic and export standards. In case of export, however, care shall be taken about the production plan, because the products are supplied to the construction companies in foreign countries, and the fitting standard in Brazil and Argentine is not complete because of the lack of architectural module there.

(3) Plywood and other wooden board

The building of plywood plant shall be carefully examined, because the useful plywoods are manufactured in Brazil and Argentine, the expected customers of Paraguay plywood, much enough to satisfy their domestic demand. Not only that, these countries have the intention of exporting these plywood products to Paraguay and other. It is accordingly very difficult to build and plywood plant, unless the Government takes such vigorous protective measures as mentioned above.

There is no demand for such wooden boards as hard and particle boards, where no demand for plywood is found. As huge sum of

money must be invested in facilities to make the products of this kind, it would be unnecessary to consider the building of plant.

In working out a promotion program for the wood processing industry, careful examination is required for the building of plywood and other wooden board factories, by making a survey of the development of the wood processing industry not only in the adjacent countries but also in Europe and U.S.A.

7 Observations Based upon the Survey Records

1. General Observation

The small market with a population of less than 2,000,000 seems to have made it difficult to encourage the growth of industries in general in this country. From a viewpoint of the future development of wood utilizing industry, however, Paraguay is provided with the following three conditions, which could be fundamental conditions very favorable for the development of wood utilizing industry:

- a. Land in the south-east area is especially fertile.
- b. Climate is moderate.
- c. Paraguay affiliated with the Free Trade Union of Latin America can receive preferential treatment in exporting the raw materials and industrial products to the Union member nations.

Above all, the huge forest resources are the important resources, only a feature of Paraguay. It would be, therefore, indispensable to the future of Paraguay that on the basis of such favorable conditions, the woods should be utilized at maximum for the industrialization of the country - even at some considerable expenses at the early stage of exploitation.

The forest woods in Paraguay but the useful woods for export have been coarsely cut. Considering the above conditions, therefore, the following steps should be taken in addition to the exploitation of primeval forests:

In accordance with the use of the wood utilizing industry, the sort of wood should be chosen (for example, Parara Pine, Oregon Pine, etc. for the pulp industry), reforestation be promoted as programmed, and the woods of present primeval forests should be processed as highly as possible into the products of high commercial value.

Even if more raw woods of primary grade are produced, over production would be caused because of the small domestic market. Meanwhile, the increase in their export to the countries in South America would be difficult. It would be subsequently necessary to introduce the advanced technique and enhance the technical standard so that highly processed commodities of superior quality may be produced in this country.

As for the form of enterprises, it would be most suitable that as disclosed in the program of the Agriculture and Stock-raising Ministry, model settlements, Stroesseners shall be established, and that a sort of complex system, in which the plantation, farming, stock raising, sawing and paper and pulp industries are combined with one another, should be encouraged under the control of the Government.

2. Exploitation of the Forest Resources

The wood reserve of the forest resources of this country is said to be approx. 1,900,000,000 m³. But we have estimated that the exploitable forest would account for approx. 30% of the total forest area, approx. 21,000,000 ha., and subsequently approx. 6,000,000 ha., and approx. 1,000,000,000 m³ in terms of wood.

In developing the wood utilizing industry, therefore, stress should be first laid upon the Alto Parana and Misiones, Ltapua districts, where a larger number of useful trees are growing. In working out a consolidated exploitation program, importance should be attached to the exploitation of Yguazu in the Alto Parana district, and Encarnacion in the Ltapua district (refer to the item, complex of the wood utilizing industry)

(a) Production increase measures for the export wood

The Cedro, Lapacho and Guayayby (whose distribution and reserve are unknown) produced in this country are very promising as the export woods. If they are properly sawed and processed, they would be famous as the first-rated products on the international wood market, because of their excellent quality and fine grains.

At present when the production of noble woods in South-East Asia is on the decline year by year, meanwhile, the Guayayby is a very promising wood, which could replace them, and subsequently should be cut as planned, and effectively utilized as an export wood.

For instance, a proper area, approx. 30,000 ha. of the primeval forest circle with a radius of 100 km. from Yguazu and Encarnacion, shall be specified as the primary development area, where forest roads and motorcar highway shall be built. By mechanizing the wood cut operation, all the trunks shall be collected. The cedro, Lapacho, Guatambo Timbo, etc. shall be exported and utilized as the timbers. Wood suitable for the pulp shall be sent to the pulp plant, while the other low-grade shall be burnt on the site. After the soil is prepared, the above export trees and the Parana Pine shall be planted.

In this area, the Parana Pine would grow in 5 - 6 years large enough to be utilized as the pulp material.

When this area is developed, the following quantities of the woods could be effectively utilized:

Cedro, approx. 135,000 m³, other useful wood, approx. 315,000 m³, and pulp wood, approx. 2,100,000 m³ in the Yguazu district.

Though the above Guayayby is a noble wood, its reserve in both district is quite unknown, and cannot be estimated.

(b) Establishment of forestry experiment stations

At present in this country, the research and test laboratories of forests and their wood are weak. The facilities of this kind shall be strengthened.

In these organs, it is desirable to install the equipments for the botanical classification of the trees growing in this country, the chemical and physical analyses, pulping test, etc., even though they are small-scaled.

3. Development of the Paper and Pulp Industry

In case the woods of the forests in this country are used alone for the paper and pulp industry, there would be technically considerable difficulties. But there are possibilities for the paper and pulp industry to become a major industry in this country in future, because the country is furnished with the following favorable conditions:

- (1) Land is so fertile, and the climate is so moderate as to grow the trees. Especially in the east area of this country there is a great possibility of the reforestation of needle leaved trees.
- (2) Rivers are large in number, and rich in water so that plenty of industrial water is made available. In addition, the wood, products, etc. can be easily carried on rivers.
- (3) Paper consumption is on the steady increase. Consumption of same sort of paper has become 2 - 3 times as much as that in the past 4 years. Such a situation is very favorable for the promotion of paper and pulp industry.

In Japan, where the needle-leaved trees (soft woods) run short, much broad-leaved trees (hard woods) have since the middle of 1950's been used as the paper pulp material.

At present, a little more broad-leaved trees are used than the needle-leaved trees.

In the mean time, the forests in this country are made of broad-leaved trees, while there is a great possibility of the wood of planted needle-leaved trees being used for the paper and pulp industry. According by there is a considerable resemblance between Japan and Paraguay in technical issues raised when the paper and pulp is manufactured. If the present paper making technique is applied, therefore, there are much prospects of the growth of paper and pulp

industry using the broad-leaved trees, even though there are much difficulties. From a technical viewpoint, several problematic points in the promotion of paper and pulp industry in this country have been observed as follows:

{ Material }

In this country, (1) primeval forests, (2) bagasse discharged from the sugar plants, (3) needle-leaved trees which could be grown in the plantations, (4) waste paper, cotton rags, etc. can be used for making the pulp.

(1) Primeval forest

Broad-leaved trees growing in primeval forests of this country can be chemically processed into pulp.

When the properties of forest trees for it is observed on the basis of some data, the following conclusions could be drawn therefrom:

In forest, the tree (A) containing extremely short fiber (less than 1 mm on the average) is larger than the tree (B) containing longer fiber (approx. 2mm on the average) in number. When their reserve is compared, however, the (B) is far larger than the (A). Though the (B) can be chemically processed into pulp, newsprint and strong wrapping paper cannot be made, unless the needle-leaved tree pulp is mixed into the above pulp, because the former pulp is inferior in strength. But the generally used writing and printing paper, etc. could be made from the (B) pulp. The tree (B) cannot be easily pulped by means of ground pulp process.

When the primeval forests are utilized for making the pulp, it should be made from mixed woods of the same composition as that of forest. If this system is employed, it would be more economical, and more labor could be saved for the following reasons:

(1) In case trees of a definite sort are collected in great quantities, expenses and labor required for the collection are large because their distribution per unit area of forest is very small. (2) Utilization of the land is higher when trees are all cut than when they are selectively cut. Land can be more easily utilized for the plantation and farming. (3) Pulp quality is

so even as not to disturb the paper making. As the tree containing comparatively longer fiber is overwhelmingly larger in number, the pulp is qualitatively not affected by the tree of short fiber, etc.

In utilizing the primeval forests for making the pulp, however, it is desirable to remove previously the trees of the following quality:

(1) Tree containing the organic matter resistant to the decomposition effect of acid and alkali, which cannot be easily pulped (2) Hard tree which would abrade the chipping machine rapidly, etc. These properties would not only affect the pulp quality but also worsen the economy of pulp manufacture.

(2) Needle-leaved trees

This is a coming subject. At present when the prospects of reforestation can be foreseen, it is not a technical issue but a political and economic problem. As the needle-leaved tree pulp is required for making the newspaper and other paper of excellent quality, reforestation work for the needle-leaved trees should be promoted as far as possible.

(3) Bagasse

In this country where the sugar making industry is thriving, a great deal of bagasse is discharged. In all workshops, the bagasse is used as the fuel for the power and steam generators.

Bagasse has a fiber strength, approx. 1.5 -- 2.5 mm. and can be made into pulp of good quality. If the refining grade is raised, and the yield is reduced, paper of good quality can be made. Without reducing the yield greatly, paper of lower than medium-grade could be made. In general, the yield is said to be 30 -- 40 %. As the bagasse is more easily made available than any other pulp material, and its pulping process is also easier, it should be utilized for the paper pulp industry as far as possible.

[Industrial water]

In this country, there are many rivers rich in water. If this water is

utilized, plenty of industrial water can be obtained.

Though the river water is always muddy, it can be simply purified for the industrial use, because the water purification technique is advanced today.

In relation to the contamination of rivers with waste water discharged from factories, there is no danger of the lower courses of rivers being badly affected, because the rivers are rich in water. Fishing and farming problems can be left out of consideration.

The Parana river and its branches in the east area of Paraguay could be fully utilized.

[Plant building site]

It is ideal that the plant building site should satisfy the following requirements fundamentally: (1) Site shall be convenient for collecting the materials. (2) Plenty of water of good quality shall be obtained. (3) Waste water shall be easily treated. (4) Labor shall be easily secured. (4) Site shall be so close to the consumer place that the products can be shipped easily.

To put it concretely, the plant should be built in the Yguazu or Encarnacion district. In these districts, road condition is good, and the transportation from the respective district to the capital, Asuncion, is also convenient.

In addition, these districts are respectively close to Brazil and Argentine.

From various points of view, therefore, it is advantageous that the paper pulp plant would be built in these districts. On the other hand, these districts are most suitable for the plantation of needle-leaved trees, and face the primeval forests. If the plantation and the primeval forest are rationally and economically combined and well controlled, these districts would greatly contribute to the development of forest industry of this country.

[Development program for the paper and pulp industry]

- (1) Considering the material situation, it is difficult for the present to manufacture the newsprint. At the beginning of the establishment of paper

and pulp industry, printing, wrapping, blotting, toilet and other thin paper shall be made.

From the actual annual paper consumption at present, it is conceivable that a total of the above papers, approx. 150 tons would be produced monthly. Even in anticipation of the future increase in consumption, the above sum would be less than 200 tons.

- (2) As for the materials, broad-leaved trees of the forests, chips of saw-mills, bagasse, waste paper, cotton rags, etc. shall be used. The planted wood such as the eucalyptus, etc. shall be utilized as far as possible.
- (3) In pulping the wood materials, the sulfate, neutral soda sulfite and chemical ground pulp processes, which are suitable for the broad-leaved trees, shall be employed.

In practice, such a small-scale plant as would meet the production requirement, 200 tons mentioned in the item , (1) is not economically justified.

If the scale is small, meanwhile, equipments would often be omitted. Thus it is accompanied by unfavorable conditions. No sulfate process equipment shall be, therefore, installed until the demand is so much increased as to justify the establishment of plant economically, but the high-grade pulp (including the needle-leaved tree pulp, etc.) shall be imported. Or a plant, whose production scale is over the demand, shall be built, and its operations shall be curtailed to control the production until a balance is made between the production capacity and the demand. Thus there is the alternative.

At the present stage, it is somewhat difficult to build a sulfate process pulp plant of an economical scale, because the paper consumption market is small. As the pulp import would be also accompanied by considerable troubles, however, it might be better to build a plant in disregard of some difficulties, if the national policy for the promotion of industries is considered.

As for the bagasse, the "Pomilio system" would be better, when the chlorine

process is used. For the time being, however, soda process, which can be easily controlled, shall be employed.

- (4) In bleaching the pulp, chlorine, caustic soda, and calcium hypochlorite shall be used. At the future stage when the consumption becomes large enough to build a well paying plant, the ClO_2 bleaching process shall be used.
- (5) In relation to the paper machine, two sorts of units shall be employed. Fourdrinier type and cylinder type. In this country, the sort of paper required is large in number, though the paper demand is small. It is, therefore, desirable that the paper making machine to be laid should be capable of making many kinds of paper. Meanwhile, the production capacity shall be so much as to be a little over the present demand, while the number of the machine unit shall be reduced as much as possible. As the units, unlike the pulping facilities, can be simply laid in accordance with the increase in demand, one unit of the above two types each shall be laid for the present.

[Other steps for promoting the paper and pulp industry]

- (1) Industrial research laboratory shall be established to make a consolidated survey and research of paper and pulp. On the other hand, paper making plant on a pilot scale shall be built to train the skilled engineers, and supply its paper products to the market.
- (2) Actual imports of cardboard are on the rapid increase year by year. As the consumption is small, the production is difficult. Because of its large increase rate, it is desirable that the sort, which could be more easily manufactured, should be first home-produced. In process of the growth of paper and pulp industry in this country, all the cardboards shall be domestically made in due time after the considerable increase in consumption and the accumulation of skill.
- (3) Plantation of needle-leaved trees shall be rapidly promoted. The eastern area of this country is a region suitable for this plantation, where the efficiency of investment in plantation could be improved, as the trees grow

in a short time until they are cut. Meanwhile, as the needle-leaved trees can be digested in a sulfate process, they could be utilized as soon as their cutting age comes, if the above measures are under way.

4. Program for Promoting the Wood Utilizing Industries Complex

According to the program for promoting the wood utilizing industry complex in this country, as mentioned above, stress is laid upon the development in the Yguazu and Encarnacion districts by reason of the followings:

(1) Both of these regions have vast primeval forests where much useful trees are found growing. (2) In exporting the wood and related wood processed products, Yguazu is adjacent to Brazil across the river, and Encarnacion also to Argentine. Therefore, the transit distance is relatively short, and subsequently the freight ratio of the export good to the cost is also small.

In addition, the above districts are expected to be regions where the Parana Pine trees could be planted, because it is keenly desired in this country that the newsprint should be home-made, when a pulp plant is built in future.

As mentioned in another item, other related wood industries are planned on the assumption that the pulp plant, which is built in future, should have a monthly production of pulp, approx. 150 -- 200 tons.

a. Sawmills

It would be reasonable to work out a plan on the assumption that the sawing of export wood accounts for 50% of the total, and the rest is for the domestic demand for the following reasons:

The wood demand for the building application is small, and it is also improbable that the wood demand for the fixture, furniture, cases, etc. would greatly increase shortly.

In this connection, it is ideal that stress should be laid on the straight-grain sawing of such export wood of excellent quality as the Cedro, Guatambo, Lapacho, Guayaby, Laurel Timbo, etc., and that their saw residue could be used for the domestic demand.

A. Scale of the sawmill

(1) Set (mechanical facilities per workshop)

- | | |
|---|--------|
| a) 48" automatic-feed-equipped band saw | 1 unit |
| b) 1,220 m/m circular saw | 1 unit |
| c) 12" lug-grinding circular saw | 1 unit |
| d) 24" -- 28" table band saw | 1 unit |

The above 4 sawing machines shall compose one set, which makes up a workshop, together with the accessories. Power source can be a gasoline engine or a turbine.

(2) Sawing capacity

If the sawing capacity of the above one unit of workshop is estimated, assuming that the straightgrain sawing occupies 1/2 of the whole sawing work, and considering the labor condition and the custom of the people in this country, the daily production, approx. 15 -- 20 m³ would be possible, and the raw wood, approx. 35 m³ would be required therefor.

It would be, therefore, fortunate if considerable quantity of the residue, approx. 17 -- 18 m³ of the raw wood, from which the saw products had been made, can be utilized for the pulping application. In deciding whether the above useful trees are suitable for the pulp making, or not, however, further researches must be made.

(3) Sawed products

Most of the trees would be generally cut into logs, 3m., 4m. and 5m. long. In sawing them, the small-width article would be 2 inches x 4 inches and its multiple, the plank be generally 1 inch x 12 inches and 2 inches x 12 inches, the chip be 1 inch x 6 inches, and the rest be made to order.

In the meantime, circular saws of thick blade, which are used for sawing in this country, are coarse in sawing. When the woods are sawed crosswise of the grains, "sawdust" is discharged at the rate of 10 -- 20%

(which varies with the plank thickness). It is, therefore, advisable to replace the thick blade with the thin.

Sawing method shall conform to the international custom. As for the 1-inch wood, for example, its thickness shall be 1 inch + 1/16 inch. The sawed product, less than 1 inch thick shall be placed out of transaction.

Guayaby, Timbo Lapacho, Laurel Trebol, Guatambu, etc. are suitable as the surface dressing materials. They can be sawed into the planks, 6 -- 12 inches wide, and exported. (they shall become the surface materials for the dressed plywood in plywood plant)

Above all, the Guabyayby, Trebol and Laurel would make their debut on the international market in place of the "noble woods" produced in South-east Asia, whose production has been yearly decreasing. In relation to the useful woods for the house-building and fixture, their sort is more than 20. Though it is possible that they would be sawed into square timbers, 4 inches x 4 inches, and 6 inches x 6 inches, it would be difficult for the present to export the square timbers, considering the square timber demand for the building uses in the adjacent countries and U.S.A. Therefore, the production of square timbers should be so much as the domestic demand.

Boards (less than 1/2 inch) are unsuitable for the export. They are often cracked and warped by the change in climate, temperature and humidity, outer physical force, etc. in transit. In the country, meanwhile, there is no custom to use the thin boards for architecture. They are used only for the sheathing, fixture, windows, in-and outlet frames and fittings. Such being the case, the sawing machine for thin boards can be considered in the second place.

b. Wood seasoning

Timber seasoning can be divided into the two sorts, natural and artificial seasonings. Considering the weather condition, annual mean temperature and

humidity, etc., however, most of the timber can be satisfactorily seasoned naturally. According to their demand, artificial seasoning equipments would be required for the flooring and other exported semi-finished products.

As it would take approx. 27 - 30 hr. for the standard artificial seasoning unit to season the Cedro, etc. approx. 1 inch thick to approx. 15% of the water content, artificially seasoned timber, approx. 56 -- 64 m³ could be obtained in one shift per 3 days, if an artificial seasoning unit of 100 m³ per chamber is laid.

As the high skill is required for obtaining the properly seasoned timber without decreasing the commercial value, however, it is desirable that a small-scale timber seasoning unit shall be first laid to make sufficient researches in the adjustment of seasoning velocity, temperature, humidity, etc. for various sorts of wood.

As mentioned above, the districts are favorable for the natural timber seasoning. In the Yguazu and Encarnacion districts, the Cedro wood could be seasoned for approx. 40 days in Nov. -- Mar. (Plank, 1 inch thick, moisture reduced to 18 -- 20%), and for approx. 50 days in Apr. -- Oct.

Timber shall be obliquely piled at the rate of 9 -- 12 m³ per unit. When the required area per unit is 4 m², timber, 1,200 -- 1,300 m³ can be seasoned per ha. Throughout the year, therefore, the monthly production of seasoned timber would be approx. 1,000 m³ per ha.

The capacity of natural seasoning yard should be decided in accordance with the production of sawed timber.

As the Guayayby, Lapacho, etc. are harder than the Cedro, etc., they should be seasoned approx. 15 -- 20 days longer than the latter.

c. Plywood plant, and other wooden board

At present in this country, plywood plant is inactive. In Argentinean district along the Alto Parana river, approx. 160 Km. north of Encornacion,

there is a plywood plant, which has a monthly production of 10,000 -- 12,000 sheets (in terms of 5 m/m x 1,200 m/m x 2,200 m/m) of plywood of international standard (including the special plywood).

As the products of this plant have satisfied a considerable amount of the plywood demand in this country, the establishment of plywood plant should be carefully examined.

But the heartwood of Laurel Trebol, Guayayby, Lapacho, etc. would be rated as the 1st-grade surface material for plywood, if they are brought to the international market. If the introduction of foreign fund and technology is possible, therefore, more plywoods made of the above materials could be exported to justify the establishment of plant economically.

d. Flooring

The Ybyraro, Chiparupa, Taperyba, Ybyrapy ta, etc. seem to be suitable for the flooring because of their hardness and rigidity. It cannot be definitely said because no data of physical test is made available.

The standard production of flooring machine is approx. 200 m² (in accordance with the labor and living custom in this country), though it a little varies with the sort of material wood.

When the flooring is mass-produced to order for a short period, meanwhile, artificial seasoning is required. When only one machine runs, natural seasoning would serve the purpose.

If the freight accounts for approx. 20% of the cost of flooring, however, export would be difficult.

5. Conclusion

Complex program (draft) for the wood industry aims at the following target:

In the Yguazu and Encarnacion districts of this country, forest resources of abundance shall be exploited, the export and pulping of wood and related products be promoted, and subsequently the required paper shall be home-produced.

Under the present condition in this country, this consolidated program could be put into practice, if the foreign aid in fund, technique, etc. is obtained.

But the problem in export is the transit route, and the ratio of freight to the export cost.

For instance, the routes are as follows:

Yguazu - Pto Franco (ship) - Pontagrassa (truck) - San paulo (railway)

= approx. 1,300 Km.

Encarnacion - Posadas (ship) - Buenos Aires (railway) = approx. 1,200 Km.

Anyway, long-distance transportation is required for the exports of commodities.

In case they are sent by railway, they are subject to damage because of the defect of tracks, locomotives, freight cars, etc.

In addition, there is another transit route from Asuncion harbor to Buenos Aires down the Paraguay river. But the freight rate, and the transit duty in Argentine are so high that the oversea export via this route would not pay due to the high freight rate except in case of the export to Argentine (timber and wood-processed articles)

In order to the overseas export of this country, therefore, it is necessary to negotiate with the adjacent countries for concluding a favorable agreement upon the reduction of transit duty and others.

At present, the following efforts should be made : Export price shall not be evaluated from the costs of raw wood and manufacture, but these costs shall be counted backward from the international price level so that the export price may adapt itself to the international standard.

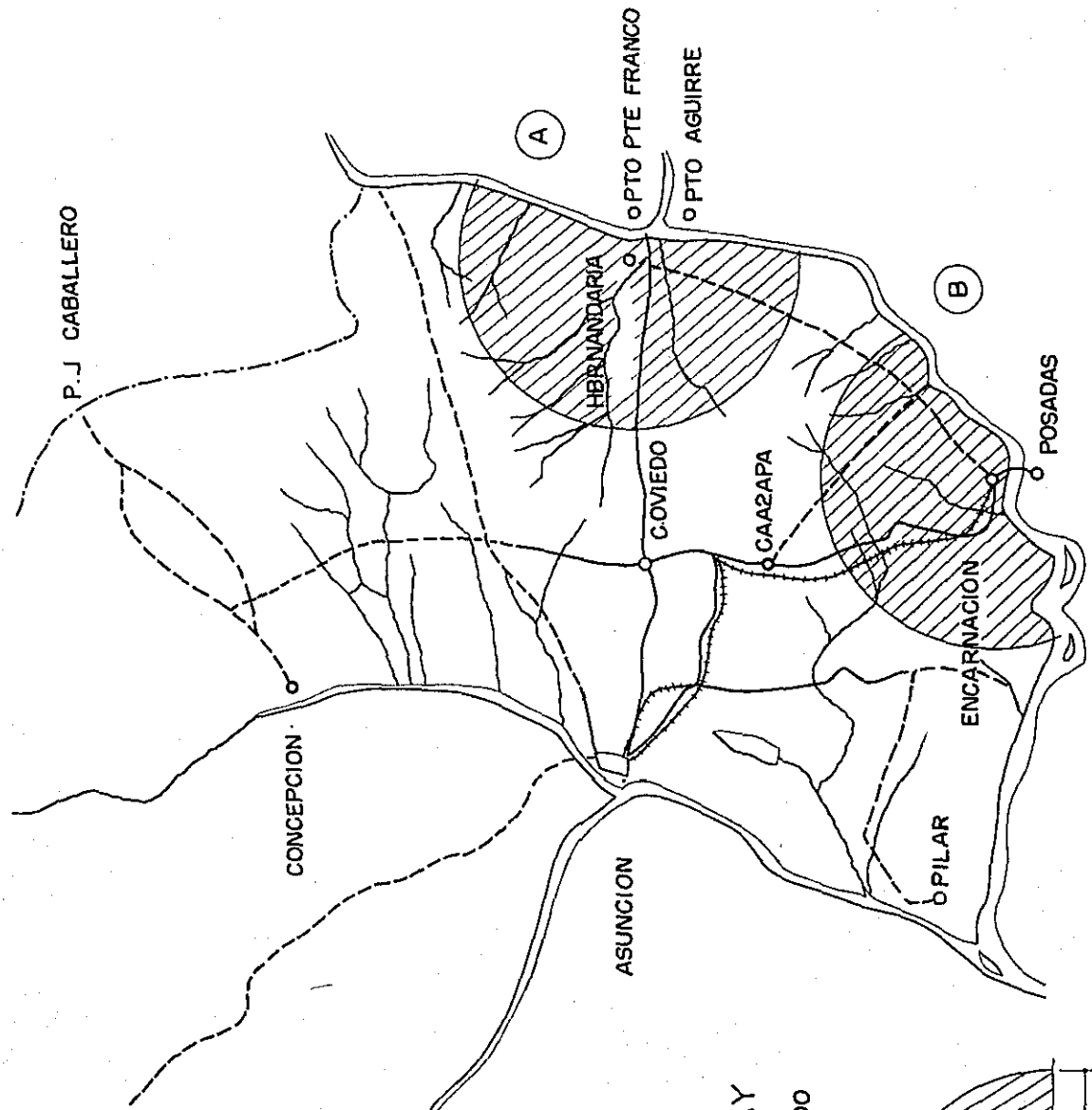
As the Paraguayan people is rich in martial spirit and full of the will to work, it is desirable for the Government and organs concerned to make the people fully aware that the export promotion is very important not only in encouraging the wood and related industries but also in advancing all the industries in this country, and to take measures so that as many people as possible may master the industrial skill.

At this juncture, meanwhile, it would be necessary to take various protective measures for fostering the domestic private enterprises as far as possible.

Paraguay is a dawning country. If the nation is self-awakened, and makes

efforts, she could compete with advanced nations in national power.

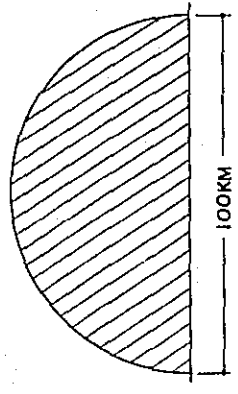
If the government considers a consolidated development program for the wood utilizing industry as one of its policies, it would be desirable to make further survey for its realization in co-operation with experts in various fields.



PARAGUAY

1/3,000,000

(Complex plan)



LAYOUT OF PLYWOOD PLANT AND THE EQUIPMENTS THEREOF

