

Appendix II

SUMMARIES OF THE TECHNICAL STUDIES PRESENTED
TO THE LATIN AMERICAN MEETING OF EXPERTS ON
THE PULP AND PAPER INDUSTRY



PULP AND PAPER CONSUMPTION, PRODUCTION AND TRADE
IN LATIN AMERICA

Paper for Printing and Writing

Tentative Forecasts for Demand in 1955, 1960 and 1965

by The Intelligence Unit of The Economist, London,
and UNESCO

The Economist Intelligence Unit was asked by UNESCO to prepare forecasts of demand for (a) newsprint and (b) printing paper - other than newsprint - and writing paper, in the years 1955, 1960 and 1965, in all countries and territories of the world where demand for either one of these two groups of commodities is expected to be at least 50 metric tons yearly before 1965.

In the preparation of such estimates, special consideration was given to the following factors:

(i) Demographic trends. Here an examination was made of the present level of population, the rate of growth of population in recent years, and the probable change in the absolute numbers and the age structure of the population.

(ii) Trends in Literacy. Where data was available, a study was made of the trend towards the elimination of illiteracy in the country concerned. This trend was then associated with the likely change in the demographic trends.

(iii) The trend of domestic paper production. The possibility of demand being either partly or entirely met by domestic production was considered to be one of the important factors influencing the level of consumption in a given area, since it would free a particular country or territory from eventual marketing or foreign exchange problems.

(iv) Probable fluctuations in income. For certain countries, it was possible to relate paper consumption to the present levels of over-all or per capita national incomes in real terms; then an estimate was made to establish the probable trend of real income during the period under consideration in order to determine, at least to some extent, the probable levels of future demand.

/In short,

In short, the methods used were basically non-statistical in the sense that no elaborate statistical relationships were established nor correlations attempted. The relevant variations were considered to be so numerous and their long-term trends so uncertain that the results of any complex statistical analysis would have been of doubtful value. In fact, a careful examination and assessment of the importance of the relevant factors relating to each country or territory was felt to be the only method likely to produce worth-while results.

The figures shown in the paper are the result of the analysis made. Country by country forecasts are given only for America, and in particular Latin America. Lack of data on the consumption of "other printing and writing paper" prevented forecasts being made for Cuba, Honduras and Uruguay. In the case of Argentina, it was difficult to suggest estimates of future demand for (a) newsprint and (b) other printing and writing paper because the "true" level of demand in post-war years is not exactly known. In particular the forecasts of future demand for newsprint are speculative and may well prove to be inadequate. They should be interpreted with caution.

Consumption trends in Wrapping, Packing and
Industrial Papers and Paperboard

by Louis T. Stevenson

This paper discusses growth trends in the United States in the hope that a study of these may be helpful to the pulp and paper industry in Latin America.

The tremendous growth in the consumption of packaging paper and board in the United States has been due largely to mass-marketing techniques, including national advertising, standardized packaging and display techniques. Paperboard has lent itself readily to this through its ability to carry both the advertising message and the product. The growth of the chain stores and supermarkets has at once facilitated and been made possible by these developments. Paper and board have played an important role in this revolution in distribution. Economy of packaging, safety in transportation and encouragement of impulse buying have been important factors. Per capita

/consumption is

consumption is rising, and with increasing population the rise in consumption is expected to continue.

A projection of past trends indicates a demand in 1965 of over 17 million tons for paperboard and almost 5 million tons for coarse paper. Whether these levels of consumption will be realized depends upon the continued development of new uses. If manufacturers aggressively continue their research and development programmes these figures may well be attained.

World Trends in Consumption of Newsprint,
other Printing Paper and Writing Paper

by UNESCO

Newsprint

Between 1928-1930 and 1950-51, world newsprint consumption expanded from an average yearly level of 6,340,000 tons to 9,283,000 tons.

In 1931-1933, owing to the depression, the average level of world consumption dropped to 5,786,000 tons. It then rose from 6,508,000 tons in 1934 to 8,095,000 tons in 1937, but dropped to 6,801,000 tons with the recession which took place in 1938.

From 1939 onwards, as a consequence of the second world war, world newsprint consumption dropped from 7,071,000 tons in the first year of the war to 4,549,000 tons in 1944.

From 1945 to 1951 increasing production gradually made it possible, as the world economic position recovered in the post-war period, to close the gap which had existed between supply and demand since 1939. It was only in 1949, however, when 8,464,000 tons of newsprint were consumed, that the pre-war yearly high of 8,095,000 tons in 1937 was surpassed.

The yearly average increase in world newsprint consumption from 1934 through 1937, when ground which had been lost during the depression of the early 1930's was being regained, was close on 600 thousand tons. The average yearly increase which took place in the post-war immediate period of recovery (1945 through 1950), was approximately 760 thousand tons.

Latin American newsprint consumption increased, between 1929 and 1947, in every year when the world figure advanced. Moreover, Latin

/American newsprint

American newsprint consumption increased in five years between 1929 and 1947 when aggregate world consumption dropped; these years being 1932, 1939, 1941, 1943 and 1944.

Excepting second world war years, the only years between 1929 and 1947 when the Latin American figure dropped were 1930, 1931 and 1938, when recessions in the United States affected the economy of several Latin American countries. While Latin America failed to show an increase in consumption in 1948, 1949 and 1950, this was not due to a decrease in aggregate demand but a consequence of the world newsprint shortage and of restrictions on imports made necessary in several countries by "hard" currency shortages. Excluding Argentina, which was perhaps the country most affected by the newsprint shortage, Latin America showed the following increase in consumption over the previous year: 13 thousand tons in 1948, 5 thousand tons in 1949, 17 thousand tons in 1950 and 30 thousand tons in 1951. Average yearly growth of Latin American newsprint consumption in 1947-1951 (excluding Argentina), was 17 thousand tons. The volume of demand for newsprint which remained unfilled in Latin America during this period is, however, not known exactly.

The second world war vastly changed the pattern of world newsprint distribution, the average figures for 1940-1945 being, in comparison with those for 1928-1939, as follows:

<u>Increases</u>	<u>Decreases</u>	<u>No change</u>
United States and Canada 16.8%	Europe 15.6%	South Central Asia
Latin America 1.4%	Far East 1.3%	South East Asia
Near and Middle East 0.1%	Oceania 0.5%	
	U.S.S.R. 0.6%	
	Africa 0.2%	

During the period 1946-1951, the newsprint purchasing position of United States consumers remained strong in comparison to that of consumers in other parts of the world, mainly owing to the division of world trade into "soft" and "hard" currency areas. The average percentage of world newsprint supplies consumed in the different areas in 1946-1951, in comparison to the 1928-1939 average, was as follows:

/Increases

<u>Increases</u>		<u>Decreases</u>	
United States and Canada	14.0%	Europe	15.0%
Latin America	1.2%	Far East	1.6%
U.S.S.R.	0.9%	Oceania	0.2%
South Central Asia	0.3%		
South East Asia	0.2%		
Near and Middle East	0.1%		
Africa	0.1%		

The above figures would seem to indicate that the main trends in world newsprint distribution in the post-war years have been:

- (1) A tendency for the combined United States and Canadian share of world supply to recede slowly.
- (2) A lasting contraction, in comparison with pre-war, in the share of world supply taken by Europe (excluding U.S.S.R.)
- (3) A stable consumption, on the long-term average, in Oceania, of approximately 2.5 per cent of the total world supply.
- (4) A long-term trend, in the underdeveloped areas of the world - Africa, Asia, Latin America, the U.S.S.R. - to take a larger share of world newsprint supply.

An examination of the growth of newsprint consumption in 1950-1951 over pre-war (1935-1939) in the various underdeveloped regions furthermore shows that, despite the world newsprint shortage and "hard" currency shortages, this expansion has been of 118 per cent in the near and Middle East, 100 per cent in South Central Asia and in Latin America (excluding Argentina) and 80 per cent in the U.S.S.R.; figures which compare with an increase of 67 per cent in aggregate United States and Canadian consumption.

Printing Paper (other than Newsprint) and Writing Paper

Only incomplete statistics are available on the world's consumption of other printing paper and writing paper. Nevertheless, consumption outside the People's Republics may be roughly estimated to have been as follows from

/1947 to

1947 to 1951: 1/

	(Metric tons)
1947	6,000,000
1948	6,200,000
1949	6,200,000
1950	7,000,000
1951	7,800,000

The above data would put the average yearly increase in world consumption (excluding the People's Republics) at approximately 450 thousand tons in 1947 to 1951. However, as consumption gains appear to have been much greater in 1950 and 1951 than in 1947-1949, and as the time series over which data are available is very short, it appears difficult to draw any definite conclusions in this respect.

Data on Latin American consumption of other printing paper and writing paper is only available for the years 1947 to 1951, and this excluding, for lack of information, consumption in the Bahama Islands, Barbados, Bermuda, British Honduras, British Guiana, Cuba, Guadeloupe, Honduras, Jamaica, Netherlands Antilles, Windward Islands and Uruguay. The incomplete figures which are known are given below:

	(metric tons)
1947	202,000
1948	182,000
1949	187,000
1950	216,000
1951	234,000

Judging from the above figures, Latin America would consume between 3 and 4 per cent of the printing paper (other than newsprint) and writing paper used in the world (excluding the People's Republics).

1/ As used in the present paper, the term "People's Republics" is taken to include: Albania, Bulgaria, Continental China, Czechoslovakia, German Democratic Republic, Hungary, Korea (North), Mongolian People's Republic, Poland, Rumania, U.S.S.R. and Yugoslavia.

ECONOMIC ASPECTS OF PULP AND PAPER MANUFACTURE FROM LATIN
AMERICAN TROPICAL AND SUB-TROPICAL HARDWOODS

Influence of Mills Size and Integration upon
Investment and Cost

by AB Karlstads Mekaniska Werkstad

This paper consists of 15 specially prepared tables providing cost data for non-integrated and integrated sulphate kraft pulp mills. Comparisons are made for daily capacities of 50, 100, 200 and 300 metric tons, and for bleached and unbleached pulp. Capital investment requirements, labour and administrative costs and building volumes are all calculated for the different types of mill.

The general conclusion of the paper is that under Swedish conditions, it is not profitable to build pulp or paper mills with a daily capacity of 50 tons or less, and that to be profitable the capacity should be at least 100 tons a day.

Surveying of Locational Factors for the Installation of
Pulp and Paper Industries in Tropical Regions

by The Centre de Recherches et d'Etudes pour l'Industrie
de la Cellulose et du Papier

Tropical raw materials for the pulp and paper industry are abundant and cheap, but a detailed preliminary study is required before preparing definite plans to install an integrated pulp and paper mill.

This preliminary study falls into four distinct phases: (1) a rapid survey of the country as a whole, and of the general possibilities for pulp and paper development; this survey will enable certain areas to be delineated within which there seems to be a prima facie case for establishing a new project; (2) a more intensive survey of the areas selected, and a consideration of the process to be adopted; prospective sites will now emerge; (3) a detailed study of local conditions, covering all aspects of intended operations; and (4) an appraisal of production conditions, financial requirements, and production costs.

/The paper

The paper discusses the categories of information which must be sought at each stage, and the methods by which it can be obtained. The need for making the fullest possible use of existing sources of information is stressed.

Forest Inventories in Tropical Regions

by Dammis Heinsdijk

More intensive management in temperate forests has led to the need for better assessment of forest resources. Earlier inventory techniques have been improved to give greater precision. In tropical forests, though a wider margin of error may be acceptable, the risks involved in pioneer development impose the need for careful assessment.

In the tropical forest there is no technical alternative to aerial survey combined with surface sampling. The latter is difficult and costly, but the extent, and therefore the expense, of the field work necessary to achieve a required degree of precision can be considerably reduced by appropriate air surveys and correct interpretation of air photographs. The experience and skill of the photo-reader are extremely important, since skilled interpretation, making use of data accumulated in widespread sampling, can provide a wide range of information.

Aerial survey can do little to help the entrepreneur concerned with the selective exploitation of a limited number of precious species. So far as pulp exploitation is concerned, the wider the range of fibres (and species) acceptable for pulping, the better will be the information obtained, both in volume and precision, for a given expenditure.

The paper presents some preliminary results of field work carried out in the Amazon. The experience of tropical inventorying in the Amazon so far tends to confirm that acquired by the author earlier in Surinam.

/Preliminary Projects

Preliminary Projects for Pulp Mills and their Service
Facilities in Tropical Regions

by The Centre de Recherches et d'Etudes pour l'Industrie
de la Cellulose et du Papier

This paper sets out the general principles to be borne in mind in drawing up plants for the establishment of a pulp mill in a tropical region. It examines the various stages, from the conception of the plant and the specification of equipment and buildings, to the laying down of a work schedule in its different phases; it draws attention to the difficulties which are likely to be met with at each stage in consequence of the special environmental conditions (climate, lower productivity of labour, communications, etc.).

While the method of building a tropical mill does not differ essentially from that employed in building a mill elsewhere, planning needs to be at once more detailed and more flexible. Generally speaking it will take longer, and the work schedule must allow for the fact that, because of the lack of local expertise and the distance from equipment suppliers, relatively slight hitches, which could be rapidly overcome in a developed country, can occasion considerable delays and pile up costs.

Wood Extraction and Transportation in Tropical Regions

by Pierre Allouard

This paper describes the conditions offered by tropical and sub-tropical forests for the extraction and transport of wood for making pulp. It also examines the influence exerted by these conditions on the investment required for exploitation and on the cost of the wood delivered to the mill.

Certain sites were selected to illustrate these points. These were in Yucatán (Mexico), Amapá (Brazil), Misiones (Argentina) and the River Magdalena Valley (Colombia), in which the author either carried out surveys or undertook visits of inspection.

Estimates of pulpwood costs in these four locations are given, explained and compared.

Economic Availability of Pulpwood from Latin-American
Sub-tropical Forests

by Orlando A. D'Adamo

This paper emphasizes the need for comprehensive planning of raw material supplies from sub-tropical forests for industrial pulp and paper mills. The danger of exhausting forest reserves must be avoided. In the case of tropical and sub-tropical rain forests, irrational exploitation inevitably leads sooner or later to a limitation of industrial development, with consequent economic and social disturbances.

Industrial planners must recognize the fundamental need to conserve forest stands either by reforestation or by natural regeneration. Studies carried out in heterogeneous forests in the Province of Misiones (Argentina) show the economic possibility of ensuring industrial supply by applying specific silvicultural methods.

The paper considers the economic exploitation of tropical forests for the dual purpose of: a) providing raw material for the pulp and paper industry; and b) providing raw material for other industries. This dual possibility arises from the very nature of the stands, where species of recognized industrial and commercial value are found in association with others of little or no value. The utilization of the latter in the pulp and paper industry would provide all the conditions for conserving and improving Latin-America's forestry resources.

Pulpwood from Peruvian "Cetico" (Cecropia)

by Banco de Fomento Agropecuario del Peru

The paper assesses the forestry resources of the Amazon basin and goes on to give a detailed description of the botanical and silvicultural characteristics of Cecropia. This tree grows rapidly, has good fibre properties and is ideally suited to provide raw material for making pulp and paper.

The Banco de Fomento Agropecuario del Peru began studies in 1939 to determine the technical and economic possibilities of using this raw

/material. Tests

material. Tests made by the Cellulose Development Corporation (England), by a pulp mill at Turin (Italy) and by the Batineyret Company (France) led to the production of several tons of newsprint; these were used for normal newspaper issues in Italy, France and Peru.

At the same time the Peruvian National Aerial Photography Service carried out a preliminary inventory which indicated that there were large stands of cético in the Pucallpa region. This is undoubtedly the most suitable area for installing a pulp and paper mill.

The sylvicultural studies on the spot have examined the characteristics of the natural growth and regeneration of cético and the possibility of establishing plantations.

According to the work undertaken in Italy and England and in connexion with the Batineyret project, paper produced entirely from cético can compete in the Lima market with imported papers; a mill with an annual capacity of 18,000 tons could be installed in the zone of Pucallpa. Peru currently imports some 12,000 tons a year of newsprint, at a cost of three million dollars.

A FAO mission has advised that the project is perfectly feasible, both from the technical and the economic standpoint.

Pulping of Latin American Woods

by G.H. Chidester and E.R. Schafer

This report describes briefly various pulping experiments at the U.S. Forest Products Laboratory on 39 individual species and 10 mixtures of species. The various mixtures were comprised of some of these woods and 70 additional ones, making a total of 109 woods tested individually, or in mixtures, or both. The mixtures ranged in composition from 2 to 32 different woods.

The Technique of Pulping Mixtures of Tropical Woods

by Régie Industrielle de la Cellulose Coloniale

This paper aims at demonstrating that from the point of view of the pulp and paper industry the only rational exploitation of tropical forests

/consists of

consists of pulping mixtures of various species. The advantages of pulping mixed woods shown by tests carried out in a pilot plant installed at Bimpresso on the Ivory Coast are discussed, and the results obtained with alternative mixtures of twelve different species are shown.

The second part of the study describes the mixing technique used in order to pass from the laboratory to the industrial stage. Moreover, tropical species are classified into two groups according to their paper-making and pulping properties.

As regards to variations in the composition of the mixtures, the results obtained in two series of studies are examined, their respective objectives being to assess the degree of variation allowable within each mixture and to determine the effects of too great a variation.

The regeneration of the forest after its first exploitation should tend towards "controlled heterogeneity".

It is stated that the composition of the mixture can contain important botanical differences without prejudicing the constancy of results, and it is suggested that the sulphate or the soda-sulphur processes with slight modifications according to the mixture are the most suitable.

Preliminary Results on the Pulping of some Brazilian
Tropical and Sub-Tropical Hardwoods

by L. Rys, A. Boenisch, W. Overbeck and H. Schwarz

About twenty tropical wood species from the Amazon region and thirty species of subtropical wood from Paraná State were examined as to physical properties, chemical wood composition and fibre length, and microphotographs of the fibres of these single woods after cooking by the sulphate process are presented.

The mixture of these woods was cooked in a laboratory digester, using the standard sulphate process. The resulting pulps were tested before and after bleaching and the mechanical properties determined after beating in a laboratory Valley beater.

It was found that the mixture of woods with a density range from 0.25 to 1.1 could be cooked successfully by the sulphate process, and the resulting pulp could be bleached to a good colour without difficulties, using a normal three-stage bleaching method.

/The mechanical

The mechanical strength of these pulps, bleached or unbleached, is satisfactory for paper making.

These results indicate that similar tropical or subtropical wood could be used for paper making without any special selection.

The Pulping of Peruvian Cetico for the Manufacture of Newsprint

by Batineyret

During 1951 and 1952, at the request of the Corporación de las Amazonas (later to become the Departamento de la Selva de Fomento Agropecuario del Perú), the French firm of Batineyret studied the possibility of manufacturing newsprint from Peruvian cetico. For this purpose, the Corporación de las Amazonas sent 50 tons of cetico logs to France.

Part of this wood was treated industrially in a mechanical pulp mill in the French Alps. A mechanical pulp was obtained with good physical properties.

Mixed with 25-30 per cent chemical spruce pulp, the cetico mechanical pulp gave a paper comparable in every aspect with ordinary newsprint. This paper was used successfully for a February 1952 issue of a French daily newspaper.

Cetico Chemical Pulp and 100 per cent Cetico Paper

Laboratory and semi-industrial trials were then undertaken, using the sulphate process to ascertain whether cetico chemical pulp could be used as a substitute for resinuous chemical pulp in the manufacture of newsprint. Bleached and unbleached pulps were obtained, with characteristics very closely resembling those of pulps from European resinous species, and only slightly inferior to spruce pulp characteristics.

From a mixture of cetico chemical and mechanical pulps (35 per cent chemical), newsprint was manufactured on a semi-industrial scale; this had characteristics wholly similar to those of newsprint currently available on the world market.

A Batineyret mission spent several months in Peru studying local conditions for establishing a mill. Details of organization, production and cost price were considered.

/The mission

The mission studies the availability and cost of all raw materials, the organization of transport facilities; sources of power; mill site; cost of manual labour; investment; and working capital required. It was concluded that the establishment of a newsprint-mill, using cético as raw material, would be a technically feasible and profitable undertaking.

Economics of Newsprint Production

by P.R. Sandwell, President, Sandwell & Co. Ltd.

In the major newsprint export countries the minimum economic size of a new newsprint paper mill has risen from 300 to 500 tons of daily capacity in the past fifteen years. The purpose of the paper is to discuss the reasons for this situation and to examine the extent to which they would apply in Latin America. The information contained in the paper is intended to explain current North American newsprint manufacturing practices and to establish a basis for assessing proposed developments in Latin America.

In Part I of the paper the relationship between mill size and capital investment and the corresponding total fixed charge against production is evaluated for North American and European conditions. Similar relationships between mill size and manufacturing cost and profit are developed. It is evident on the basis of the figures so developed that in North America and Europe a new mill to produce newsprint in its usual form can only do so economically if it is of relatively large size. Part I concludes by enumerating the conditions which have fostered and allowed this situation.

Part II of the paper deals with Latin American conditions. Comparative relationships between size and capital investment are developed for a hypothetical mill which would have raw materials suitable for pulping by conventional methods and which would serve the larger metropolitan markets. Capital costs are found to be more or less the same, and because of compensating factors, fixed charges are found to be about the same as in North America. General economic circumstances in respect to markets, raw materials, energy, transportation, labour, and sources of capital alter the relationships between mill size and manufacturing cost and profit as they are known in North America.

On the basis of conventional techniques, and under the conditions assumed for the purpose of this paper, it appears that newsprint can be produced economically in mills of more modest size in Latin America than in the Northern Hemisphere. Very small mills, sized to match raw material or market conditions, require either some special local advantage or integration with other plants in order to make them economic. It is evident, however, that conditions in Latin America are sufficiently different from those in North America to justify departure from conventional techniques. More liberal paper quality requirements and the current development of new processes well suited to Latin American raw materials suggest the possibility of new mill designs, equipment better suited to small capacities, and a balance between heat and power, the combination of which may well overcome the disabilities of the cost patterns inherent in conventional newsprint manufacturing techniques.

The Use, in Newsprint, of Bleached Cold Soda Pulps from
certain Mixtures of Latin American Hardwoods

by G.H. Chidester and K.J. Erown

The high yield, cold soda pulping process was applied to two mixtures of Latin American hardwoods. Mixtures of equal parts of 8 hardwoods from the Yucatán forests and 4 Brazilian eucalypts were pulped under varying conditions. Quantities of the cold soda pulps, prepared under optimum conditions, were semi-bleached and used in newsprint papermaking trials.

The major results were as follows:

- (1) Newsprint papers made entirely from the semi-bleached cold soda pulps were more than adequate in strength and brightness but were more transparent than standard newsprint, and the porosity was high. The opacity was improved equally as well by adding 40 per cent of groundwood pulp or 15 per cent of clay to the furnish containing the Yucatán cold soda pulp. These additions also decreased the strength properties of the paper, but not below those of a commercial newsprint.
- (2) Satisfactory cold soda pulps were obtained in yields of 84 to 91 per cent. The pulps were bulky and slightly darker and weaker than cold soda pulps prepared from aspen and cottonwood by this process.

/(3) The

(3) The cold soda pulps were bleached to brightnesses in a range of 56 to 69 per cent by the application of calcium hypochlorite with 10 to 15 per cent available chlorine based on the moisture-free pulp. The pulps had good appearance and were satisfactorily free of shives.

Economic Aspects of Integrating Pulp and Paper Industries
with other Forest Industries

by J.A. Hall

In this paper the author points out the effects of a rational exploitation of the forest on its yield, and the advisability of integrating the forest products industries in order to make the best possible use of the crop.

It is emphasized that the industrially less-developed countries of the world should take advantage of the experience gained by those countries with a higher degree of industrialization, and reference is made to the special example provided by the United States whose forest resources were almost depleted in the past century in order to meet the extraordinary demand for wood resulting from its industrial development. Fortunately, it was gradually realized that the character of the forests is limited and that it would be necessary to exploit them in an integrated form in order to be able to produce the wood needed to maintain the standard of living.

It is recommended, therefore, that, in the long-range planning of the exploitation of Latin American forest resources, integrated operations should be envisaged such as are now common in the northern hemisphere.

The author points out an important feature of forest crops, namely, that the methods used in harvesting go far towards determining the yield and quality of succeeding crops.

Reference is made to an ideal integrated plan according to which the residue from one stage in processing would be picked up and used at an earlier stage, and in which activities based on mechanical conversion, such as sawmills and chemical industries like that of pulp and paper, would take a part. Chemical industries act as scavengers, converting great quantities of waste material into valuable products.

Next are reviewed the minimum economic size of each component of an

/integrated operation

integrated operation, the size of the potential market for each product, the adequate forest inventory which is a prerequisite for the establishment of an integrated industry as well as the adequate marketing research.

The degree and form of integration that is best for any given situation such as the size and character of forest ownership, the history of forest exploitation and development, the nature of the industrial setup and various economic conditions such as density of population, size of the potential market, distance from markets, transportation facilities, sources of power, etc. are also discussed here.

Completely integrated operations usually demand a sustained supply of raw material. In many cases such a supply is dependent upon the general state of industrial and cultural development in a given area. Integration, therefore, will usually proceed parallel to the general industrial development of the country. If this moves too fast, it may bog down in raw material shortages or a lack of markets for its products.

Wood by-products are briefly enumerated and some important comments are made on the use of wood as a source of carbohydrates which in their turn could serve to increase the world food supply.

Finally, it is stated that planning for the integrated utilization of a forest in an industrially under-developed country requires vision, study, and careful consideration of inter-related economic factors. The result of such planning would be the more complete employment of wood in meeting human needs.

The Amazon Region and the Paper Industry

by A. de Miranda Bastos

The Amazon basin covers a vast area of some 7 million square kilometres, about half of which lies within the territory of Brazil. Because of its extent and the variations in its climate, it contains a large variety of trees, which have been the object of research for many years. It is only recently, however, that a systematic study has been made of the density of the stands in some areas and of their economic value in terms of area covered, means of transport, composition of the stands and frequency of the various species.

/The Amazon

The Amazon basin is destined to become a world centre of pulp and paper production. Nevertheless, many of the projects and plans put forward over the last fifty years with a view to industrializing local economic resources, have been doomed to failure. There have been many reasons for such disappointments, including shortage of capital and labour, unhealthy conditions, poor transport and insufficient agricultural production to meet local demand.

These difficulties are in course of being overcome. Towards the end of 1951, the Food and Agriculture Organization of the United Nations appointed a mission which is making field studies. Its findings will be particularly interesting, in view of the information and recommendations contained therein.

In addition, the Superintendencia do Plano de Valorizacao Economica da Amazonia (SPVEA) set up in 1953 to foster the development of agricultural, industrial and mining production in the region, is undertaking development work of a positive nature, for which it has large and ever-increasing economic resources at its disposal. The Federal Territory of Amapá, created in 1943, contains, apart from its fibre resources, rich manganese deposits and a considerable hydro-electric potential, and has helped to develop the Brazilian Amazon region. Studies of forest species have been made in the Territory with a view to exploitation. Experts from FAO and ECLA have concentrated their efforts on the area close to the Paredao waterfalls on the Araguavi river; a hydro-electric plant is planned at these falls, with an initial capacity of 25,000 kilowatts and possibilities of expansion to 100,000 kilowatts. All the conditions are present for converting this zone into a large paper-producing centre. Light-coloured species, with a low density, predominate in the area. It has been estimated that economic exploitation could be based on a minimum of 250 cubic metres per hectare. Again, surveys made in the vicinity of the Vila-Nova River proved that, on the basis only of trees with diameters of more than 30 centimetres, over 240 cubic metres of usable wood per hectare would result; this wood conversely, is dark-coloured and has a high density. This proves that there is an immense variety of species to be found in the region and that, as regards the paper industry, the important thing is to know how to select the area which will meet technical and economic requirements.

Potential Use of Wood from the Upper Parana (Paraguay)
for making Pulp and Paper

by E.B. Hamill

The dense sub-tropical forest of the Upper Paraná, in Paraguay, has excellent potentialities for the establishment of a pulp and paper industry. The soil is fertile and the climate is good; large coniferous plantations can be developed; there is a navigable river system; plenty of water is available for pulping operations and as a potential source of hydro-electric power. The Servicio Técnico Interamericano de Cooperación Agrícola, at the request of the Paraguayan Government, undertook a study which established that the installation of a pulp and paper industry in this area would be a key factor in an integrated forest utilization programme and in the colonization of the region. The problems to be solved are of an economic rather than of a technical nature.

The upper Paraná forest is some 350 kilometres in length and from 50 to 75 kilometres wide. A section of this area extending some 100 kilometres along the Paraná river and about 30 kilometres wide offers the best prospects. It is crossed by navigable rivers and contains the three most important hydro-electric potentials. There are on an average some 30 different tree species per hectare; Leguminosae predominate, over 27 of that family having been identified. Enough varieties of bamboo are found to provide roughly 10 per cent of the fibrous raw material available in the Alto Paraná for paper making. It is estimated that, including all species, this region could supply about 100 cubic metres of usable wood per hectare.

Despite their heterogeneous nature, the species of the Upper Parana forest region, mixed in the same proportion as found, will make a homogeneous paper pulp under normal working conditions. No special methods are required. The use of chemicals is relatively low in both cooking liquor and bleaching. The pulp is not suitable for making high-resistance packing paper, since its properties are only average, but by mixing it with 40 to 60 per cent coniferous pulp or pulp made from certain tropical plants, first quality wrapping papers can be obtained. The pulp is easy to bleach and can be used to make various types of writing paper. Mixed with 20 to 40 per cent of coniferous pulp, it can be used for fine printing papers. It can be blended

/with mechanical

with mechanical pulp or other low-grade materials to make ordinary writing or printing papers; there seems little likelihood, however, that the pulp could be used alone for making newsprint, in view of its poor resistance characteristics. Tests of the suitability of Upper Parana species for making purified pulp for chemical use do not entirely rule out this possibility, though they lead to no definite conclusion.

ASPECTS OF PULP AND PAPER MANUFACTURE BASED ON OTHER
LATIN AMERICAN FOREST RESOURCES

Mexican Experience with Coniferous Plantations for Pulp and Paper

by Hans Lenz

In Mexico industrial plantations of timber were originated by paper manufacturers with a view to increasing their long-term resources of raw material. The paper describes the results achieved at the privately-owned plantation of "La Venta", located 24 kilometres from the capital, at an average altitude of 2,700 metres. This plantation has supplied wood for the paper industry since 1920.

Planting tests have been made with a number of exotic species such as Pinus radiata, P. caribaea, P. nigra, P. alepensis, P. resinosa, P. ponderosa and others, and also with Douglas fir (Pseudotsuga taxifolia) and Abies concolor. It has been found, however, that the native species yield better results particularly Pinus patula, P. montezumae and Abies religiosa (oyamel). Special care has to be taken to protect the oyamel during its growing period.

The experience at "La Venta" has been corroborated by similar work carried out at Zacayucan where the first trees were planted in 1936. Here the species have had to be limited to pines (Pinus patula and P. montezumae) since the oyamel did not thrive because of the altitude.

Pulpwood from Eucalyptus Plantations

by Armando Navarro Sampaio

In this paper the author deals with the economic culture of the eucalyptus in the State of Sao Paulo, Brazil, initiated in 1903 by the Paulista Railroad Company, under the direction of the agronomist Edmundo Navarro de Andrade.

/After a

After a brief historical description of the dissemination of the genus *Eucalyptus* in Latin America, observations are presented on the behaviour of the different species in various types of soil and climate, bearing in mind the future utilization of the wood.

He describes in detail methods of planting and soil treatment, control of diseases and pests, and the problem of fires.

He also presents in detail a plan for the selection of genetic studies on the principal species planted.

Estimates in physical units, and in Brazilian currency per hectare have been made on the cost of planting and cultural operations until the exploitation of the wood.

The best methods of exploitation of the wood for various purposes are described, and presented together with statistical data on fuelwood production per hectare, and the development in diameter and height of the different species planted in the State of Sao Paulo.

He includes all the data obtained during fifty years of research, on the various uses of eucalyptus wood for fuel, charcoal, posts, piles, sleepers, civil constructions, joinery, pulp, essential oils and tannin.

The result of the author's observations in Australia, where he travelled during September and October of 1952 as Brazilian representative in a UNFAO mission to study the use of eucalyptus for pulp and paper, are also related. He visited three big paper factories there working with eucalyptus pulp, utilized in the following proportions:

Newsprint paper - Eucalyptus pulp	80%
Long-fibre pulp	20%
<u>Mechanical pulp</u>	
Kraft paper - Eucalyptus pulp	60%
Long-fibre pulp	40%
<u>Chemical pulp</u>	
Superior quality paper for books, magazines and writing paper	
Eucalyptus pulp -	90 to 100%

Finally he describes what is being done in relation to the production of pulp and paper from eucalyptus wood in the State of Sao Paulo, where there are several firms producing different types of paper using varying proportions of Eucalyptus Saligna pulp, together with mechanical pulp from

the Paraná Pine (Araucaria angustifolia) or imported long-fibre pulp. The average proportion of eucalyptus pulp used in the fabrication of writing paper and book paper in Sao Paulo is 75 per cent.

Pulpwood from Plantations of Exotic Conifers in the Paraná Delta

by Celulosa Argentina S.A.

- 1) During 12 years of experimentation with 9 species of conifers in the low floodlands of the Paraná Delta, only Pinus Elliottii (until 2 years ago considered to be P. caribaea) and Pinus Taeda have shown a favourable adaptation to this environment with a rapid rate of growth, resistance to edaphic humidity, and tolerance to waterlogged lands and acid soils.
- 2) Planting may be carried out between April and August, on land with or without flood control once ditches have been made, utilizing bare root plants or plants placed previously in rough clay pots; the bare root plants placed in their final position cost approximately Arg. \$0.10 each, while those in clay pots cost Arg. \$0.40 each.
- 3) The following spacing in planting is considered advisable: 2 x 2 metres in the case of Pinus Elliottii and 2 x 2.5 metres for Pinus Taeda.
- 4) As the large majority of the Delta lands do not have a deep underground water layer, the roots of the pines extend laterally between 10 and 50 centimetres below the surface of the soil.
- 5) The highest rates of growth have been noted in soils that have their sandy layer near the surface, or in those which have a thin, loose, permeable layer of silt underneath the organic layer, permitting the capillary rise of the water contained in the sandy layer.
- 6) The average annual growth of the existing plantations in the Delta has been more than 1 metre in height and over 1.5 centimetres in diameter (measured at a height of 1 m. 30 cm.).
- 7) On the basis of the average height and diameter measurements of pines in a small forest and the thinning carried out in the same plantation, the estimated volume per hectare in the twelfth year of growth has been 255 cubic metres of barked wood in the case of Pinus Elliottii and 280 cubic metres for Pinus Taeda.
- 8) Under present conditions of cultivation the average annual increase

/per hectare

per hectare, taking as a basis the volume of gross wood, has been 30 cubic metres for *Pinus Elliottii* and 33 cubic metres for *Pinus Taeda*.

Forestry Measures Undertaken by the Argentine Government
in order to Increase Pulp and Paper Production

by Administración Nacional de Bosques, Ministerio
de Agricultura y Ganadería de la Nación (Argentina)

In 1938 the importance of paper consumption in Argentina was already apparent, and demand had increased gradually year by year.

With the object of promoting pulp and paper production, the Argentine Government has projected, as part of the First and Second Five-Year Plan, the installation of new mills - issuing Decree 8594/49 to promote supplies of raw materials - and the cultivation of plantations of species adequate for this purpose.

The Government set aside the forests of the San Pedro Colony in the province of Misiones, where araucaria angustifolia is grown, a species that can be satisfactorily utilized in the manufacture of chemical pulp, and also the Paraná Delta zone, with appropriate climatic and soil conditions and an extensive area for plantations of Salicaceous species, employed in the manufacture of mechanical pulp, and had initiated a definite development movement in these areas.

This naturally does not mean that other species and areas which could contribute to increased production of raw materials for pulp and paper are not being taken into consideration.

In turn, forestry credit - guaranteed by Art. 59 of Law 13,273 - favours the cultivation of tree plantations by private enterprise, and this, together with permanent technical advice and the necessary supplies of seeds, slips and plants at favourable prices, will enable Argentina's forestry activities to supply the paper industry with the raw material required for its development.

Furthermore, in order to consider the possibilities of utilizing native species as raw material to satisfy the demand of the pulp and paper industry, the National Administration of Forests is carrying out the necessary technological investigations.

/In conclusion

In conclusion, the Argentine Government, determined to solve this serious problem, has organized the country's forestry activities in order to ensure an adequate supply of raw materials required by the pulp and paper industry to meet domestic demand.

South African Experience in the Planting of Exotic Species

by N.L. King

This paper briefly outlines the natural timber resources of South Africa and the efforts that have been made to augment the meagre supplies.

It traces the development of forestry from South Western Cape eastwards through Natal to the Transvaal and indicates the main species that have proved successful.

It gives the areas afforested with exotic species, the present yield and the uses to which the woods are being put.

Finally, it discusses the timber requirements of South Africa, the potential yield of plantations and forests and the possibility of extending plantations to an extent sufficient to satisfy the needs of the country.

Production of Chemical Pulp and Groundwood from Willow,

Poplar and Poplar Willow

by Celulosa Argentina S.A.

The paper gives a short account of the salicaceous species with special reference to the types growing in the Paraná Delta. Poplar and willow woods in Argentina provide good mechanical pulps for the manufacture of many types of board and certain grades of paper. Particulars are given of experiments carried out with the aim of improving the quality of the pulps.

Tests at the Forest Products Laboratory, Madison, U.S.A., have shown that the varieties of poplar found in the Delta can be used to make semi-chemical pulps, because of their high cellulose and low lignin contents. The results of tests are presented in several tables.

Tests were also made to determine the quality and characteristics of the mechanical pulp obtained by dressing the pulpstone of the grinder at different speeds. The results of these tests are described, and the conclusions enumerated.

Pulp and Paper Making from Eucalyptus in Australia

by R.B. Jeffreys

In this paper the author discusses the use of Eucalyptus in Australia for the manufacture of pulp and paper. Reference is made to the fact that although there are over four hundred species of Eucalyptus growing in Australia, less than twenty of them are used in the pulp and paper industry. A list of the species that are used is given. The other species are not all unsuitable for paper making and the reasons for the limitations in use to twenty species are discussed.

Brief references are made to the use of Bleached Soda Eucalypt pulp, in the manufacture of writing and printing papers, and to the use of Eucalypt Mechanical pulp in the manufacture of newsprint. The manufacture of Eucalypt Kraft pulp and its uses in the unbleached and bleached forms for making wrapping papers, lithos and liner boards are discussed in some detail.

Particular attention is paid to the difficulties that have been experienced in making and using Eucalypt Kraft pulp. Methods of overcoming the difficulties are mentioned. In making the pulp the main difficulties were associated with evaporating and burning the black liquors. The black liquors have a very high viscosity which effects the evaporation and the solids tend to form a black inert mass on the floor of the recovery furnaces.

Reference is made to the wide variations in the quality of the pulps produced from Eucalypts of different species and to the effect of growth rate and age on the pulping properties of pulpwoods from the same species. The effect of these factors on black liquor properties is also discussed.

On the paper machine the chief trouble experienced was sticking at the press and the solution to this problem is mentioned.

The author compares the Eucalypt forests of Australia from which the various pulp mills are being supplied, with the Eucalypt plantations in other parts of the world. Most of the Australian pulpwood comes from mature and overmature forests, a considerable proportion of which have grown at a slow rate. The overseas plantations are comparatively young and appear to have

/been goown

been grown mainly at a fairly rapid rate. It is suggested that the overseas Eucalypts will probably make better chemical pulps than the average Australian pulpwood and that the black liquors will probably give less trouble in the evaporators and the recovery furnaces.

Research into the Use of Trithrinax Campestris (Palma, Palmera, Caranday) leaves as Raw Material for Paper

by Walter Ginzel

The palm, Trithrinax campestris, grows in natural stands in various parts of Argentina, such as Santa Fé, Cordoba, San Luis, Santiago del Estero, Tucumán, Corrientes and the province of Entre Ríos, where the largest stands are found. This palm, which is popularly known as the "palma", "palmera" or "caranday" according to the area where it is found, grows to a height of 2 to 4 metres, the trunk being covered with remains of foliage; the leaves are flabellated and divided into segments. It is these leaves which can be used, not only in the textile industry, but also, when green and well-developed, in the paper industry.

The fibres are from 0.7 to 2.5 millimetres long and from 8 to 20 micra wide; thus the average length/width ratio is 100:1, making them suitable for use in paper. Their structure is cylindrical, with very thick walls, so that they are suitable without much refining, for making bulky, absorbent papers; because of their fibrillating capacity, they can also be used to obtain strong papers.

The alkaline process, with caustic soda, was used for tests on a laboratory and on a semi-industrial scale. Air-dried leaves with 10 per cent moisture were cut up into sizes of 2 to 3 centimetres and treated in the digesters. Caustic soda consumption ranged from 8 to 10 per cent, calculated on dry raw material, depending on the method of cooking used. The pulp yield was 40 to 50 per cent, which is similar to that of straw and other annuals already used industrially on a large scale. The completely dry pulp analysed as follows: 73 per cent cellulose; 17 per cent pentosans; 7 per cent lignin and 3 per cent ash. Because of the process used and the composition of the pulp, this may be classified as a type of "semi-chemical pulp".

/Trithrinax palms

Trithrinax palms grow abundantly in several parts of Argentina; this, coupled with their easy exploitation and the successful tests made, indicates that this new raw material for pulping can be used on an industrial scale.

ECONOMICS OF PULP AND PAPER MANUFACTURE FROM SUGAR CANE BAGASSE

Pulping with Particular Reference to the

Mechano-Chemical Process

by Elbert C. Lathrop and Samuel I. Aronovsky

Sugarcane bagasse is a valuable material for the pulp and paper industries. Much has appeared of late in the daily and technical press about new processes for pulping bagasse, new mills to be built, and particularly about making newsprint from bagasse alone. These stories have been written for many purposes, political, promotional, and technical. Most of the reports have, of course, some basis in fact, but the bias with which some were written and the unqualified character of many of the statements have proved very confusing. On the one hand, a person might be led to believe that bagasse is ideally suited to make almost any kind of paper, and on the other that its utility is quite limited. Neither opinion would be correct. It is the purpose of this paper to present factual information concerning the kinds of pulps and papers, from the poorest to the best, that our present knowledge tells us may be made from bagasse.

From the standpoint of necessity owing to unavailability of wood or other pulps, it is possible to manufacture usable papers or boards from pulps made from whole or screened bagasse but these will be of low quality. Pulps made by cooking with lime will be useful only in making low-quality board or wrappings. Waste papers if available can be used to advantage in the manufacture of such products.

By pulping with the pressure, Celdecor, or mechano-chemical (M-C) processes, using chemicals composed of or containing caustic soda, much higher grade products, including bleached pulps, may be made from whole or screened bagasse. When bagasse pulps and waste papers alone are available, the use of liberal amounts of fillers in making printing and other higher

/grade papers

grade papers is advisable. By using such methods, boards as well as printing papers of various quality can be produced which will be acceptable in many markets. Much better results will ensue if mechanical wood pulps or kraft pulps made from tropical or hard woods are available for blending with the bagasse pulps. In such cases the best use for the bagasse pulps will be as blends with the virgin wood pulps and such waste papers and fillers as may be available. The use of various such combinations will make possible the manufacture of a much wider range of fairly good to good papers.

The best results can be expected from pulping only depithed bagasse fibre. If commercial uses for the separated pith, such as fuel, feed, or paper filler, can be found, the costs of such depithed pulps may be lower than those of pulps made from whole or screened bagasse. Such bagasse pulps can be used alone for the manufacture of the highest quality corrugating board medium and also for the manufacture of glassine and certain kinds of waxing papers. When these unbleached pulps are blended with kraft or sulfite softwood pulps, superior wrappings, bag, and multiwall bag papers and liner boards can be manufactured. When the pulps are bleached and blended with bleached mechanical pulps or bleached chemical wood pulps, a wide variety of very high-quality printing and specialty papers becomes available. These bleached bagasse pulps can replace other chemical pulps in blends with mechanical wood pulps to produce newsprint, magazine-book, coated book, and other papers containing large amounts of mechanical pulps. Furthermore, the high tensile strength of these bagasse pulps when produced by the mechano-chemical process suggests that weak mechanical pulps might find a much wider use in the manufacture of good papers.

If it should prove expedient to make newsprint from 100 per cent bagasse pulp and filler, a collateral market for the use of the bleached pulp in printing, writing and other papers should be rapidly developed to provide for the loss of the newsprint market in the event that mechanical pulp or lower cost imported newsprint becomes available.

In selecting pulping methods, consideration should be given not only to the cost elements, such as low initial capital investment, maintenance, and operating costs, but also to simplicity and utility of equipment, flexibility of changing processing conditions to meet changing pulp

/requirements, and

requirements, and ease of process control. Bagasse is a variable raw material; the paper and board industry in any country is bound to expand with time; and competition in world markets will increase. It is desirable and should be possible to design new mills with great flexibility so as not only to manufacture, from the bagasse and other raw materials available in the local market, the best products possible but also to provide increasingly better products and some of wider use as the market expands or as other types of pulps and raw materials become available for blending with the bagasse pulps.

Economic and other Factors to be Considered in the Use of
Sugarcane Bagasse as a Raw Material for Pulp and Paper
Manufacture

by Elbert C. Lathrop

Neither paper nor sugar manufacturers seem to have a clear understanding of each other's problem nor appreciate the full significance of the economic and technological factors under their joint control that may contribute to lasting success in both industries. It seems desirable, therefore, to discuss the subject fully so that new ventures into bagasse utilization may be made with the least risk of failure.

Factors relating to bagasse production, which are more or less under the control of the sugar producer, are discussed rather fully. Variations in quality and quantity of bagasse due to cane variety and culture, to cane harvesting practices, and milling practices are shown to produce rather wide variations in the chemical and particularly in the physical characteristics of bagasse, including dirt and carbon contaminations.

The present uses and value of bagasse as a raw material for fuel, building material, and paper manufacture, and for use as litter or mulch are briefly described. It is pointed out that surplus bagasse is present at most sugar mills, requiring burning for disposal.

Problems concerning baling, handling, storage, losses during storage, and the cost of stored bagasse are discussed at length because the subject is evidently not generally well understood.

At the present time no method exists for the economic utilization of

/"total bagasse".

"total bagasse". The objections to pith in paper manufacture are discussed at length. Methods used to separate pith from fibre have been perfected. Several of these are described, including flow sheets and cost data. From this data estimates on costs to produce several grades of papers from depithed fibres vs. whole bagasse show the fallacy of believing that depithed fibre is more costly to use for papermaking. Uses for pith, particularly as an absorbent for molasses for feeding, are discussed.

From the analysis presented the sugar mill is the logical place to prepare depithed fibre, in which event high-grade pith becomes available. By combining pith and blackstrap molasses and using this material for feeding cattle on the plantation, the highest value will be realized for both. Silage and fodder is also available on the plantations in the form of tops from the cane. Thus based on integration between the paper and sugar industries, pith-free fiber could be made available for high-grade papermaking, pith and molasses for feed.

In considering the close integration of a sugar and pulp and paper mill, however, the writer adds a word of warning. The paper mill, if it is to make bleached paper should not burn bagasse or pith for fuel, because of the almost certain contamination of the bleached pulp with carbon particles. If the paper mill is to be located near a sugar mill, it should be so located as to avoid the same hazard.

Saving of Bagasse for Paper Making : Thermal Considerations

by Cellulose Development Corporation

If bagasse is required for purposes other than burning, a factory which used, say 600 kgs. of steam per ton of cane can make several economies. The following table summarises those for which calculations have been made.

/Summary of

Summary of Economies Discussed

	<u>Savings in Kgs. steam/ton cane</u>	<u>Bagasse saved Pc. bagasse produced</u>
Installation of an airheater or economiser		10-15
Circulation of the condensates in the evaporators, maximum	10	1.5
Introduction of steam bleeding from the multiple effect for use in juice heating, say	50	7.5
Reduction of the Imbibition Water from 33% to 20%	32	5
Installation of a thermocompressor on the 1st effect	40	<u>6</u>
		30-35

Most of these modifications could be made concurrently, but the total economy would not quite equal the sum of the economies made separately. The first three are all measures which have been quite widely used in the industry; there are still a number of factories which have not adopted all of these and some who have not adopted any.

Whilst deliberate reduction of imbibition water and the installation of a thermocompressor have less appeal, there are other steps not enumerated but discussed which may be described as the more diligent application of scientific common sense: elimination of steam exhausting to atmosphere, thermal insulation, close control of imbibition water and of final moisture of bagasse.

In addition, in certain special circumstances, the surplus of bagasse may be increased by the direct production of alcohol on a large scale; also by growing cane with a high fibre content.

In general, the economies outlined may be said to save between one quarter and one third of the bagasse.

It would be possible to make more drastic savings where the possibility exists of using high-pressure exhaust steam and some pressure evaporation, and also of increasing the number of effects.

/When the

When the means of economy are exhausted, alternative fuels may be used; this may be quite economic and will also result in more satisfactory boiler operation than when bagasse is used as fuel.

Of the possibilities discussed in the paper, probably the most attractive are those which least complicate the sugar mill operations. Undoubtedly thermo-compression requires a degree of technical control which makes it suitable only for more advanced sugar factories, whereas stepped steam-bleeding from the evaporators is considered simple enough for any sugar factory to apply.

Improvement in boiler efficiency is straightforward, and is applicable to almost every mill. An important yet straightforward improvement is the electrification of all machines which are driven by steam engines which merely exhaust to the atmosphere, and the lagging of pipes and condensate tanks.

Saving of Bagasse by Improved Boiler House Operations

by G. Ranwez

The paper industry, compelled by increasing raw material requirements, has experimented successfully with the use of bagasse. Difficulties arise, however, in obtaining supplies of bagasse, since its main use is in the sugar mills themselves, in supplying their requirements of fuel.

A simple and profitable solution to this problem may be found in rationalizing and improving combustion, and in the introduction of heat recovery elements and modern combustion devices.

It is estimated that the modernization of sugar mill boiler plant could, in the case of Argentina, release sufficient bagasse to manufacture some 22,000 tons of pulp per year. This need not involve either the use of additional fuel, such as wood, nor resort to an alternative fuel, such as oil, which is imported.

/Preservation, Handling

Preservation, Handling and Storing of Bagasse
by The Celotex Corporation

For more than thirty years the Celotex Corporation has been engaged in the collection and handling of bagasse in the state of Louisiana, U.S.A., and its use in the manufacture of insulation fiberboard products in a factory located in the same state. As a raw material for this purpose, bagasse has both advantages and disadvantages, but the former outweigh the latter, and the disadvantages have had their effect on the development of equipment and techniques used to handle this annual crop. Multiple installations are required to bale and stack, and then later un-stack and ship, this bulky material to the factory. The large investment required for many baling stations and storage fields, and the seasonal nature of the operation, represent "hidden costs" which must be taken into account in considering the economics of bagasse usage.

Factors Influencing the Selection of Processes and Choice of
Equipment for Bagasse Pulp Manufacture

by Joseph E. Atchison

In this paper the writer reviews all the important factors which might influence selection of the process and the choice of equipment for a bagasse pulp mill. It is pointed out that the first step in the development of any project for the production of pulp from bagasse should be a complete technical and economic survey by personnel who are specialized in this field. The question of choice of process and equipment, as well as the decision regarding the feasibility of any project, involves a complicated inter-relationship of many technical and economic factors which can be properly treated and analysed only by highly experienced personnel.

The great importance of depithing sugarcane bagasse before pulping the fibre is reviewed in considerable detail. Numerous reasons are given for removal of the pith before pulping and the author points out many difficulties which may be experienced in all phases of the operation if the pith is not removed before pulping. A review is given of some important work which has been carried out in this field in Formosa and Louisiana.

/It is

It is pointed out that conventional pulping methods normally used for wood are not, without modifications, applicable to pulping bagasse. A number of these modifications are described.

A review is given of the most important processes now available for pulping bagasse, taking into consideration methods in commercial use in various parts of the world for cooking both bagasse and straw. The five processes described are the

Soda Process,
Sulphate Process
Monosulphite or Neutral Sulphite Process
Caustic Soda-Chlorine Process
Mechano-Chemical Process

These processes are compared and some advantages and disadvantages of each are given. Flow diagrams are included for the mechano-chemical process and for pressure digestion cooking by either the soda, sulphate or monosulphite processes.

Each of the technical and economic factors which must be considered in selecting the proper process and equipment for any bagasse pulp mill project are discussed at length and the relationship of each one of these factors to the choice of process and equipment is given. The factors discussed are as follows:

1. Initial cost of equipment for each process or the capital required for a mill of given size;
2. The relative availability and cost of chemicals necessary for each process in the specific area;
3. The availability and cost of fuel delivered to the plant site;
4. The availability and cost of purchased power;
5. The availability and cost of labour in the area;
6. The availability and cost of an adequate water supply;
7. Means available and cost of effluent disposal;
8. The cost of bagasse delivered to the pulp mill site;
9. The grade of pulp, paper or paperboard which is to be manufactured.

Experience of

Experience of Industrial Bagasse Pulping

by Cellulose Development Corporation Limited (England)

The interest in pulping bagasse for paper-making and the reasons for it are discussed against the background of present world pulp resources and consumption trends.

Successful enterprises data only from about 1939, but there are now about a dozen mills in various parts of the world pulping bagasse on a commercial basis. Four of these mills produce bleached pulp, three using the Celdecor-Pomilio process (as at mid-1954).

Bagasse availability, storage and pulping by different processes is considered, and the uses, special properties, and limitations of bagasse for pulping are discussed.

After more than 100 years of experiment, bagasse pulping is now established on a sound basis; it is believed it can play a significant part in meeting increasing world demand for pulp and paper.

Industrial Experience in Bagasse Pulp Manufacture in Argentina

by Celulosa Argentina S.A.

This paper describes the manufacture of chemical pulp from bagasse in the State of Tucumán, Argentina. After indicating the source of the raw materials and the process adopted, it discusses the early problems encountered in the baling and storing of bagasse, and the way in which these were solved. An explanation is given of how the pith is eliminated before cooking.

A description follows of the investigations undertaken at the company's research laboratories concerning the influence of pith on the various stages of the process and on the resultant pulp. The relative merits of producing pulp from bagasse containing pith as opposed to bagasse freed of pith are discussed.

The experiences at the Capitán Bermúdez and Tucumán mills in making bleached pulp from depithed bagasse are described, as well as the operational procedures.

Finally, a description is given of laboratory and industrial-scale tests carried out with a view to using bagasse pulp for the manufacture of newsprint.

Industrial Experience in Bagasse Pulp and Paper
Manufacture in Paramonga

by José Correa S.

The paper describes how an agricultural by-product (bagasse) has been converted into a great variety of papers by W.R. Grace & Co. at their mill at Paramonga. This mill has successfully operated for more than fifteen years. It is situated in close proximity to the sugarcane plantation operated by an affiliate of the company in the Peruvian coastal lowlands.

A modified soda process is employed for producing pulp from depithed bagasse for the manufacture of all kinds of wrapping and packing papers. For higher qualities some imported pulp is used as well.

Twenty-five Years of Argentine Industrial Experience in
the Pulping of Straws and Cane

by Juan Di Filippo

The paper begins with a description of the studies and procedures carried out by Celulosa Argentina since its establishment in 1931. The early background of the caustic soda-chlorine process is given.

Problems connected with raw materials, water, fuel and power are dealt with and an enumeration is given as to the availability of straw and salt in the vicinity of the original mill. The company's first mill was located at Capitán Bermúdez (formerly Juan Ortiz) Argentina, and began operations in 1930-31. Its technical features at that time are described, and contrasted with the present ones.

Data are provided relating to numerous laboratory tests which have been made for the pulp mill.

Bagasse Pulp and Paper Mill at Piracicaba

by Lino Morganti

The political, economic and technical considerations which led to the decision to establish a pulp and paper mill based on bagasse at Piracicaba are described. This mill is planned to produce 15 thousand tons of pulp and paper annually by the Celdecor-Pomilio process. The pulping process

/is described,

is described, and an account is given of the way in which power, water, chemicals and other requirements are to be met.

The paper concludes with a description of the operations from the reception of the bagasse from the sugar mills to the finishing processes in the paper mill section.

The Alkaline Pulping of Bagasse for High-Strength
Papers and Dissolving Pulps

by William J. Nolan

A method has been developed for the depithing of bagasse which recovers 70-80 per cent of the bagasse as very clean fibre. The pith fraction contains a very small proportion of fine fibres. Photographs are furnished to show the quality of the fibre and pith fractions. Bagasse fibre has been pulped at constant steam pressure and liquor concentration to produce high purity pulps. Pulps of 45 per cent yield, containing 2.0 per cent pentosan, 0.8 per cent lignin, 95-96 per cent alpha cellulose, have been produced in 10 min. cooking time. Degree of polymerization of these pulps is about 1000-1100. Pulps of about the same purity and slightly higher yield can be produced in 5 min. cooking time but the degree of polymerization is too high for dissolving purposes, being 1700-2000. These pulps can be bleached to 84 G.E. brightness by a 5 stage standard process, using 1.5 per cent equivalent chlorine. To realize this brightness it is necessary to extract the pulp with dilute HCl before bleaching. Ash content of the bleached pulp is high (about 0.14 per cent). Pulps of paper-making grade can be produced from bagasse fiber at low concentration and constant steam pressure in 15-20 min. cooking time. Yield of pulp is 60-63 per cent of the original fibre and the pulps are very high in pentosan content, 23-24 per cent. These pulps are 20 per cent stronger than the maximum tensile strength of pine kraft and 10 per cent stronger in bursting strength. They are considerably stronger in double folds but are less than half as strong in tear. The pulps can be hydrated to maximum strength with the expenditure of very little power. Unbeaten strength in burst, tensile and double folds is unusually high. The low lignin content of these pulps (2.0 per cent) indicates that they should require only 3-4 per cent chlorine for bleaching.

/PRESENTATION OF

PRESENTATION OF PAPERS ON SELECTED TECHNICAL MATTERS

Modern Trends in Layout and Design of Pulp and Paper Mills

by A.M. Hurter

With few exceptions there has been little change in the technology processes and equipment for pulp and paper manufacturer during the past decade and there is no indication that this situation will change in the near future.

The considerable change in the industry and the present trend is more a matter of the careful application of established processes and equipment than of the introduction of any revolutionary development.

Automatic control, continuous processing, carefully applied materials handling methods, efficient mill layouts and mill integration, to reduce both waste and manpower, distinguish modern mills and represent the present trends in modern mill design.

Automatic control and continuous processing have had a marked influence on modern mill design. Materials handling methods are also a very important phase of modern mill design. However, it is often not fully appreciated that efficient materials handling in the movement of materials at the lowest possible cost under the circumstances and that the technically neatest solution is not necessarily the best.

The mill layout and the mill property have a very definite influence on not only the overall efficiency of the mill as originally built but also on the capital expenditure required for expansion and the overall efficiency of the mill when enlarged.

The principal trend in equipment design has been toward continuous, high capacity units. These features are of lesser importance in the case of small diversified mills and for such mills the use of second hand machinery should be carefully considered.

The acquisition of modern machinery does not necessarily result in a modern mill. It is quite possible to design an essentially modern mill using equipment available a decade ago. The opposite is equally true; if modern design concepts are overlooked it is quite possible to obtain an obsolete mill even when using modern equipment.

Water Supply and Waste Effluent Disposal as Factors
in Locating Pulp and Paper Mills

by Julius Grant

The subject is considered under three main headings, namely the quantity and quality of the water supply, and the disposal of waste effluent.

Estimates are given of the quantities of water required for the preparation of different types of pulp with or without integrated paper manufacture. Where water supplies are limited or vary in quality it is shown how water of different degrees of purity may be used for different parts of the process. Economy of water by recovery methods is also discussed.

The relative merits of lake, river and well waters are considered. The first is preferred, because of its relative constancy of volume and composition, and freedom from suspended matter. Dependence on wells may involve certain risks, and unless adequate wells actually exist it is safer to choose a site where there is visible water all the year round.

Criteria of quality of water for different types of paper and pulp are tabulated and discussed, with special reference to colour, hardness, iron content, dissolved solids and pH value. Methods for the treatment of water supplies are also dealt with.

Considerations affecting the discharge of effluents into rivers, lakes, the sea or elsewhere are discussed and compared. The importance of full and frank collaboration in these matters with local authorities is emphasized. In general, paper mill alkali pulp process effluents are more amenable to treatment than are other types of effluent, and a method is envisaged for the complete elimination of polluting effluent in certain of the former instances. Brief reference is made to methods of treating effluents and to methods of assessing the capacity of an effluent to produce pollution.

The Relationship Between the Morphological Characteristics of
the Fibres from Tropical Woods and the Quality of the Pulp and
Paper Obtained from them

by the Régie Industrielle de la Cellulose Coloniale

This paper examines the results obtained in the research laboratories of the Régie Industrielle de la Cellulose Coloniale, Ministère de la France d'Outre-Mer, on the factors governing the strength characteristics of paper from tropical woods.

Some rules are laid down regarding the relationships which exist between biometric data and paper characteristics.

Three species in particular were studied: Kaka (Phialodisens plurijugatus), Ohnon (Euadenia trifoliata) y Amón (Buchelcia coriacea). The principal laboratory findings are as follows: the higher flexibility coefficient the better is the tensile strength; the greater the felting power the poorer is the tensile strength and the higher the tearing factor. Although influenced by biometric characteristics, especially by ratios length/lumen and width/lumen, folding strength is governed more by other as yet undetermined factors.

The final conclusion is that only by the use of a complex mixture of tropical woods could a paper be produced which would have satisfactory characteristics in all respects.

A New Process for Bleaching Pulp from Tropical Woods

by A.M. Hurter

This paper refers to laboratory tests carried out with a view to improving the classical processes for bleaching tropical wood pulps involving the use of chlorine, hypochlorite, alkaline chlorite and chlorine dioxide.

Investigations have shown that it is possible to increase the speed of reaction and to obtain satisfactory strength characteristics and brightness by using nascent chemicals or by carrying out the operation under special concentration and pH conditions.

To bleach tropical wood pulps the following method is suggested:

- 1) one chlorination
- 2) one soda treatment
- 3) one nascent hypochlorite treatment
- 4) one post-chlorination
- 5) one acid hypochlorite treatment

The application of this new method resulted in better brightness and strength characteristics than those obtained with the classical method.

The principal advantages of this new system are: speedier operations, the possibility of obtaining a high degree of brightness using low-cost chemicals, a considerable saving in operational costs and a reduction in the initial investment required for new mills.

These are merely laboratory findings and it would be necessary to verify them on an industrial scale and to solve some problems arising in this connection.

Low Cost Supply of Sulphur Dioxide for South America

by C.J. Wall

There is a shortage of low cost domestic elemental sulphur in South America, Europe and Japan. The solution found by industrial countries has been to make up the deficit by producing SO₂ gas from the sulphide minerals of iron, copper and zinc. The iron sulphides, pyrite (FeS₂) and pyrrhotite (Fe₇S₈) would be of the greatest interest to South American sulphur users, since they are very common and are usually found associated with any ore body.

The author points out that the Dorrco FluoSolids System is a new and improved method of roasting these sulphides, developed over the past twelve years. Forty-four commercial and eleven pilot plants using the FluoSolids System are at present in operation or under construction, and new fields for this technique are being opened up daily. Among the applications for the system is its use in pulp mills, as iron sulphides provide a cheaper source of sulphur dioxide than elemental sulphur.

/Economics of

Economics of Waste Liquor Recovery and Burning in the
Sulphate and Sulphite Processes

by Gustaf Edling

Sulphate Mills. The paper deals with questions regarding heat production by burning the black liquor, and the heat consumption in sulphate kraft mills.

All the data provided relate to normal mill practice in Sweden and have been checked by engineers belonging to the Swedish Steam Users Association of Stockholm. From the figures given it is evident that a modern sulphate mill, properly planned and operated should be self-supporting with regard to fuel.

Sulphite Mills. The paper mentions that the first Swedish sulphite mill was started in 1874, and that by 1890 17 such mills were in operation. Consumption of fuel was, naturally, very high, since the waste liquor was not utilized at all.

The first plant to produce alcohol from the sugar contained in the liquor was started in 1909 and there are now 30 of these factories in Sweden. Such plants, however, utilize only about 20 per cent of the organic matter in the liquor.

In 1920 the first installation for the evaporation and burning of sulphite waste liquor was started. It is of interest to mention that this first plant had an evaporator using a thermo-compressor.

Since the close of the 1930s development in the utilization of liquor has proceeded to such an extent that at present about 20 plants of this kind are in operation in Sweden. Experience from these plants proves that the main problems in connection with the evaporation and burning of the liquor have been overcome and that quite a normal operation may be obtained.

Data are given to illustrate the quantity of heat which can be produced by burning the liquor. These figures as well as those indicating the consumption of heat in the different departments of the mill (cooking, drying, evaporation) are all based on results achieved during normal operation. Moreover, they demonstrate that a sulphite mill can in some cases also be self-supporting with regard to fuel.

The paper concludes with data relating to the capital costs involved for different kinds of plants.

Economics of Electric Power and Steam Consumption
in the Paper Industry

by G. Ranwez

The paper consists of a comparative study of costs per ton of paper, of thermic and electric energy, calculated for different steam pressures. A model mill is used as the basis for the calculations, and it is assumed that steam pressures in the boiler may range from 15 to 90 atmospheres, with different degrees of super heating. It is further assumed that a bleeding turbine is used, with extractions at 8 and at 3 atmospheres, and having a pressure of 0.06 atmospheres in the condenser. The various steam circuits are illustrated in a series of charts.

It is concluded that a considerable economy of fuel is obtained, the higher the pressure used.

The Aschaffenburg Zellstoffwerke Method of Manufacturing
Newsprint from Bagasse

by Rudolf Schepp

Sugar cane bagasse provides large quantities of fibrous raw material; usually this fibre serves only as fuel in the sugar mills. For more than a century efforts have been made to produce from bagasse a paper suitable for newsprint.

Bagasse cannot be pulped by a simple mechanical process, as in the preparation of groundwood from conifers. Chemical pulping is necessary, but this is not easy on account of the fibre characteristics.

The essence of the economic problem of manufacturing newsprint from bagasse is to use a relatively simple pulping process, without bleaching, and yet obtain a paper comparable with newsprint in colour and printing properties. In our view the only possible solution is a modified neutral-sulphite process. Very careful preparation of the bagasse is necessary to remove discolouring matter inherent in the fibre or caused by fungal growth during drying. The removal of the pith is of less consequence. Because of the morphological heterogeneity of the stem, complete cooking is not recommended; it is advisable to complete the pulping process by mechanical

/action, as

action, as for semi-chemical pulp. A short prehydrolysis ensures regularity in the subsequent pulping, as well as completing the elimination of colouring matter. The operations can be varied in accordance with the qualities desired, and these variations determine the yield, which ranges from 55 to 68 per cent. The limit of technical defibration is around 68 per cent.

The strength properties of bagasse newsprint compare favourably with those of standard newsprint because the strength properties of bagasse pulp are superior to those of spruce groundwood.

A short comment follows on the manufacture of other qualities of paper from bagasse pulp, and, finally some cost data are presented.

Defibrator Continuous Semi-Chemical Pulping Process

by Aktiebolaget Defibrator

Although semi-chemical pulp has only been used on an industrial scale for a relatively short time, its applications are becoming more and more widespread. Some species of wood which are not readily pulped by conventional processes, can be advantageously made into semi-chemical pulp.

The paper outlines briefly the various types of semi-chemical processes that have been developed, but points out that the continuous semi-chemical process is to be particularly recommended when a completely new plant is contemplated without relation to some previously existing pulp mill. The advantages of a continuous semi-chemical pulping system as compared with a batch system are enumerated, and the special process developed by the authors is described. A flow sheet is included of a typical installation, showing the basic principles of the process.

Modern Pulp Screening Equipment and Systems

by Karl Lindgren

The paper deals with many different screening units and screening system designs. It emphasizes that the efficiency of a screen depends on the design, the time that the pulp remains in the screen, the kind and quantity of the dirt present, the pulp consistency and the overscreening

/percentage. Some

percentage. Some screens are better able to remove long particles than spherical ones, while others are more efficient in extracting round dirt. Thus combinations of various types of screen are advisable. The choice of correct screen is important, but the use of a correct screening system is even more so.

The particular features and performance details of the types of screen in most common use are discussed and their most suitable position in a screening system indicated. The author classifies the screen types in six different groups:

- Flat diaphragm
- Low frequency rotary
- High frequency flat
- High frequency rotary
- Centrifugal
- Vortex separators

Sections are included covering screening systems for

- Bleached and unbleached sulphite pulp
- Bleached and unbleached sulphate pulp
- Groundwood
- Wastepaper
- Straw and bagasse
- Screening ahead of paper and board machines

In discussing these systems the author describes the principle of double screening, the necessity in many cases of overscreening the advantage of correct choice of consistency, the value of constant conditions and even pulp-flow, and the choice of suitable screen plate perforations and slot widths. Some appropriate flow diagrams are also given.

Special attention is devoted to screening equipment of the latest type, and how screening departments may be modernized by using these units.

Screening departments for different purposes, however, must be planned in accordance with certain main principles and every screening problem needs to be treated as a separate case. The science of screening, if such a pretentious expression may be used, is not an exact science, but often a feeling for the right combination of equipment available and the application of ideas verified by actual tests.

However, it is not in itself sufficient to equip a screening department with the most modern units and in strict accordance with accepted rules. The different units must be given careful attention, properly maintained and run in accordance with instructions, though one often finds neglect or indifference to these simple but excellent rules.

The Modern Paper-Making Machine Applied to the Utilization
of Short-Fibred Materials

by Ralph C. Heys

The paper now presented is confined to an analysis of the application of the modern Fourdrinier type of paper machine for the manufacture of papers from a weight of, say, 20 grammes per square metre to 300 grammes per square metre or thereabouts; on the one hand, it does not consider the manufacture of multiple boards, which, almost without exception, are made on cylinder mould or vat machines, and, on the other hand, only a brief reference is made to that type where a single large dryer is used in the manufacture of such specialties as cellulose wadding.

Before attempting to describe what the author considers to be a modern paper machine with characteristics making it particularly suitable for the manufacture of paper from short-fibred stock, some clarification is needed as to what the term "Modern Paper Machine" really means.

First, he maintains without reservation that a newly manufactured paper machine is not necessarily a modern machine; unfortunately new machines are still being built to obsolete designs, using patterns which should have been scrapped long ago. The capital cost of such a unit may be lower, but the difference in price between it and a modern machine, which has a potential for increased production and speeds, should not be a deciding factor, as the purchaser has mortgaged his future.

Advances which have been made during the last ten years for increasing production - especially in speeding up well-designed machines originally built as early as 1924 for conservatively running at 200 metres per minute and which now make newsprint at 450 metres per minute and over - illustrate quite well that any paper machine designed today should have the possibility of being speeded up, as the life of such a machine can well be over 30 years.

On the other hand, there is no need to complicate the design unnecessarily with non-essentials and expensive gadgets; a modern machine should be as simple as the circumstances dictate; automatic devices which become essential with higher operating speeds may be added when and as required.

Secondly, there are many older paper machines which - if reconstructed

/by reliable

by reliable paper making machinery engineers - are not only suitable for the quality of paper required and speeds at which the paper can be manufactured, but, after reconstruction, can be considered modern in the widest sense of the term.

The essentials of a modern machine vary with the types of paper to be manufactured, but certain elementals are common to all machines whether these are to run at 30 metres or 600 metres per minute. Moreover, generally speaking, most older type machines made by well-known builders can be modified to incorporate these improvements.

Improved Quality and Production from Existing

Paper-Making Equipment

by Frank T. Peterson

An outline is given of the development of stock preparation equipment and paper stock treating machinery to impart selective qualities to the paper to be produced. Modern stock preparatory systems as outlined are broken down into three main functions: pulping or slushing; refining; and cutting. The author has demonstrated various methods of applying this type of stock preparation theory.

A discussion follows of paper machine formation and suction roll equipment modifications to further enhance production and paper machine speeds and so forth.

REVIEW OF THE DEVELOPMENT PROSPECTS FOR PULP AND PAPER

INDUSTRIES IN SELECTED LATIN AMERICAN COUNTRIES ^{1/}

Brazil

by José Carlos Leone

In 1953, Brazil consumed 170 thousand tons of chemical pulps, 206 thousand tons of mechanical pulp - including waste paper - 146 thousand tons

^{1/} No papers on this subject for Argentina, Bolivia, Paraguay and Perú were submitted. Nevertheless the final printed report will contain the statements made on this matter by experts from those countries.

of newsprint and 250 thousand tons of other papers and boards. The respective production figures were: 51 thousand tons of chemical pulp, 104 thousand tons of mechanical pulp (including waste paper), 43 thousand tons of newsprint and 220 thousand tons of other papers. In other words, domestic output met requirements to the following extent: chemical pulp, 30 per cent; mechanical pulp, 52 per cent; newsprint, 30 per cent; other papers, 97.3 per cent.

Chemical pulp is made in 14 mills, one of them having an annual capacity of 35 thousand tons while the other thirteen average slightly over one thousand tons each. Paper - other than newsprint - is manufactured in 53 mills with a total capacity of 246 thousand tons; 68 per cent of these mills had annual capacities below 5,000 tons, while only five could produce more than 10 thousand tons a year. There is only one newsprint mill, having a daily capacity of 100 to 120 tons. Absence of detailed statistics prevents any true assessment of domestic capacity for making mechanical pulp; all that can be confidently asserted is that 11 mills have an aggregate capacity of 55 thousand tons, but there are other small mills distributed mainly throughout the states of Paraná and Santa Catarina.

Newsprint production - unlike that of other types of paper, which practically meets demand - shows no great expansion in Brazil. Various factors have hampered its development, among them the exemption of newsprint from import duties, the high cost of the equipment required for large-scale production and the inadequate domestic output of mechanical pulp. Meanwhile, the growing imports of newsprint have an unfavourable impact on the country's balance of payments. In 1950, Brazil spent nearly 8 million dollars on newsprint; in 1953, the figure rose to 19 million dollars, placing this product fifth on the list of Brazilian imports.

By 1960, it is estimated that the demand for paper and board will have risen to 539 thousand tons, 187 thousand of which correspond to newsprint and 352 thousand to other papers and boards. Pulp requirements to meet a production of such size would be 191 thousand tons of chemical and 208 thousand tons of mechanical pulp.

The exchange reform introduced in October 1953 has, by making imported goods more expensive, awakened the interest of industrialists, particularly as regards pulp production. The Government, moreover, has recently taken a

/keen interest

keen interest in the expansion of the pulp industry, which has been included among those industries considered as basic to the country's economic development. Taking into account only the plans for expanding the capacity of integrated pulp and paper mills - which are almost certain to be put into effect - there should, by 1960, be a minimum increase in paper production of some 96 thousand tons.

There are in Brazil four main sources of raw material for the pulp and paper industry. These are:

1. The virgin forests of Paraná pine (Araucaria angustifolia), of which the wood provides an excellent pulp for wrapping papers, and is already used by the largest pulp mill in the country;
2. The eucalypt plantations in the Sao Paulo region, the pulp of which is suitable for the manufacture of writing and printing papers;
3. Sugar cane bagasse from the states of Pernambuco, Alagoas, Rio de Janeiro and Sao Paulo, the use of which is already being successfully practised in the last-named state and is likely to be extended in the near future; and finally
4. Tropical woods from the north, which for the time being offer long-term potentialities.

Taking into account the specific conditions of location, energy, economic size of the mill and other technical or economic factors, only the two first-mentioned sources of supply may be said to deserve consideration for the immediate expansion of pulp and paper capacity. Bagasse and tropical woods will undoubtedly also represent very important resources, once the problems defined above have been overcome.

CENTRAL AMERICA

by the FAO Forest Mission

1. Costa Rica

In 1951, paper consumption in Costa Rica totalled 3,850 tons, including 1,800 tons of newsprint. Until 1953 demand was covered entirely by imports, mainly from Canada and the United States. In September of that year the "La Perla" pulp and paper mill began operations, and is still the only one in existence (1954). It is designed for an annual output of 3,000 tons abaca

/waste fibre.

waste fibre. The raw material used is supplied by two abaca cleaning factories, the quantity available being estimated as sufficient to make 12 tons of paper a day, and it has already been proved that, with adequate care, a good quality kraft paper can be made.

Potential future sources of raw material for making pulp and paper include the forests of Heredia and Alajuela, San José and Puntarenas, and Limón, covering respectively some 400 thousand, 160 thousand and 130 thousand hectares. The first-named provide the most favourable conditions, as the topography is flat, and the San Carlos and Sarapiquí rivers, besides forming an excellent natural transport system, provide an abundant source of water. Sufficient raw material could be made available to supply a pulp mill of economic size, but detailed study of the composition and density of the forests is required.

A group of industrialists prepared a project based on using the species guarumo (Cecropia peltata) and poró (Erythrina peoppigiana) as raw materials for pulping. The quantities of these species are not, however, thought to be sufficient to supply a pulp mill of economic size.

As to the other raw materials required for the paper industry, Costa Rica produces limestone, salt and kaolin. At present the electric power capacity is deficient, but it will improve considerably once the Government's electrification plan, with the recommendations made by the Integration Programme's electrical mission, is put into effect.

Finally, short-term fibrous resources are available in the form of abaca fibre, in sufficient quantity to provide the Central American countries with wrapping paper and some kinds of writing and printing paper. From the long-term point of view, the broadleaved species obtainable from the virgin forests in Heredia and Alajuela, in the north of the country, might be taken into account.

2. El Salvador

In 1953, El Salvador's total consumption of paper and board reached approximately 6 thousand tons, about 2.75 thousand tons of which were newsprint. With a total population of slightly over 2 million, per capita consumption may be reckoned at roughly 2.9 kg. As El Salvador has no existing pulp or paper industry, all supplies are at present imported, mainly from the United States and Canada.

Only the pine forests situated to the north of the country, near the border with Honduras, might be considered as a possible source of wood material for pulp and paper. However, it is believed that supplies from this area could not satisfy the requirements of a pulp mill of economic size.

In some places, "escobilla" (Sida rhombifolia) has been planted to prevent soil erosion, although the altitude of the areas concerned is not particularly suited to its growth. The bark is suitable for the production of textile fibre and the stalk (1 to 2 cm. in diameter and approximately 2 m. in length) represents a possible but very limited source of short-fibred raw material which might be used for pulping.

Other fibrous raw materials, such as bagasse and henequen waste, are not available in sufficient quantities to consider them as possible sources of pulp.

Because of the lack of suitable raw materials and the present low domestic consumption of paper and paper products, there seems little prospect of El Salvador manufacturing its own supplies of pulp and paper for some considerable period to come.

3. Guatemala

In 1952, Guatemala's total consumption of paper and board amounted to 6,753 tons, including 2,428 tons of newsprint. With a population of rather less than 3 million, consumption per capita may be reckoned at roughly 1 kg. Except for some small quantities of wrapping paper and boards, all supplies are imported, mainly from the United States and Canada.

It has been estimated that by 1965 the country's annual requirements of paper and paperboard including newsprint, will have reached about 12,000 tons.

At present (1954) there is only one paper mill in the country - Industria Papelera Guatemalteca - situated in the Escuintla district. The raw materials used are racate limón or citronella grass; the company having its own plantations of the second. These materials are first distilled by steam to extract the oil. The plant has a capacity of about 12 tons per day but operation has been somewhat sporadic owing to marketing difficulties arising from the quality of the product.

/Guatemala has

Guatemala has abundant forest resources. From a pulping point of view probably the most important long-term sources of raw material in the country, and perhaps in the whole of Central America, are the typical tropical broadleaved forests in the immediate surroundings of Lake Izabal. Pine forests (Pinus oocarpa and P. caribaea) cover the neighbouring mountainous area, and thus could provide an important source of long-fibred pulp for chemical pulping.

Elsewhere, in the region of Peten, are found other extensive areas of tropical broadleaved forest and in the district south of Huehuetenango a large area under pines. Bad terrain and lack of communications, however, exclude the possibility of either of these areas being considered as potential sources of pulpwood supply, at least for the time being.

Apart from the forest resources, sugar-cane bagasse and henequen waste are available, but in very small quantities.

With regard to chemicals, there is sufficient lime and salt but materials such as saltcake, sulphur, alum, etc. would have to be imported.

Although consumption of paper and paper products in Guatemala is increasing, it is not at present sufficient to support commercial operation of another mill in addition to that of Escuintla. This mill could in fact supply most of the country's needs of wrapping paper and board if product quality and the mill's efficiency were improved, and providing it worked at maximum capacity. From the long-term point of view the Lake Izabal area appears to offer the most favourable prospect for increasing local production capacity.

4. Honduras

Consumption of paper and paper products in Honduras has been increasing at the rate of about 4 per cent per year; it amounted in 1953 to over 2,7 thousand tons (including nearly 500 tons of newsprint). At present all supplies - equivalent to 1.7 kg. per caput - are imported, chiefly from the United States and Canada. The country has at present no pulp or paper industry.

With 43 per cent of the land under forests, Honduras possesses several potential sources of raw material for pulp and paper, but unfortunately lack of transport facilities in some places and inadequate supplies of water in others preclude their exploitation for this purpose in the near future.

/Nevertheless in

Nevertheless in the area around Lake Yojoa - a region served with a good highway - there are large stands of pine, chiefly Pinus oocarpa, which it is estimated could maintain supplies to a pulp mill with a capacity of 100 tons a day, sufficient to meet the needs of the entire Central American market, and to give an exportable surplus by 1965, estimated at some 21,000 tons.

Elsewhere in the Yoro district - an area comprising about 250,000 hectares - there are other large resources of pine (Pinus oocarpa and P. pseudostrobus). With proper sustained yield management it has been calculated that these resources could meet the demands of a pulp mill of at least 50,000 tons capacity a year and probably very much more.

Stands of broadleaved species and plenty of conifers are found in the Olancho district and "guaramo" (Cecropia) - suitable for making newsprint is said to grow abundantly on the banks of the Paulaya river. Immediate exploitation is impossible, however, owing to lack of communications.

So far as chemicals, fuel and power are concerned, Honduras has plentiful supplies of good quality salt and limestone in the Lake Yojoa and Yoro districts, but wood, which is expensive, is the only available domestic fuel. Present production of electricity is insufficient to meet the country's industrial demand, though a large-scale hydro-electric plant is projected at the Rio Lindo falls, and could supply a large pulp mill.

It is evident that domestic consumption of paper and paper products in Honduras will not be sufficient to support production from a pulp and paper mill of economic size for many years to come. Nevertheless reports indicate that the country possesses large resources of raw material suitable for pulp, especially in the regions of Yoro and Lake Yojoa, which should be borne in mind for the future.

5. Nicaragua

Total consumption of paper and board in Nicaragua in 1953 was approximately 2.3 thousand tons (of which about 750 tons were newsprint), or around 2 kg. per capita. The entire supply is imported, mainly from the United States and Canada. No pulp and paper industry exists in the country at present.

/Nicaragua has

Nicaragua has considerable resources of timber potentially suitable for pulpwood. The coniferous forests in the district of Nueva Segovia, an area covering approximately 170,000 hectares, could supply high quality pinewood, but mountainous terrain, lack of transport facilities and an inadequate water supply prevent the installation of a pulp and paper mill, at least in the near future.

About 670,000 hectares in the El Cabo and Zelaya districts are thinly covered with Pinus caribaea. The forest has, in many places, been depleted by fires, poor exploitation and the pasturing of animals. Even so, it is believed that this area, given proper management, could maintain supplies to a pulp and paper mill of economic size. The terrain is favourable for road building and certain rivers in the region (Coco, Huahua and others) could serve as a source of water and as a means of transport.

South of Zelaya, broadleaved forests cover an area calculated at over 6,000,000 hectares, but exploitation is at present impossible owing to a complete lack of communications.

It is concluded that many years will elapse before domestic consumption of paper and paper products in Nicaragua is likely to reach sufficient proportions to support a pulp mill of minimum economic size. Moreover, before any pulp and paper scheme based on the woodland resources of the El Cabo and Zelaya districts could properly be considered, a system of sound forest management would have to be developed and reforestation measures introduced.

Colombia

by Manuel Archila M.

The report prepared by the Currie Mission, and sponsored by the International Bank for Reconstruction and Development, estimated Colombia's annual per capita paper consumption at 3.26 kg in 1951. The annual increase in demand was set at 6 per cent, which would mean that demand in 1955 would amount to about 65,000 tons, thus justifying the installation of a domestic paper industry.

The following may be considered as potential sources of raw material:

/a) Some

- a) Some tree species from tropical or sub-tropical forests;
- b) Sugar-cane bagasse; some 170,000 tons of dry bagasse are available each year, and at present are used only as fuel;
- c) Rice straw; production of this cereal is increasing very rapidly, particularly in the districts of Tolima and the Cauca Valley, where climatic conditions and modern irrigation systems allow almost continuous harvests to be obtained;
- d) Several species of willows, eucalypts, pines, etc., which could be artificially cultivated over large non-forested areas to provide raw material for a paper mill.

The Instituto de Fomento Industrial is currently engaged in a detailed and systematic study of the forests in the middle valley of the Magdalena river, with a view to installing a pulp and paper mill. The materialization of this project depends on whether it is technically and economically feasible.

The only mill at present operating in Colombia is Cartón de Colombia S.A. It uses imported pulp, bagasse and waste paper, and has an annual output of 12,000 tons of wrapping and writing paper, and 12,000 tons of paperboard. It is planning to expand its output to 36,000 tons a year in order to meet the demand for papers of the kraft type.

The sugar-producing region of the Cauca Valley combines favourable conditions for the installation of a paper industry based on bagasse; the coal in which the area is rich could replace bagasse as fuel for the sugar mills; moreover the harvest is continuous and not seasonal as in other sugar areas.

Chile

by the Corporación de Fomento de la Producción

Although the paper industry in Chile meets domestic demand to a greater extent than is true of most of the Latin American countries, it is still largely undeveloped. Over the last five years, 57 per cent of newsprint requirements and 15 per cent of those for all other paper and board, plus 85 per cent of the chemical and 10 per cent of the mechanical pulp used in production, have had to be met by imports. This means in

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fact that imports have amounted to 13,700 tons of newsprint, 3,400 tons of other paper and board, 26,700 tons of various kinds of chemical pulp and 1,400 tons of mechanical pulp.

Domestic production of all paper and board has increased by 11.5 per cent over the past five years. Imports have declined, however, so that apparent consumption has remained constant.

A single company has supplied 96 per cent of total domestic production, and is the only one to make newsprint, writing and printing paper. The remaining output corresponds to numerous small plants whose capacities, with one or two exceptions, do not exceed a thousand tons a year.

As regards chemical pulp production, there is only one mill in the country, using wheat straw and employing the Pomilio soda-chlorine process. It has an annual capacity of 5,500 tons. All the pulp is bleached, and is used by the same mill to make writing papers. Production at this single mill has fallen off by 20 per cent in recent years, because the increasing use of combine harvesters in the wheat fields makes the supply of raw material ever more difficult. Apparent consumption of bleached pulp has remained practically constant, however, since imports have increased.

Unbleached pulp comes entirely from abroad. Save for an occasional fluctuation, some 17 thousand tons a year have been used.

The two rayon and short-fibre mills have increased their imports of dissolving pulp by 50 per cent since 1949, reaching the figure of 3,400 tons in 1953.

Mechanical pulp, using insignis pine (Pinus radiata), began to be made in Chile several years ago. In 1953, productive capacity amounted to 18,000 tons a year, coming from two mills which make the pulp for their own use.

During the five-year period ending in 1953, apparent consumption and output reached approximately the figures shown below.

	<u>Apparent consumption</u> (tons)	<u>Output</u> (tons)
Bleached chemical pulp	10,700	4,600
Unbleached chemical pulp	17,700	-
Dissolving pulp	2,900	-
Chemical pulp	16,600	15,200
		/Total demand

Total demand in 1960 for paper and board is estimated at 119,400 tons, of which 41 thousand tons would correspond to newsprint and 78,400 to other paper and board. The demand for mechanical pulp is set at 45,300 tons and for chemical pulp at 55,500. Dissolving pulp requirements for rayon are estimated at 10 thousand tons.

Chile is in an excellent position to meet all its present and future requirements for pulp and paper, and even to become an exporter of these products. Not only are abundant fibrous raw materials available, in 6 million hectares (8 per cent of the country's total area) of natural forest consisting of broadleaved temperate zone species and extensive plantations of Pinus radiata, but also the other essential requirements for the development of the industry.

According to tests made, the natural forest in the south of Chile includes several species suitable for making chemical pulp. The Pinus radiata plantations have been established in the last 25 years, particularly in a district in the south-central sector, some 300 km. in length by 70 km. broad, where they cover nearly 200 thousand hectares. These artificial forests grow at the annual rate of 20 solid cubic metres, barked, per hectare. This means, since there are no difficulties in the chemical or mechanical pulping of the wood, that the plantations represent a vast productive potential, which would amount to nearly 200 thousand tons of pulp by 1960.

Development plans envisage an ever more complete utilization of the wood available, particularly that from Pinus radiata. The International Bank for Reconstruction and Development granted a loan to a private Chilean company for 20 million dollars, guaranteed by the Corporación de Fomento de la Producción. It is to be used to build two new mills. The first, which will eventually produce 47,250 tons a year of bleached and unbleached pulp and 10,500 tons of kraft paper, is to be located at the confluence of the Laja and Bio-Bio rivers. The other, on the southern bank of the Bio-Bio, opposite the city of Concepción, will have an annual capacity of 44 thousand tons of newsprint and 6,600 tons of board. The building of both mills has already begun and it is expected that they will enter production in 1956-1957.

Industrial utilization of the pine plantations on as complete a scale

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as possible, means that a minimum annual output of 700 thousand tons of pulp will be attained within the next 15 years. This would require total investments amounting to nearly 200 million dollars.

The first part of this plan would be to instal a rayon mill, with an annual capacity of 60 thousand tons. Some 50 thousand tons would be available for export. According to tests made to date, insignis pine wood is perfectly suitable for making this type of pulp, and its manufacture would meet part of the growing needs of Latin American and European countries.

Mexico

by the Nacional Financiera, S.A.

Mexico buys abroad all of its newsprint, part of its chemical wood pulp requirements and certain papers requiring rather more advanced technique. These imports reach a yearly average of 290 million pesos a year - some 23.2 million dollars - which, although a negligible amount in the world market, is very significant for a country like Mexico which has limited resources for meeting the needs of its economic and demographic development. In 1951, these purchases represented 4.25 per cent of all imports, and 12.5 per cent of the trade balance deficit.

Over the last twenty-five years, some thirty paper mills have been established; by 1954 they consumed 105 thousand tons of raw and bleached pulp, and about 18 thousand tons of mechanical pulp. Mixed with waste paper - purchased locally and, exceptionally, abroad - these pulps are used to make all the wrapping paper, board, writing and printing paper for Mexico's requirements. A direct survey conducted among the manufacturers revealed that chemical pulp production had risen to 51 thousand tons in 1954. The remainder - 54 thousand tons - continued to be bought on the world market together with newsprint and other papers which require very specialized manufacture.

Estimates drawn up by FAO and by the Nacional Financiera S.A. show that the maximum Mexican demand for pulp will reach 118 thousand tons in 1960. Newsprint consumption - the present level of which is approximately 70 thousand tons a year - will have risen to 87 thousand tons by that same

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year. In a period slightly exceeding five years, Mexico will require roughly 30 thousand tons more of chemical pulp and 80 thousand tons of mechanical pulp.

Conscious of the impact which these purchases have on its trade level and balance of payments, Mexico is studying methods to avoid such problems as well as the pitfalls of self-sufficiency. The aim is to eliminate, within two years, the present deficit of 54 thousand tons of chemical pulp. New mills have been built, some of which were already completed in 1954. Improved working methods have been introduced and some expansions have been made. By 1956 at the latest, a minimum of 100 thousand tons of chemical pulp will be produced, although this figure should rise to 137 thousand tons if all the mills work at full capacity. The Nacional Financiera S.A., between 1950 and 1953, granted credits for 245 million pesos - some 19.5 million dollars - to the new mills. Meanwhile private enterprise has invested at least a similar amount. If to this is added the investment made by the Compañía Industrial de Atenquique, which began operations in 1946, it appears that Mexico has spent over 70 million dollars in a decade with a view to attaining self-sufficiency in its raw and bleached pulp requirements.

Even so, there are still two problems to solve, relating to the production of newsprint and of special papers. Newsprint at first encountered a major obstacle - the excessive resin content of Mexican conifers. In the south of the United States, however, where there are similar varieties, the resin has been eliminated and ordinary mechanical pulp has been made. After a careful study of locational factors, it has been found that the forest area of Michoacán, with its centre in Uruapán, possesses the best conditions. An investment of 10 million dollars will enable its woods to be exploited and a mechanical pulp mill to be installed with an annual capacity for 36,800 tons. This tonnage, mixed with 5,200 tons of chemical pulp, will be used to produce 40 thousand tons of newsprint, sufficient to cover 57 per cent of present consumption and 46 per cent of that estimated for 1960. Other projects intended to hasten self-sufficiency depend for their execution on the development of the road network and of power plant, on the growth of domestic savings and on the possibility of obtaining foreign credits. If Mexico had the resources needed to exploit all its coniferous forests, it

/would become

would become an exporter of chemical pulp and of newsprint. However, it might enter the world market with other raw materials, such as sugar-cane bagasse, which is being successfully used by the Compañía Industrial de San Cristobal, and will shortly be used also by a new mill being built at Ayotla.

Imports of certain types of paper requiring very specialized manufacture amount, on an average, to about 5,660 tons a year (1949-1950), with a value of some 38 million pesos. Of these, the only one that can be eliminated in the near future is cellophane paper, imports of which exceed 5 million pesos each year. It will be produced in Monterrey by Celotex S.A., on the basis of alpha cellulose, to be made by Celulosa Chihuahua S.A., which is one of the new mills now nearing completion.

Uruguay

By the Asociación de Fabricantes de Papel de
la Unión Industrial Uruguaya
(Uruguay)

The latest complete and reliable official data are those for 1949, since the production of 30 thousand tons estimated for 1950 undoubtedly represents the prospects at that time rather than the actual amount produced by the country's mills. Thus, in order to determine the current position (1954) private estimates have to be used, and any forecast of future demand for paper and board must be based on data prior to 1950.

In 1949, out of a total consumption of 42,734 tons, 19,501 tons corresponded to domestic production and 23,233 tons to imports. Of these, in turn, 17,034 tons were newsprint - all of which is imported - and 6,199 tons corresponded to other papers and boards. Per capita consumption in that year amounted to 18.1 kg., made up of 7.2 kg. of newsprint and 10.9 kg. of other papers and boards.

Estimated paper consumption during 1954 stands at an annual 55 thousand tons, of which only 28 thousand are produced in the country. The 20,500 tons of newsprint required are all imported, together with 6,500 tons of other papers and boards. This is equivalent to a per capita consumption of 22 kg., 8.2 kg. corresponding to newsprint and 13.8 kg. to other papers and boards.

/Current production

Current production of paper other than newsprint amounts to approximately 50 thousand tons, leaving a surplus of 22,000 tons annually in relation to consumption. To balance consumption and demand for all grades of paper, the following solutions are proposed:

- a) To complete additional installations for the production of some paper and board which is at present imported (glassine, cigarette paper, bristol board for cards used in accounting, etc.) It is hoped that capacity to manufacture these products will rise by 5 thousand tons annually, enabling imports to be limited to 1,000 or 1,500 tons.
- b) To promote, through agreements with other governments, exports of some paper grades which may be of interest to other countries (especially neighbouring ones), with a view to satisfying their immediate needs, at least until their own capacity is enlarged. It is impossible to foresee the tonnages that could be exported, since these mostly depend upon the relevant exchange agreements.
- c) To produce domestically at least one-third of the present newsprint consumption. This will be the easiest problem to solve, provided that economic and financial arrangements can be made between the government, publishing houses and paper manufacturers. Its solution would also encourage domestic production of mechanical pulp, which is the most important raw material for newsprint manufacture.

In order to estimate future demand for paper and board, per capita paper consumption was correlated with per capita income, 2 per cent being taken as the average growth rate of income. For 1960 this method of calculation showed a demand for approximately 67 thousand tons, 27 thousand of which correspond to newsprint and 40 thousand to other paper and board.

No less than 10,730 tons of chemical pulp and 2,458 of mechanical pulp were imported in 1953. In addition, 3,800 tons of straw pulp were produced locally by the soda-chlorine process. Fibrous raw material resources are very limited and the market is too small to allow the installation of units of economic size which could produce the different types of pulp required. It would therefore be more advantageous for the country to enter into an inter-Latin-American co-operation plan and take part in the development

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of neighbouring countries' projects by investing capital in exchange for a guarantee, on the part of these countries, to allow duty-free exports of given quantities of pulp to Uruguay.

As regards mechanical pulp, however, the situation is different. The large plantations of poplar and eucalypt established during the last few years could easily cover the needs of a new mechanical pulp mill with an annual capacity of 8,000 tons. Such an output would suffice to meet the annual newsprint demand and to replace imports of this pulp. Recently one of the paper-making firms has put into operation an interesting installation for making dark mechanical pulp which is particularly suitable for the manufacture of wrapping paper and boxboard.

Venezuela

by the Corporación Venezolana de Fomento.

The strong currency and the ready supply of dollars which characterizes Venezuela's economy have, as far as production and consumption of paper and board is concerned, given rise to considerable imports of all types of paper. This in turn has meant that there is little incentive for investigating and developing the use of domestic raw materials. Until 1953, Venezuela produced only 15 per cent - 7,718 tons - of its paper and board requirements, in a mill operating on the basis of imported pump and waste paper. Consumption in that year amounted to 68,870 tons - 12.5 kg. per capita. It was distributed as follows: 20.4 per cent for newsprint; 19.3 per cent for printing and writing paper; 15.2 per cent for wrapping paper, 20.5 per cent for board and boxes, and 24.6 per cent for other papers and boards.

Domestic output consists of wrapping paper, mainly of the type used for cement sacks. At the beginning of 1954 another small mill for making toilet paper was installed in Guacara, a town near Valencia.

It is estimated that consumption of paper and board will rise to 91,200 tons (14.3 kg. per capita) by 1960.

Although Venezuela has tropical softwoods which can be used for pulping, they are difficult to exploit because of the high cost of labour and transport. This directs the immediate prospects towards the use of

sugar-cane bagasse as raw material for a pulp and paper mill. The Corporación Venezolana de Fomento has prepared a project for producing 13,500 tons of paper a year. The output would be distributed as follows: 3,500 tons of printing and writing paper; 5,500 tons of paper for multiwall sacks, 1,000 tons of wrapping paper, and 3,500 tons of corrugating board. Installation costs are estimated at 20 million bolívares. Meanwhile, private enterprise has formed a company with a capital of 25 million bolívares for a pulp mill with an initial annual output of 25,000 tons to be expanded later on to 35,000 tons. This pulp will be used to make wrapping, and kraft papers, ordinary board and corrugated board for boxes. At a later stage, the company will probably put into execution a plan for using the country's timber resources as its raw material. For this reason, the exact location of the mill has not yet been decided.

The first part of the report deals with the general situation in the country. It is followed by a detailed description of the various regions and their characteristics. The report then discusses the economic and social conditions of the country and the progress made in various fields. It concludes with a summary of the findings and a list of recommendations.