Bamboo belongs to the same family as corn, wheat, and other grasses. There are about 700 known species of bamboo all over the world. Thirty of these are found growing in the Philippines.

Bamboo varies in height from 15 cm. to over 30 meters at maturity. This perennial monocotyledonous plant can thrive at temperatures ranging from 9 to 36 degrees Centigrade and has been found at altitudes as high as 3700 meters above sea level as in South America.

BAMBOO and pulp making

As a raw material for pulp and papermaking, bamboo has several advantages. It is relatively clean and, unlike wood, does not require barking. Its fibers are generally longer than those of other grasses and hardwoods. Fibers of some bamboo species have been found to be as long as those of the conifers, if not longer.

Generally, bamboo is easy to propagate. It grows rapidly. In India it is exploitable from 6 to 12 years after planting and at 3- to 4-year harvesting cycles thereafter. Unfortunately, reliable information on sustained yields of Philippine species are not yet

available. It is likely that climatic and other environmental factors in the Philippines are similar to those in many bamboo areas of India. Hence, there is every reason to believe that Philippine bambos behave similarly. It is encouraging to note that in Burma, India, and Pakistan sustained yields of 1.6 to 9.1 metric tons of dry bamboo per hectare per year have been reported. In the United States and Japan it has been noted that the annual yield of pulp per acre from bamboo is as much as 5.5 to 7 times greater than that for pine pulpwood which, in addition, takes a much longer time to grow before it can be harvested.

At present, bamboo is the principal raw material of the pulp and paper industry in India and it is a potential raw material in Burma. The annual consumption in India is about 400,000 tons. It is also used for the same purpose in Thailand, Japan, Taiwan, and Pakistan.

In India, clear cutting or cutting of all the culms in a clump or in an area was found to be destructive to the health of the plant and led to a deterioration in yield. On the other hand, selective

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manhood and self-respect are literally being torn to shreds by helplessness and despair."

In the face of these realities, the development effort can not but be a continuing imperative. I have had occasion to state, without wishing to be categorical, that the only effective formula there is for eradicating poverty, for advancing the standard of living of the people, for carrying out the precept of the Constitution that social justice be promoted to insure their well-being and economic security, is production. And it must be production that should outstrip the growth as well as the increasing needs of the growing population.

Production is the end result of the coordination of a number of factors. These are labor, capital, entrepreneurship, and the resources of nature. The instrumentality that coordinates these factors and lines them up together into a driving force that pushes the productive power forward is business enterprise. Without business enterprise production is an impossibility. Business enterprise, however, inevitably must operate under systems of governmental, monetary, fiscal and other statutory rules and regulations.

cutting which is now practiced there and in Pakistan requires the cutting of only the mature culms in cycles of 3 to 4 years to ensure high sustained yield. In this regard, felling rules prescribe the number of culms to be cut, when and how the cutting is to be done.

The harvested bamboo culms are brought to the pulp mill either by rail, trucks, or by floating in rivers.

PREPARATION OF RAW MATERIALS

Crushers

The crushers used are similar to those used in sugar mills. The culms are split and broken by feeding them through pairs of rolls with progressively narrowing clearances and grooves.

Chippers

Modern high speed chippers having 5 to 10 knives, like those used for pulpwood, are being used in recently constructed mills. Some chippers have provisions for holding the culms against the chipper knives.

In some mills combinations of crushers and chippers are used. The culms are first lightly crushed and then chipped.

These rules and regulations can help the productive processes to move ahead. They can also hold them back and obstruct them. Rules and regulations obstruct business enterprise when they curtail the full and beneficial utilization of the resources constituting the tools and factors of production. When they do, they obstruct not business enterprise alone; they obstruct production itself. When production is obstructed, the effort to eradicate poverty, to provide fuller employment opportunities, to raise the standard of living of the people, to promote social justice, is also obstructed.

For the past twelve years until a little over a month ago, business enterprise had been operated under a system of controls, particularly in the matter of accounting for the foreign exchange proceeds from exports and in having all imports and other commitments to pay foreign exchange abroad licensed. The latter especially was particularly shackled by diverse regulations governing the importation of commodities for consumption or production; for the purchase of plant machineries, spare parts or raw materials; for the acquisition of essential or luxury or unclassified articles; and for other

After crushing and/or chipping, the chips are screened and the fines discarded. The oversized pieces are reduced to the proper size by passing through hammermills, disintegrators, and other similar devices. The screened pieces go to the bins, silos, or direct to the digesters.

The crusher produces subdivided pieces which are very easily penetrated by cooking liquor. However, the bulk of pieces produced in crushers is greater than that of an equal weight of chips produced in chippers. The material produced in the chippers contains less fines and the chips are of more uniform length (1 to 1-1/2 inches) than those produced in the crushers. The crushed material consists of irregular-sized pieces, some of which are as long as 5 inches. Because of the high silica content of bamboos, which easily dulls the knives, frequent regrinding or replacement of the chipper knives is required.

PULPING METHODS

The sulfate and sulfite processes are employed in bamboo pulp mills today. The soda process is also suitable for bamboo, but the pulp is

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purposes. Whether a business enterprise may go into one kind of business or another, or whether it may or may not be permitted to go into business at all, depended also upon other kinds of regulations, — all of which as the regulatory and licensing authorities were becoming bolder, were becoming administered also according to their personal whims and caprices, and, eventually, a time arrived when licenses, if issued at all, could be had only against questionable considerations.

From the economic standpoint, the control system was showing signs of having outlived its usefulness during the last few years. Conceived to conserve the exchange reserves of the country, we had less than $100 million in reserves in 1961 when there was $300 million in 1950. Adopted as a tool of managed economy to accelerate and increase agricultural, and expand and diversify industrial, production, the country found that the yearly increase of its gross national product had dwindled by 1960 to 2.6% compared to the 6.9% average of 1950 to 1955 and the 4.4% from 1956 to 1959, with 1961 making no better showing than 1960. The Governor of the Central Bank is authority for the statement that "our export trade, long suffering from lack of incen-

inferior in quality in most respects to that produced by the sulfate process. Experiments in mechanical grinding, neutral sulfite, cold soda semichemical pulping, and continuous kraft digestions have been done on bomboo, but these are not yet practiced on a commercial scale.

Sulfate method

The sulfate method is the most widely used in bamboo pulping because it readily produces acceptable pulp from mixtures of species. The pulp is stronger than that made by other processes and the chemical recovery system is efficient and reliable.

There are two methods of sulfate digestions, namely, the fractional or two-stage method and the single-stage method.

The fractional method is based on the studies of Raitt at the Indian Forest Research Institute. The first stage of digestion uses the spent liquor from the second stage of a previous digestion. Raitt's process is carried out at a temperature of about 108 to 115 degrees Centigrade for two hours using about 8.5 percent active alkali as sodium oxide. During the first stage,

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tive due to the administratively fixed rate of ₱2.00 to $1.00, did not respond as favorably as hoped to the first stages of gradual decontrol which afforded higher exchange rates. Instead, it was caught in the grip of speculation at home while plagued with deteriorating market prices for our products abroad. Our export trade dropped by 10% in 1961, while imports increased by 17%. Investments slowed down, financial resources were frozen in inventories, agricultural and manufacturing production slackened, and mining suffered a reduction in output".

With extraordinary courage and vigor, and animated by a resolve to free the economy once and for all of the plethora of regulations and regulatory bodies that were choking the national productive effort, the new President who took office on December 30, 1961 authorized the promulgation on January 21, 1962 of the decontrol order. At one stroke, almost all licensing requirements for carrying out foreign exchange transactions were written off the books. This was a most courageous step. Had safeguards against hoarding and consequent runaway prices been ineffective, flight of whatever little of the foreign exchange reserves still left could have taken place. The decontrol system could

the starches and pectins are removed. The black liquor is pumped to the recovery plant at the end of this stage. Subsequently, fresh liquor containing active alkali as sodium oxide equivalent to 15.5 percent of the weight of the chips is charged and the cooking proceeds at 153 to 158 degrees Centigrade for one hour and for two hours more at 140 degrees Centigrade. Delignification occurs during this stage. The spent liquor from the second-stage cook is drained into the digester of a first-stage cook. The pulp obtained by this method is easily bleached by a single hypochlorite treatment. However, the modern two-stage methods use (1) in the first stage, 2 to 3 percent active alkali as sodium oxide and a cooking time of 2 to 4 hours at 142 to 150 degrees Centigrade and (2) in the second stage, 12 to 13 percent active alkali as sodium oxide and a cooking time of 4 to 4.5 hours at 162 to 170 degrees Centigrade.

The use of less complex single-stage cooking methods to produce bleachable pulps is now possible due to the modern multi-stage bleaching processes. The single-stage

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have been utilized by unscrupulous speculators to bring about an economic debacle, even a social upheavel in the country.

I must quote again the Governor of the Central Bank on the safeguards taken to insure the success of the decontrol program. "In view of the massive inflationary pressures which had been built up last year by prodigal government spending and liberal credit, it was imperative to place some restraint on new monetary creation. Money supply during the one year period ending October, 1961, had expanded by 15%. Such a magnitude of monetary expansion was well above the danger point signified in the Central Bank Charter. Central Bank rediscounting and lending to private banks had also gone up by nearly 100%. The specific measures taken to counteract these conditions were: (1) the raising of the rediscount rate; (2) the reimposition of rediscount quotas on banks; (3) the raising of bank reserve requirements against demand deposits, and (4) the prescription of time deposits as a condition for opening import letters of credit. A stipulation intended to dampen the inflationary effects of exchange windfalls arising from decontrol requires that 20% of all

sulfate method takes 4 to 5 hours at 165 to 173 degrees Centigrade with 15 to 16 percent active alkali as sodium oxide. The sulfidity of the cooking liquors used for both single- and two-stage digestions varies from 10 to 25 percent.

Studies in the Philippine Forest Products Research Institute have shown that some Philippine bamboo species such as bolo (*Gigantochloa levis*), buho (*Schizostachyum lumampao*), giant bamboo (*Gigantochloa aspera*), kauayan-kiling (*Bambusa vulgaris*), kauayan-tinik (*Bambusa blumeana*) and yellow bamboo (*Bambusa vulgaris* var. *striata*) respond well to the single-stage sulfate method using 15.5 percent alkali as sodium oxide with 25 percent sulfidity, a cooking time of 3 hours, and a miximum temperature of 170 degrees Centigrade. The yields ranged from 40 to 47 percent.

Sulfite method

A disadvantage of the sulfite process for pulping bamboo is that each species must be cooked separately as different digestion conditions are required. Of course, more labor is required in handling

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export proceeds should be turned over to the Central Bank at the official rate of two to one."

The measures taken to free the economy from regimentation were a long stride forward from the regime of government functionaries dictating to their fellow citizens how their business should be conducted or how their consumption needs should be satisfied. It was again Dr. Laurel who said, "We prefer this type of economy" — he meant free economy — "because both theory and experience tell us that it is the only type that can enable us to preserve our democratic institutions."

Corollary to social justice, another objective of increased production is to lessen if not close the gap between export income and import expenditures. The long range goal is to develop favorable foreign trade balances, the only way by which the value of the peso in both the domestic and the international markets can be stabilized. Without reaching a settled balanced position in the foreign trade, the exchange value of the peso or the term of its foreign exchange convertibility will always be an uncertain, unstable rate that will float up and down with the variable waves and troughs of demand and supply of foreign exchange as well as demand and supply of

each species separately in stacking, chipping, etc. The cooking time is much longer than that required by the sulfate processes. Another factor which has hindered its wider use has been the lack of a chemical recovery system. The application of modern recovery systems now available could possibly make this process competitive with the sulfate process.

The sulfite process is employed by only one mill in India. The magnesium-base cooking liquor contains about 1.95 percent free SO_2 and 2.3 percent combined SO_2. The total sulfur in the liquor is equivalent to about 8.0 to 8.6 percent of the weight of the chips. Cooking takes 19.5 to 20.5 hours and the maximum temperature varies from 155 to 160 degrees Centigrade. Because of the low capacity of this mill it is not economical to recover the chemicals for re-use.

BLEACHING

Two-stage cooked sulfate pulps are bleached in the mills by two hypochlorite treatments with washing after each treatment. The available chlorine consumption ranges from 7 to 10 percent.

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peso to pay for it. Supply of foreign exchange adequate to meet every foreseeable demand can not be had unless and until the foreign trade is at least balanced, or until we attain what the economists call an equilibrium in the balance of payments position. The country can not depend upon stabilization loans all the time.

If decontrol had been promulgated without the safeguards we have mentioned, and without a knowledge of the existing situation in the market of essential foodstuffs and other necessities of daily life, the commodity hoarders and price speculators could have gained dominance of the situation. Prices could have skyrocketed. But because the country had four to five months' inventories of essential commodities on hand, it was calculated that such supplies were too large for cornering and hoarding, so that skyrocketing of prices was not likely to take place.

Even then, there has still been a notable increase of commodity prices, especially the prices of imported goods. Prices of domestic goods have a way of following sympathetically the behavior of prices of imported commodities. But such increases as have taken place have largely been a kind

Multi-stage bleaching is used for sulfite and for single-stage sulfate pulps. This consists of chlorination, caustic extraction, and one or more stages of hypochlorite treatment, with every stage being followed by washing. Available chlorine consumption varies from 6 to 8 percent.

PAPERMAKING

The processes and equipment used in bamboo papermaking are essentially the same as those used for other fibrous materials. Bleached sulfate and sulfite bamboo pulps, either alone or in mixtures with other pulps, are used for making a wide variety of writing, printing, and wrapping papers, newsprint (as the chemical pulp portion), and paperboards. Unbleached bamboo pulp is used for paperboards, wrapping, and bag papers.

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of sounding out by the trading elements to see how far the consuming public would follow. After all there is a limit to the capacity of consumer purchasing power to absorb price increases.

To further neutralize the threat of speculation and hoarding, the time deposit requirements in the opening of import letters of credit covering essential consumption and production goods have just been lifted. Thus, another major step has been taken to ease the way of free enterprise. The relief could have been more widespread, however, if the importation of all raw materials and spare parts of existing manufacturing plants were likewise eased. They represent investments that should not be liquidated, sources of employment that should not be emasculated, productive facilities contributing to the economic advancement of the country that should not be stultified, even if they pertain to the non-essential producer category.

While easing the way for the importation of essential commodities to replenish diminishing inventories, counteracting thereby the incipiency of increasing prices being generated by imagined scarcities, this relaxation measure poses a new problem. It will create a substantial demand for foreign exchange which will lower once more the value of the peso. Foreign exchange holders will tend to hold on to their dollars as long as possible and will sell only when no further dollar price advance may be expected. In other words, the floating rate will call again for more pesos to buy one dollar. This, how-