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IN

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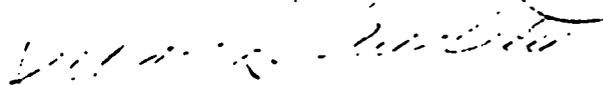

RICHARD J. AUCHTER

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EXECUTIVE SUMMARY

The wealth of published information based on research and actual operation supports the thesis that growth of forest products industries in the tropical countries of the world is dependent on the development of financing rather than on providing more technical solutions. This point is true whether one considers the environmental and ecological factors of sustained yield from the tropical forests via natural or plantation silviculture or the processing systems available for converting the great diversity of species and fiber characteristics into any type of forest product.

World demand for pulp and paper by 1990 requires some 2 million tons of market pulp from the tropical hardwood area. Capacity for some of this will be ready for start-up late in 1978 or early 1979. Planning for much of the remainder is in various stages of development from acquiring financing to final engineering design. These market pulp mills must be 750-1000 tons per day in size to be economic and each requires from 350-450 million 1977 dollars.

Growth in forest product consumption in the tropical countries can exceed that for the industrialized world. This is desirable for the welfare of the people in the tropics and can provide an added growth factor for the industrialized world. Thus, support for stage-wise development of forest product industries using appropriate technology in the lesser developed countries should be provided by industry, technical assistance agencies and the financial community.

INTRODUCTION

Relatively few of the thousands of wood species growing in the tropical areas of the world find a ready market for conversion into forest products. This has resulted in the designation as primary species those being utilized and secondary species for those left behind. This latter group represents a vast resource but one that in its ready accessibility to shifting agriculture and as a source for fuelwood is in danger of destruction rather than utilization.

The Agency for International Development recognized this problem and in 1974 funded research at the Forest Products Laboratory to establish the technical feasibility of using the secondary species on essentially a run-of-the-woods basis for the manufacture of pulp for paper and paperboard and as a raw material for the production of reconstituted wood products such as fiberboard and particleboard.

It was hoped that as a result of this and related efforts by others, a "pre-investment package" could be assembled for the benefit of potential investors and decision makers. The essential elements of such a package include a discussion of the technical feasibility of forest product manufacture using mixtures of secondary species native to the area, a preliminary industrial survey based on specified site characteristics and market for the product and suggestions for alternative procedures which could materially affect the development of forest product enterprises in the lesser developed countries of the tropics.

In all of this one should not lose sight of the local benefits, economic and social that accrued from the establishment and growth of forest product enterprises in the industrialized nations of the world. The history of this industry documents its relation to the growth of economic and social factors during the humanization of these countries and that this can be repeated in the lesser developed countries while using with care their abundant forest resource.

TECHNICAL FEASIBILITY

In the consideration of a manufacturing enterprise, technical feasibility is seldom absolute in all details. Generally, there are so-called musts and wants in the technology designed into a manufacturing system. It is also recognized that some problems will need to be overcome during start-up and the early phases of operation. This latter part is perhaps the greatest incentive for assuring that appropriate technology is adopted in the design strategy; and this is true whether the enterprise is for the lesser developed countries or for the industrialized world.

Generally stated utilization problems

The problems that have been raised with respect to the utilization of the thousands of wood species in the tropics for pulp and raw material for reconstituted forest products are in most cases real. We must recognize, however, that similar problems were raised about the wood resources in the temperate zones and that solutions were developed or accommodations reached. Again, history has numerous examples where what was stated as impossible or difficult to achieve by someone was done by others with relative ease when the economic need was sufficiently great. Perhaps the most prominent and closely related of these is the expanded use of hardwood pulp in Japan, Europe and North America. Their positive economic benefit was soon supplemented with findings that product quality and

even some processing operations were also enhanced.

The natural tropical forest itself has characteristics which limit their use. They have a great diversity which may be as large as several thousand species in a contiguous area. They are also not even-aged and as a consequence the wood quality from the same species in an area is quite variable. Finally, commercial value is limited to a few species which when removed degrades the forested area.

The tropical hardwood species diversity results in density ranges twice that for hardwoods in the temperate zone. The ultra high density species in the range of 0.90 to 1.20 or higher are said to be difficult to handle and to convert to particles such as chips or flakes needed in the manufacturing processes for pulp and building board.

Fiber dimensions, particularly length and cell wall thickness of tropical hardwoods are somewhat larger and more diverse than for North American and European hardwoods. It must be remembered, however, that variability in fiber dimensions within any one tree are generally as great as between trees or even within the hardwoods as a class. Fiber flexibility, considered by some as important in the paper-making process is somewhat poorer for the tropical hardwoods than for those in the temperate zones.

Silica content in a significant number of tropical hardwood species presents unique problems. First, high levels of silica cause knife dulling and breakage during chipping and flaking. Then the silica dissolves from the

wood into the pulping liquor and causes scaling in evaporator and indirect heater tubes. That silica which remains with the pulp or flake can cause further problems in slitting and cutting of the paper and building board.

Extractives and other minor constituents of the wood, whether solvent or water extractable, can cause a variety of processing problems. With tropical hardwoods, these are sometimes new materials not yet encountered with temperate zone woods and the value of the commonly used alleviating techniques must be established.

The remaining utilization problems are related to inadequate infrastructure and the availability of manpower and skills to convert trees to marketable forest products. These are formidable problems considered by many as more difficult than the technical problems previously discussed.

Status of experience on the problems

It is fortunate that in the past decade much research has been done and sufficient practical experience gained to permit a more realistic consideration of the problems which are said to retard development of utilization procedures.

While much has and is being learned by research in natural and plantation regeneration of the tropical forests, caution and restraint in development is recommended. Measures are available for implementation that would insure satisfactory development of the tropical forest lands. Included in these measures would be the designation of certain areas for protective uses. While natural regeneration has

been somewhat disappointing, timber plantations for pulpwood and other forest products have shown good success. Whether or not these can be sustained is rightly questioned by some but those foresters involved in these ventures are optimistic for the future.

A wide variety of logging methods is used in the tropical forests and as utilization is extended to more species additional options will become available. Improved utilization with some degree of plantation regeneration will reduce hauling distance and permit the development of better and more permanent transportation systems. The silvicultural and harvesting procedures needed to maintain a forest product enterprise offer great opportunity for employment of the people native to the tropical forests.

Forest inventories are generally inadequate and it would be most helpful for assessing progress if forest inventory data were scheduled to be developed under the guidance of a responsible international agency, FAO for example.

Laboratory research by North American, European and Australian organizations, both private and public has demonstrated that it is technically feasible to produce pulp, paper and reconstituted products from a great variety of tropical hardwood mixtures. Woods from Africa, Latin America and Southeast Asia were used in these research efforts.

The successful operation of commercial plants has generally confirmed the laboratory research results and provided solutions to those problems which arose from using

the variable character of the tropical hardwoods and which are usually only solvable in continuous operation.

Particle preparation via chipping, flaking or other means of the ultra high density and the high silica content species remains a problem. Present solutions range from not harvesting or culling out such wood to reserving them for reduction at specified times when machinery is deemed better suited. In the latter case there is little or no concern for particle quality since much debris is usually produced. It is possible that a pre-crush of these logs by a system similar to that developed by TVA for oak could ease the processing to particles problem. Also knife and chipper research as done for temperate woods could help in this problem solution but the machinery and knife manufacturer must see the potential for sales before such effort is allocated.

The silica problem extends into the pulp mill where scaling of evaporator and heater tubes necessitates more frequent boil-outs and mechanical cleanings. In recent years, North American mills using whole tree chips have also had to resort to more frequent cleaning to re-establish adequate heat transfer. Cleaning rates quoted by one tropical hardwood operator do not seem excessive. Research on scaling phenomena at various institutes will provide some relief with suggestions for operating procedures and the use of additives.

The heterogenous diversity of wood species and anatomical characteristics is said to cause quality variations

in pulp strength which would adversely affect its marketability. That the above could be true is a possibility but with reasonable care in harvesting, log storage, chip storage and chip reclamation this can be relegated to the minor or no problem area. Research using significant different species mixtures whether from Southeast Asia, Latin America or Africa showed that pulp strengths were quite comparable, usually within the limits of testing error in variability.

An area where much of a general or theoretical nature is known is the pitch problem related to the extractives and extraneous materials present in the tropical hardwoods. With temperate zone wood the specific nature or characteristic of the pitch problem must be ascertained before remedies can be prescribed. The problems are sometimes cyclical, sometimes process oriented and usually come and go without apparent logic or reason. This is what makes solution difficult but attentive and systematic study has developed a significant body of published information on the changing nature of the extractive materials and their reaction to the pulping and papermaking processes.

Pulping processes - product quality - wood supply

For the production of medium yield (55-60%) and low yield (40-45%) pulps from a mixture of tropical hardwoods, the well known kraft process is recommended. Research has found that individual tropical woods as well as mixtures can be pulped with ease by the kraft process. When white pulps are to be produced, the low yield pulps can be bleached

to competitive brightness levels using the conventional whitening agents - chlorine, caustic, chlorine dioxide and peroxide - in sequences of 4 or 5 stages.

Higher yield pulps (75%) for corrugating medium are produced using green liquor, soda or neutral sulfite cooking processes. There could be some quality or runnability problems with neutral sulfite pulps but means to overcome them are available. In this type of paperboard strength, while needed to provide the functional properties of the corrugated container, is not necessarily the critical factor in determining the runnability of that paperboard during the corrugating process. The specific mechanisms are not well understood but this lack of knowledge does not prevent the production of competitive boxes from tropical hardwood paperboards.

Thermo-mechanical pulp at 95% yield is recommended for newsprint and fiberboard products. In the case of newsprint, the process is more sophisticated because of the fiber qualities that are necessary to provide printing and runnability properties. This usually means two additional stages of refining or fiber treatment following the thermal stage. For fiberboard, the thermal stage pulp may need only minor adjustments in further refining to make it suitable for either the wet or dry forming process.

Based on research data and mill experience as reported at the International Conference on Improved Utilization of Tropical Hardwoods product quality whether pulp, paper,

paperboard or building board can be competitive on the world market while using substantial levels of tropical hardwood pulps. For local markets, many forest products can be made with a 100% tropical hardwood furnish.

The availability of a long-fibered softwood pulp supply is warranted for any paper or paperboard mill operating on tropical hardwood. They are used in limited quantities at critical times when product quality and runnability are marginal or substandard. Therefore, in planning the maintenance of a wood supply to a mill, the development of some long fiber or softwood plantations will be essential and should be part of the early planning in the selection of a mill site.

In recent years, the concept of full-forest utilization has made available additional wood to ease the projected shortfall of wood fiber needed to meet the world demand for fiber products. Without the extension of this concept to all wood growing areas of the world the future demand for wood will be greatly in excess of that safely available from the world's forests. It would appear that if these demands are not met in this manner, the destruction of the tropical forests will continue.

Full-forest utilization will not only make more wood available for fiber but result in making available bark, fine material, small branches and foliage for conversion to fuels, chemicals and animal feed supplements. This may not apply to the tropical forests where questions of soil stability and nutrient retention are as yet unanswered.

PRELIMINARY INDUSTRIAL SURVEY

A preliminary industrial survey or case study represents one of a series of feasibility studies useful to the decision making process which can lead to the investment of capital for the erection of a manufacturing facility. In general, specific concepts are evaluated with regard to their effect on operating costs and their potential for application. In this particular instance, the concepts of full forest utilization for product and energy are considered and their relationship to the maintenance of a wood supply and the economic operation of a facility evaluated.

Commercial operations - planned or operating

More than half of the world's forests are located in the tropics. They are an important resource locally and internationally as a significant raw material base for forest products essential to all areas of the world. Their development in the last quarter century however, has provided only modest benefits to the peoples of the tropics. With 80 percent of the industrial wood harvested in the tropics being processed outside the timber producing countries, government dissatisfaction with the rate of progress toward local conversion is becoming more evident and in some cases remedies are being forced by restricting log exports.

From a few small-scale industrial trials carried out in the early 1950's, commercial pulping of tropical hardwoods now takes place in the Phillippines, India, Bangladesh, Brazil and Colombia. Practical experience and research have

proven that most grades of paper and paperboard can be produced with fiber furnishes with substantial quantities of mixed tropical hardwood pulp.

Production of market pulp from mixed tropical hardwoods has been studied for a long time. It now appears that this objective will be reached even though there is currently a depressed market for short-fibered pulp. Two projects are under construction in Brazil - the Aracruz mill based on a plantation of eucalyptus that was started in 1967 and the Jari market pulp mill based on Gmelina and Caribbean pine plantations. The combined annual tonnage is projected at 650,000 tons with start-ups scheduled for late 1978 or early 1979.

Other market pulp projects from mixed tropical hardwoods are under some degree of implementation in Cameroon and Gabon. Serious studies involve the mixed tropical forests in Indonesia, Guyana and Ivory Coast and some positive results from these efforts are expected.

Market potential

FAO recently issued a world pulp and paper consumption outlook. This study was different from past efforts in that they enlisted industry assistance and leadership. This was based on FAO's realization that industry might better identify shifts in factors affecting demand, that their own econometric approaches may not fully consider changes in demand causes and that the cyclical forces affecting 1973-1975 consumption warranted a critical industry appraisal.

The Working Party projected a modest decline in world economic growth with Japan and Western Europe as the key contributors. Five-year trends were the bases for the projection which first showed that the economic growth rate has been declining since the 1960-65 period from a level of 5-5½% to near 4½% in the 1970-75 period. This is seen to further drop to 4% in the 1985-90 period.

World pulp and paper production capacity surveys by FAO are intended to keep demand trends and capacity developments in a reasonable perspective for an industry which has a history of major cyclical booms and busts many of which are industry caused. A cursory review of recent surveys shows considerable activity in the areas of the tropical forest countries such as Latin America, Africa, Middle-East and Southeast Asia. It is reasonable to expect that economic growth in these areas could be maintained at a level above the figure projected in order to speed up their human development. Furthermore, as subsequent discussions will show, the free world needs the output as well as increased exports to these areas to reach the projected economic growth.

In reviewing the self-sufficiency situation for the various areas of the world, the Working Party concluded that in bleached hardwood pulp, Latin America and Other Eastern Hemisphere countries - the tropical area - would by 1990 be exporting to Japan and Western Europe better than 2 million tons of pulp annually. Only North American determination

to maintain its market for some 750,000 tons prevents a greater growth in the export of tropical hardwood pulps and permit consideration of more market pulp mills.

The bleached softwood pulp picture is not as good in that only Latin America is projected to be self-sufficient and perhaps contribute nominal tonnage for export. The Other Eastern Hemisphere countries will be only slightly more than 50% self-sufficient. This must be considered in the plans for wood growth in these areas and should result in the development of softwood plantations for pulpwood.

Of some importance, is the Working Party's projection that by 1990, sulfite pulp will cease to be involved in the world trade picture with less than 10 million tons being produced for captive conversion to paper products.

In the total paper and paperboard trade area, Latin America is somewhat short of self-sufficiency at a 90% rate while the Other Eastern Hemisphere area is only 69% self-sufficient. The Latin American region falls below the 90% rate with respect to newsprint and printing and writing papers whereas the Other Eastern Hemisphere region is more self-sufficient in these grades than their average for all papers. Perhaps the inclusion of Australia, New Zealand, South Africa and perhaps a few other countries in the statistics for this region warps the data somewhat from the true picture for most of the countries in the tropical forest areas.

History tells us that paper and paperboard availability

and use are closely related to economic and cultural development. Thus while progress in the tropical countries may be slow there remains great potential for growth in paper and paperboard production. Timing is important and urgent in providing the means for overcoming the factors which are retarding the development critically needed for the enhancement of the native population in the tropics.

Infrastructure and political policies

While it is true that infrastructure and services relating to the pulp and paper industry were part of the development costs when this industry grew within the present industrialized world, such costs in the lesser developed countries are too great for a project to absorb. Concessions of various kinds will be needed whether provided by governments or world organizations which can subsidize such efforts based on the greater good that would result.

The limited paper and paperboard use in the lesser developed countries requires that these countries co-operate in product development for regional consumption to provide the avenue to develop the increased demand that ultimately will lead to local production facilities for many, if not all types of paper and paperboard. This is a difficult task and requires superb diplomacy by the integrating organization but is a necessary effort in order to advance development rates in accordance with present hopes and dreams for improved human relations.

Financial considerations

It is generally agreed that the development of forest products industries in the tropical countries is not a technological but rather a financial problem. The arrangement for capital for infrastructure and operating facilities is the single factor which today holds up equipment purchases and plant erection. The few that are proceeding slowly and cautiously have many partners - governments, equipment manufacturers, private lenders, industry and others each of whom are assuming a small portion of the risk capital involved.

Studies devoted to the structure of the pulp and paper industry prior to 1975 usually considered regional growth in production and investments and the limits of forest exploitation along with the risk of medium-term shortages. Today it is not only interesting but apparently essential to analyze the principal trends of this industry on an international level to achieve significance.

Encouraging human growth in the future is partially a question of technology and partially a question of social values. Each is affected by priorities, national and international and the realization that even the most affluent society cannot maintain high and rising standards while providing new production facilities, maintaining national defense capabilities and adding expenditures for increasing demands to improve environmental and social conditions.

Identification of new means of making money available

for agreed upon international programs are vital since present methods have critical limitations which delay progress at best but more likely prevent progress. Taxes on international trade have been suggested as one means to raise the monies needed for establishing the enterprises which would permit real economic growth in the tropics. Political, legal and administrative factors can discourage consideration of new international financing methods, but neither this nor their low potential for early use should be permitted to delay analysis and some designation given to their worth.

Preliminary survey - C. T. Main study

The Agency for International Development funded research at the Forest Products Laboratory to determine the potential for utilization of the mixed tropical hardwoods, particularly the secondary species as a base for useful forest products. Their utilization would provide employment opportunity, stimulate local economy and improve balance of trade while giving due regard for ecological and environmental factors.

Within the scope of the project was a Preliminary Survey or Case Study which would consider technical and financial feasibility of harvesting run-of-the-woods tropical hardwoods for the manufacture of pulp and for the generation of steam and electrical energy.

The basis for this survey was information developed by research at the Forest Products Laboratory and other research groups such as Centre Technique Forestier Tropical, Commonwealth Scientific and Industrial Research Organization,

Tropical Products Institute, Pulp and Paper Research Institute of Canada; from visits to operating mills in the Philippines and Colombia; from the United Nations Food and Agriculture Organization and from C. T. Main's own experience and activity.

The economics of constructing a new market kraft pulp mill are adversely affected by today's depressed market demand and prices. As indicated earlier in this report there is an indicated limit to the number of market hardwood pulp mills needed to supply the estimated 1990 world demand. These market pulp mills must be sized to take advantage of the economy of scale which today is recommended as 750-1000 tons per day at a cost of \$350-450 million each.

The utilization of the mixed tropical hardwoods result in a lower wood cost to an operating mill even though the infrastructure costs are high. Thus an existing pulp mill could benefit by extending their species use for products as well as for the generation of their energy requirements.

There are of course local social benefits which were not and generally cannot be included in the financial analysis but which must be considered by the local authorities in their planning for development assistance.

ALTERNATIVES TO FULL-SCALE DEVELOPMENT

As is shown in preceding discussions, the number of market hardwood kraft pulp mills that can be supported by world demand of this type of fiber is limited to perhaps six economy of scale mills of 750-1000 tons per day each. This

requires a total investment of 2.5 billion 1977 dollars. A number of mills are already being built or in the advanced stages of planning and investment development. This should not discourage planning for market pulp demands beyond 1990. It does show that consideration of the development of local forest product demands in the tropical countries must be given support.

Stage-wise development planning

Local demands for forest products are generally negligible in many countries of the tropical forest regions. Those materials which are needed are imported and the balance of trade deficits restrict demand growth. Local production of forest products with procedures that may seem primitive with respect to present industrialized world technology could be the catalyst to make world demand for forest products grow beyond the nominal level projected. It is these areas of the world that can make the difference whether the economic growth curve for forest products continues to decline or holds steady and even advances somewhat.

The international assistance agencies should co-ordinate the study, survey and planning of various modes of development that could be recommended and implemented for areas with tropical forests that will assure environmentally safe utilization for the production of forest products. There are numerous potentials, few of which have been evaluated by or for the lesser developed countries. The contribution to social and cultural benefits of such

development can and perhaps must be estimated to give priority to the promotion of implementation efforts.

All of the potential utilization plans have log or wood harvest as their basis. From this, individual and/or utility fuelwood needs can be provided; log and/or chip export can be considered; some sawnwood for local construction of shelters produced; production of newsprint, tablet and school papers as basic needs can be promoted; boxes made for shipment of local produce; and, hopefully many other small and important uses can be added.

Appropriate technology

Much has been written and said about the technology which would best promote social and cultural enhancement in the lesser developed areas of the world. There is no ready answer. Much of this is related to the reluctance on both the industrialized and lesser developed world to respectively promote and accept technology that is considered obsolete by the former and perhaps insulting to the latter..

The technology adopted by the industrialized world is not all good nor well applied. High energy demanding processes and products are under critical adverse appraisal of their costs versus alternatives to meet the product or service demand. Reduction in man-hour requirements per unit of product or service must be balanced against the social costs of unemployment. Thus, even in the industrialized world there is need for the promotion of the idea of appropriate technology.

Just as the new producer of a product often teaches the old and established producers some better technology - new or modified - so can the development of industry in the third world provide mechanisms for a wiser and more beneficial economic growth for all peoples of the world.

RECOMMENDED AID ACTIVITY

It appears that the promotion and development of the economy of scale forest products enterprises that are needed to meet the demands of the industrialized world will be met via the usual channels of financial support. These, however will do little to promote the advancement of the social, economic and cultural development of the bulk of the population in the tropical forest areas. Other avenues are necessary. These are the small scale operations that develop and expand local needs and then regional demands for forest products. It is this avenue that needs the support of the international technical assistance agencies for guidance through studies of product development for local needs and desires.

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