

# Appropriate forest industries

Selected papers of an Expert Consultation  
held in Jakarta, Indonesia  
30 September-6 October 1985

FAO  
FORESTRY  
PAPER

**68**

**FINNIDA**



FOOD  
AND  
AGRICULTURE  
ORGANIZATION  
OF THE  
UNITED NATIONS  
Rome, 1986

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M-36

ISBN 92-5-102389-1

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## BACKGROUND

The FAO/Finland Expert Consultation on Appropriate Forest Industries was held in Jakarta, Indonesia, from 30 September to 6 October 1985, with the financial support of the Government of Finland and with the Government of Indonesia providing host facilities.

The objectives of the Consultation were to review issues which have a bearing on appropriate development of forest industries, to propose means for evaluating the appropriateness of forest industry proposals or already implemented projects and to advise on the activities which FAO should undertake to promote appropriateness in forest-based industries.

The main themes to be discussed by the Consultation were:

- (a) Common features of forest industries projects;
- (b) Rural enterprises;
- (c) Institutional requirements;
- (d) People and industry;
- (e) Education and training;
- (f) What is appropriate?

Background documents for each theme had been sent out to the participants of the Consultation before the meeting, together with brief discussion papers for each theme, highlighting the issues to be discussed. During the Consultation itself, the papers were not presented but there was a brief introduction by the Secretariat for each theme, following which the theme was discussed. The emphasis of the Consultation was, therefore, on exchange of views among the participants rather than on presentation of papers.

In this volume the documentation of the Consultation has been included, together with the introductory presentations made by the Secretariat and a summary of the discussion of each item. It should be emphasized that this summary is not a verbatim report but, rather, highlights and emphasizes points which were raised during the discussions. The discussion papers originally sent to the participants are not included since they would serve no specific purpose in this context, after the Consultation, and the introductory papers by the Secretariat cover the same issues in a more detailed manner.

A number of recommendations on specific details were put forward during the course of the discussions, together with some broader recommendations. The contents of all these were essentially covered by the following recommendations to FAO, adopted by the Consultation:

In cooperation with the appropriate international agencies, FAO should:

1. Emphasize the importance of appropriateness in forest industries and strengthen its activities in providing advice and assistance to governments and industry in this regard. Special emphasis should be given to forest-based industrial development in the context of the tropical forest action programme and its objectives related to arresting deforestation.

2. Prepare concrete and practical guidelines for identification, design, preparation, evaluation and implementation of appropriate forest industries. These guidelines should include economic, social, institutional and ecological aspects in addition to conventional issues normally considered in the above activities. Training should then be organized at regional and subregional levels, using these guidelines.
3. Pay greater attention to the role that small rural industries can play in the overall development of the forest industry sector, and promote action to ensure support for greater sustainability and growth of these rural enterprises.
4. Increase its efforts in providing advice to governments on necessary adjustments in their legal and institutional framework for the creation of favourable conditions for appropriate industrial development and for improvements in benefits derived from forest industries at national and local levels.
5. Expand and strengthen the ongoing efforts of FAO for the promotion of people's participation in forestry with regard to activities for development of appropriate forest industries.
6. Continue to strengthen the education and training capability of developing countries to improve the managerial and technical skills required by appropriate forest industry enterprises.
7. Take action to improve the existing knowledge of the impact of policy measures within and outside the forestry sector on sustained development of appropriate forest industries.



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PART I

INTRODUCTORY PAPERS

AND

SUMMARY OF DISCUSSIONS

## COMMON FEATURES OF FOREST INDUSTRIES PROJECTS

Introductory Note  
by the Secretariat

(Consultant: J.S. Bethel)

### 1. INTRODUCTION

Successful industry projects have certain features in common and the industries based upon the forest are not exceptions to the general rule. Like other natural resource-based industrial projects, forest industry projects involve the organization of a set of technologies to efficiently use available capital, energy and personnel skills to convert the resource into a commodity or product that can be marketed at a profit. The industry may be designed to use the woody portions of the forest trees as the basic raw material and indeed this is the usual case. It can also be based upon the use of non-wood components of the forest biomass such as foliage for thatch or forage, honey, resin, rattan, bamboo and the like.

Because the wood component of the forest biomass is the predominant forest industry raw material, this is the primary focus of this particular context. Clearly, other components are equally important. In any case, the basic principles of sound industrial organization are equally applicable to the processing of all components of the forest biomass. One basic tenet of industrial project design is the assurance of an adequate raw material supply base.

### 2. FOREST RESOURCES

As population increases, the pressure upon land for non-forestry use will increase. The forest land base will be diminished and it will be increasingly difficult to control the use of highly productive land. In the long run, the demand for forest products will increase but it will have to come from a smaller area of poorer land.

This raises the question of the adequacy of the present and potential future of the forest supply base for industry. Ninety-five percent of the industrial forests of the tropics are natural forests. These forests carry no silvicultural costs and are often thought to be an inexpensive source of wood. It is sometimes said that planning for use of these forests is relatively easy because problems of harvesting, processing and marketing are easily identifiable and solutions are well known. But these forests in the tropics are generally very poor sources of raw material supply. Rich in biomass, they often yield less than 5 percent of that biomass in industrial materials. Furthermore, they are generally low in productivity. One to 2 m<sup>3</sup>/ha/a are typical growth rates for naturally occurring forests.

Man-made forests represent about 5 percent of the industrial forests of the tropics but the proportion of this type of forests is increasing very rapidly. Since plantations are designed to meet the needs of a specific industry, they yield much higher fractions of their biomass in useful industrial materials. Productivity on man-made forests is much higher than on naturally occurring forests. Common yields are 10 to 30 m<sup>3</sup>/ha/a and growth rates up to 75 m<sup>3</sup>/ha/a have been reported. The importance of the supply of industrial wood from man-made forests in the developing countries by far exceeds their relative areas compared to natural forests.

Industry pays the bills for forestry. Income from industrial use of forests can provide governments with the funds required to engage in tropical forest conservation and rehabilitation as called for by the recent World Forestry Congress. As opportunities are presented to develop forest resources for industrial use, they should be located so as to be accessible to manufacturing sites and within the context of transport and energy networks.

### 3. CAPITAL SUPPLY

An adequate supply of capital is essential to the development of a new industrial enterprise. This is particularly true of large industrial complexes of the sort required to produce fibre products. Capital is required not only for the original installation of the facilities but for working capital as well. This latter requirement may be most important since many new industrial enterprises require a substantial start-up time before they break even or begin to return a profit to capital. Failure to recognize this phenomenon has often led to failures in new industries.

There are essentially three basic sources of the capital required to initiate a new industrial enterprise; namely, equity capital, borrowed capital and gift capital.

#### 3.1 Equity Capital

Equity capital represents the investment of individuals in an enterprise which gives them a share in its ownership and entitles them to share in its profits if it is successful. In a corporation the investor has a voice in the management of the enterprise commensurate with the number of shares owned. In a cooperative each investor has an equal vote.

Equity capital is often scarce in developing countries where risks are frequently perceived to be high. Accordingly, many developing countries encourage the investment of foreign capital. This often creates problems. In order to minimize risks, the foreign suppliers of capital often want to exercise control over management of the firm to protect their investments and this is sometimes contrary to national policy. A plan to start small and grow through reinvestment of profits is sometimes a useful way for a developing country to build a manufacturing enterprise and still retain management control.

#### 3.2 Borrowed Capital

Capital can be obtained by borrowing in the financial markets either of the developing country itself or in world markets. If the firm or its owners have a good credit rating or have collateral to guarantee the loan, capital can often be obtained from commercial banks. Sometimes capital can be raised by selling debenture bonds to interest investors. Such bonds are sometimes made attractive to investors if the purchase of debentures gives the investor the right to purchase some of the output of the factory.

The developing countries have access to funds from international and regional development banks. These funds can be made available for capital support of industrial projects where governments are participants in the firm. Often these funds are available at much more attractive interest rates than those available from commercial banks.

### 3.3 Gift Capital

A not insignificant source of capital available in some developing countries is gift capital provided from multinational or bilateral technical assistance programmes. These funds are often available to pay for the cost of prefeasibility or feasibility studies, for the development of raw material supplies or for market studies. All of these are important to project development and, if financed through technical assistance grants, make scarce capital available for investment in facilities or working capital.

## 4. ENERGY SUPPLY

An important aspect of industrial development is the supply of energy for manufacture and for transport of materials. The forest-based primary industries are in a unique position to achieve energy independence, an important consideration in developing countries with limited access to fossil fuels, hydroenergy or nuclear energy. The mechanical processing manufacturing facilities such as sawmills, veneer plants and plywood mills typically develop more residues than what is required to supply the energy needed in manufacture, provided that they are equipped to burn wood residues and to cogenerate energy in the form of both heat and electrical energy. Fibre processing plants can supply very large fractions of their energy requirements from residue utilization and peak surplus can be sold to the national grid.

## 5. PERSONNEL SKILL SUPPLY

In the design of forest-based industry for developing countries, it is often desirable to create an industrial design that is labour intensive to reduce the demand on scarce capital supplies. It is worthwhile to note that the most important measure of personnel supply for industry is not the number of bodies available in the labour force but the size of the pool of relevant personnel skills. Personnel can be used in industry over a whole spectrum of skill levels ranging from the use of personnel for manpower where it is just muscle strength that is being purchased, through the level of skilled labour where physical dexterity is the important ingredient to technical skills requiring judgement and the capacity for analytical work. The higher levels of skills offer the best opportunities for development of the individual. The provision of muscle power may provide subsistence but often very little more. In developing countries it is often in the higher levels of skills that a shortage makes itself felt and where this is the case these positions must be filled by expatriates if the industry is to be viable. Perhaps the easiest and most effective way for a developing country to utilize forest-based industry to enhance the development of individual citizens is to increase the size of the pools of personnel skills at the technical, scientific, technological and management levels.

## 6. INDUSTRIAL ENVIRONMENT

The industrial environment in a country is largely a function of the social and governmental system. Laws and regulations can inhibit or restrict the development of industry or make it so costly to operate that it becomes economically unviable. In contrast, some developing countries create industrial environments that encourage industry through deliberate incentives. For forest products industries based, as they frequently are, in rural areas the development of an adequate infrastructure can be powerful incentive to industrialization.

## 7. MARKETS

Industries are created to service and supply markets and some of the most intractable problems of developing countries have their origin in the marketing sector.

In most of the developed countries forest industry has its base in a strong domestic market for forest products. These markets provide opportunities to sell low-valued products that cannot carry the costs of transport to distant export markets but that carry a share of overhead costs thus permitting competitive pricing of export items.

Serving export markets requires very sophisticated and timely world market intelligence, something that is sometimes lacking in developing countries. It is extremely important in export marketing to develop a reputation for reliability with respect to quality, with respect to pricing and the financial aspects of sales.

## 8. PROJECT DESIGN

Project designs may be very simple for small scale industries and very complex for large scale industries. Projects that involve large capital investments and commitments of forest resources are designed on the basis of prefeasibility and feasibility studies including extensive market analysis. The availability of capital and the commitment of raw material resources are likely to be a function of the quality of these analyses. If they suggest that a project is in fact unviable they can prevent substantial waste of resources.

Where capital for construction of the manufacturing facility is not easily available locally, the technology of choice may be one that makes maximum use of personnel skills and minimizes the demand upon capital. But this must be carefully orchestrated. Sometimes machinery is used to save labour. When this is the case and labour is plentiful and inexpensive, substitution can be reasonable. Sometimes highly sophisticated equipment is included in a manufacturing system not for the purpose of saving labour, though that may occur, but for the purpose of achieving a higher level of uniformity in product quality. If the manufacturing enterprise is to serve a very demanding international market, then this capital investment to achieve quality assurance may be essential even though it limits the size of the labour force.



## COMMON FEATURES OF FOREST INDUSTRIES PROJECTS

### Summary of Discussion

#### 1. FOREST RESOURCES DEVELOPMENT AND TECHNOLOGY

There is sometimes a conflict between the objectives of the forest service, which may see its main task to be conservation of the forest resource or tree stand improvement, and the industry, which wants a supply of raw material at a constant rate and at an adequate level of quality. However, these conflicts have been resolved in many countries, although problems still exist. Foresters need to understand and realize that by appropriate planning of the forest management activities, part of the forest can be set aside for production of raw materials, whereas other parts are reserved for conservation for various purposes and reasons. Industrialists, on the other hand, are becoming increasingly aware of the importance of maintaining a sustained raw material supply base and of their responsibility in maintaining an ecological balance.

In fact, in the development of forest resources for industrial use the importance of cooperation between foresters and technologists is increasingly recognized, although problems still exist in this context. For instance, in the selection of species for plantations or in the inventory of natural forests, there is still space for improvement in cooperation between the two interest groups. From the industry's point of view, growth and yield measurements on their own are of little value in making industrial judgements. It is the supply and yield of raw material of suitable quality which is important in this regard.

In the context of development of plantations as a source of raw materials, there is a need for paying attention to optimal uses in the selection of species and rotations. The markets of the originally foreseen manufactured goods may have changed considerably by the time the plantations are ready for harvesting. As a safeguard against this, allowance should be made for use of the raw material resource for manufacture of other possible products, as well.

Included in project design is the choice of technology to be employed. In a particular case the technology selected may reflect the relative availability of resources such as raw material, capital, energy, personnel skills as well as the market to be served. With marginal forests, industry must become more efficient to compensate for more variable and lower quality raw material supply.

#### 2. CHANGING RAW MATERIAL BASE AND TECHNOLOGY

An industry designed for utilization of wood raw material from a natural forest may find it difficult to utilize plantation-grown wood by the time the plantations are ready for harvesting. One reason for this may very simply be that the industry in the technological planning phase has neglected to take into account the foreseen change in type of raw material. The equipment selected for the mill, although ideal for the type of raw material used initially, may not be suitable for the raw material available in the second phase, when plantation-grown wood is available. The industrial design therefore needs to give careful consideration to the raw material which is foreseen to be used in various stages of development of the overall industrial project.

### 3. MARKETS AND TECHNOLOGY

The creation of new forest industries and expansion of existing ones must be based on knowledgeable and realistic forecasts of markets and the competitive position of the enterprises on these markets.

The selection of products and technology for manufacturing them is by necessity governed by the market requirements. Local or domestic markets often provide an outlet for products which are competitive with imported ones due to high transport costs. Local markets may also be less demanding and thus accept products made from raw materials which do not meet the requirements of export markets. On the other hand, export markets, although highly competitive, provide important foreign exchange earnings. These markets, however, exhibit considerable fluctuations and a mixed market of both domestic and export markets may provide more stability for the sale of the output of the industry.

Product quality is not necessarily achievable only by making a major capital investment in high technology equipment. If the labour pool includes a large fraction of individuals with high levels of personnel skills, simplification of the mill design with regard to process controls may be feasible.

A reason for adopting a highly sophisticated manufacturing technology is to improve upon yield in the conversion of raw material to finished product. A very expensive raw material provides a great incentive for improvement in product yield. However, all these considerations of application of high technology presume that skills exist for its servicing and maintenance. Otherwise, the choice of technology and the type of industry may need to be completely re-evaluated.

## SMALL SCALE PROCESSING ENTERPRISES

Introductory Note  
by the Secretariat

### 1. INTRODUCTION

Small scale forest-based processing enterprises exist in all countries. They differ from larger scale forest industries in a number of important respects. Generally they serve markets which are not reached by the latter; their linkages with the rest of the economy are mainly with the rural/agricultural sector rather than the urban/industrial sector, and they are affected by government policies in quite different ways than larger forest industries.

Small enterprises serve rural markets for furniture, builders' woodwork, wooden and cane farm storage structures, carts, agricultural implements, and a multitude of other products. They thus meet the needs for forest products for domestic use of the greater part of the developing country populations which live in rural areas, and in addition provide important inputs into agriculture. Small enterprises also account for the greater part of the manufacture of craft goods based on forest raw materials.

The unit size of such small forest-based enterprises (FB-SSI) is very small indeed - averaging less than three persons employed including the proprietor and family labour. Other characteristics include little use of powered equipment, high proportion of self-financing, predominantly dispersed and rural location, significant seasonality of operation and close links with agriculture. Such small enterprises meet most of the needs of the rural/agriculture sector for forest products because this market is widely diffused, is poorly served by roads, and therefore not easily served by more centralized large factories. This rural market also demands many low cost products that only local enterprises can supply.

As rural infrastructure improves, giving greater access to supplies of products from outside, and as consumer habits and tastes change with rising rural incomes, there is a tendency for production to become concentrated in larger units and for these to locate in urban centres. However, for many situations, and over long periods of time, small local processing enterprises offer the most rational way of meeting most rural needs. Though information on efficiency is scanty, it appears that small enterprises use both labour and capital as efficiently as larger industries.

The recent work summarized in the background paper on small scale industries has shown that small forest-based processing enterprises form a very large part of the overall forest products processing total in employment terms. Thus recent surveys for Jamaica and Sierra Leone estimate employment in small enterprises to be 2 to 9 times higher than in larger industries.

In Kerala State of India, small reed-based enterprises help to support about 15 times more people than what the large scale industry based on this raw material employs. Furthermore, in most countries FB-SSI constitute the second or third largest rural manufacturing industry. They thus make a significant contribution to off-farm rural employment - an issue of growing importance at a time when a rising proportion, already more than half, of rural people can no longer sustain themselves solely from agriculture.

Other characteristics which have positive developmental consequences, in addition to employment generation and provision of inputs into agriculture include: seasonal stabilization of rural earnings, providing a productive outlet for small rural savings, utilization of scattered forest resources which would otherwise be inaccessible, using predominantly local rather than imported inputs, transfer of skills into rural areas, improvement of income equity, and provision of low-cost goods in locations not served by larger industries and to social strata often neglected by normal commerce. In some cases they also produce a major proportion of goods: in the Argentina case study prepared for the Consultation, small enterprises reportedly produce 60 to 80 percent of all charcoal.

It is thus becoming apparent that small scale forest-based processing enterprises are a much more important component of the forest industries sector than has been generally recognized, and require more attention directed toward meeting their particular needs. Information from selected countries is summarized in the following background paper: Small Scale Forest-Based Processing Enterprises - Their Characteristics and Impact on Rural Employment and Income. This is supported by two case studies which compare small and large enterprises using the same raw material (reeds) or producing the same product (charcoal). The first case study is Saravia Toledo's paper entitled Production of Charcoal in Salta Province (Argentina) and the second is Nair's Bamboo-Based Industry in Kerala State, India.

## 2. PROBLEMS

Small forest-based enterprises suffer from the general neglect shown to the small enterprise end of the industrial spectrum, and to small rural enterprises in particular. Most countries focus on promoting large industries and building up an urban/industrial infrastructure. Policies and measures to encourage this not only neglect the particular needs of small enterprises, but often inadvertently discriminate against them. Large industries currently benefit exclusively or in larger measure than small ones from easy access to institutional credit or credit guarantees, favourable import duties or duty exemption, provisions for accelerated depreciation, tax holidays, market reservation for "infant" industries, access to foreign exchange, allocation of scarce raw materials (especially imported ones) and training systems run by governments. In some cases, the law may not specifically exclude small enterprises from these benefits, but procedures are so complex as to make them inaccessible to small firms. Furthermore, the rural location of many enterprises makes contact with the administrative structures difficult.

The principal problems faced by small forest-based enterprises tend to be weakness of demand, poor access to raw materials, limited supply of skilled manpower, and shortage of finance. The case studies confirm all these to varying degrees. Apart from shortage of demand for FB-SSI products, the case studies show that it fluctuates and that markets are difficult to reach. In both India and Argentina, small enterprises are shown to depend on middlemen to reach their markets and so fail to capture full profits for their products. This has general applicability.

Synthetic substitutes are a problem, while for larger enterprises markets may be more stable but can be risky if made up of only a limited number of large buyers.

On raw materials, the destructive and short-term nature (5 years) of operations by small enterprises is mentioned in the Argentina study as contributing to ecological damage. This is contrasted to the long-term, controlled multiple use of forests by larger enterprises which permits sustenance of benefits. This should be viewed in the context of many short-lived large enterprises in many countries especially in logging. The most prominent elements of raw material supply problems are overall shortage (for both small and large enterprises) and frequently also, allocation of most supplies to the larger industries. The allocation of 90 percent of the reeds or bamboo resources to the pulp industry in the Indian example illustrates the frequent lopsided raw material sharing between large and small enterprises.

Financial problems have also been referred to, especially for small enterprises. Limited access to institutional credit is highlighted in the background paper as a major constraint to small enterprise development. Lack of skills has not been highlighted as a constraint in the case studies, but it is another serious problem. It is well known that informal training in FB-SSI's needs supplementation to boost managerial and technical skills.

A general problem which affects FB-SSI with regard to demand/marketing, inputs availability and access to many benefits currently available mostly to large industries is proliferation and complexity of laws, regulations, and procedures which exceed the ability of normally only semi-literate entrepreneurs to cope. It is in these areas in addition to financing, training and policy liberalization that FB-SSI's need most assistance.

### 3. THE POTENTIAL

The background paper gives orders of magnitude on small enterprise sector growth rates which show the considerable dynamism of these activities even under present rather difficult circumstances in many countries. There is also strong evidence that small enterprises grow as rural incomes increase and demand for their products expands. The indications therefore are that as developing economies grow, the small enterprises will still have an important role to play. This can be boosted if positive official interventions are initiated aimed at removing the key barriers relating to policy, institutions and other aspects referred to earlier which constrain sound development in absolute terms or relative to larger industries.

The evidence suggesting high levels of efficiency in use of scarce capital should serve to encourage positive intervention. In certain cases (as in the charcoal study) worker productivity levels are high; sometimes they are even higher in small than in larger enterprises. In some types of forest industry activity, therefore, small enterprises will not necessarily be an inferior option by the criteria normally used to select investment options and must be considered alongside all other possibilities.

### 4. ITEMS FOR DISCUSSION

The following points for discussion should be considered in terms of what can be done within and outside the forestry sector to improve matters. It is also necessary to plan small industry growth which is compatible with that of larger units, in line with comparative advantages of both.

1. What forest products processing activities are concentrated in small scale enterprises and what factors favour this?
2. The policy, legal and institutional environment in which the small enterprises operate and how this could be improved to ensure their greater viability in future so they can contribute more to development.
3. How to improve the ability of small enterprises to contribute more to physical development of their environment and to meeting other social obligations without overloading them with unproductive costs.
4. With regard to specific elements:
  - (a) how to tackle their raw material problems including sustainability of supplies;
  - (b) how to improve access to larger and more stable markets and to finance;
  - (c) how to improve the skills available within the sector and those provided through advisory services.
5. How to liberalize conditions for small enterprise growth in such a way that they prosper without losing the special developmental benefits associated with smallness.
6. How to avoid technological stagnation among small enterprises.

## SMALL SCALE PROCESSING ENTERPRISES

### Summary of Discussion

#### 1. GENERAL

The inclusion of small scale enterprises in forest industry development programmes should be pursued vigorously. To achieve this, specific assistance is often necessary in planning and implementation; this should include technical assistance as well as financial and resource inputs.

In planning for greater inclusion of small scale enterprises the purpose should be to maximize the special development advantages that they have, such as greater employment, stabilization of income, provision of vital agricultural inputs, use of scattered and limited raw materials, transfer of skills to rural areas, and meeting the special needs of poorer people. The small units should thus be designed to meet needs not currently served adequately by larger enterprises.

Special problems exist, such as small and unstable demand, excessive competition, limited finances, shortage of skilled manpower, and unreliable raw material supplies. There are also problems of identifying new market opportunities and of upgrading technological levels to be addressed. Small enterprises also have poor sustainability of operations and give limited contribution to development of social infrastructure in the communities. The problems can be looked at in terms of forest resources, markets and support systems.

#### 2. FOREST RESOURCES AND SMALL ENTERPRISES SUSTAINABILITY

Small units have in the past often failed to provide for continuity of raw material supplies. As a result, operations have often been temporary and the employment and income based on them has been unstable. Greater stability should be sought perhaps by encouraging small farmers to manage forests better or to plant trees, rattans and other forest raw materials. Suitable incentives should be provided for this, as well as technical assistance.

In order to conserve raw materials, greater efficiency should be promoted in the use of existing resources. Small enterprises should therefore be encouraged to use more residues from forest operations and from larger industries.

The observed tendency for small enterprises to utilize scattered, inaccessible and residual forest resources of limited interest to large industries should be encouraged.

Where local resources are very severely depleted, governments or their agents may need to provide raw materials from more distant sources. Such assistance should be accompanied by efforts to establish new local supplies to avoid long-term dependency on official support.

The greater ability of natural forests to provide a wide variety of raw materials other than wood for small scale enterprises is recognized. Attempts should therefore be made to ensure their

perpetuation through appropriate technical and institutional mechanisms. Forest plantation activities should also consider including non-wood forest plants of value to small enterprises.

### 3. MARKETS AND MARKETING

Many opportunities for development of small scale enterprises are currently missed due to lack of information by entrepreneurs of possible markets and how to reach them or even of products which could be considered for manufacture on a small scale. Accordingly, it is necessary to identify potential new products for manufacture by small enterprises and to disseminate information on these to entrepreneurs and their support agencies.

The quality of existing products should be improved and some standardization should be sought for better marketability.

Poor market intelligence is a major problem for most small enterprises. Assistance is needed to improve knowledge of what the market wants, to identify new opportunities and to formulate better organizational formats for reaching the markets. The possibility of sales to large industries should be explored.

Certain products of small scale industries have potential for expanded markets in distant urban centres and even in export destinations. Such opportunities are not now fully captured, and where they are, the net benefit to producers is often limited. This problem has been particularly marked, for example, for handicraft industries based on rattans or wood carvings but even for utility products like charcoal. It is necessary to help increase the share of benefits retained by producers through improved organization and more direct access to the consuming centres.

### 4. SUPPORT FOR AND PROMOTION OF SMALL ENTERPRISES

Due to varying circumstances in the countries, generalization is not possible with regard to the degree of official intervention necessary to help small enterprises. It is considered possible that very high levels of support which remove all key supply or market problems could erode the comparative advantage of small units relative to larger ones. In that case, they could be displaced by larger units and their special contributions to society would be lost.

It seems essential therefore that some competition and hardship should be allowed among small enterprises so that only the efficient emerge which can then be given tailor-made support packages. The most successful of them can create nuclei of dynamic innovation in a sector that could otherwise stagnate. The less successful should not, however, be completely abandoned.

Whatever the degree of intervention proposed, it will be necessary to recognize the special features of small enterprises and to tailor assistance accordingly. Firstly, the considerable differences between cottage or household-based industries and the larger workshops will need recognition. Among the former group the special characteristics to be considered arise from extreme smallness; great control and participation by family-based rather than free market labour; limited operational records; seasonal operation; numerous enterprises; geographical dispersion; poor measurability of assets, outputs and efficiency; and high incidence of reliance on forest raw materials other than wood.



Smallness of the enterprises and their great number will require adjustments to existing planning and programming procedures as well as to management systems. Instead of considering enterprises individually workable procedures and guidelines must be developed for treatment of enterprises in groups if only to limit the overhead burdens of each unit. Evaluation procedures and criteria for financial assistance should also be amended to more realistic ones which can be met by enterprises that often have no records and written title to their assets.

Assistance measures, programmes and policies for small industries must furthermore be coordinated among agencies dealing with them alone and those concerned with large scale industry. This will ensure efficiency and appropriate collaboration between industry of all sizes.

## INSTITUTIONAL REQUIREMENTS

Introductory Note  
by the Secretariat

### 1. INTRODUCTION

From the institutional viewpoint, forest industry development is influenced by or through the existence of proper governmental, parastatal, private sector and local peoples' organizations or agencies. The roles of all such institutions are governed or defined through appropriate legal provisions and statements of priorities as reflected in formal or informal policies. Both forest-sector and external policies may be relevant. Furthermore, efficient operation of the institutions and implementation of policies requires suitable and adequate manpower; training capacity is therefore another key institutional consideration. The final major ingredient for development is capacity to mobilize financial resources for running the institutions and for investment in industrial development. Balance is required among these various aspects as well as coordination to ensure achievement of objectives.

In the presentation given through the background documents, emphasis is on the legal aspects, but this should not be taken to imply overriding importance of this aspect in all cases. The papers examine the subject in terms of how the law can influence the level of benefits derived by local people from forest industries. Thus the Secretariat paper examines subject areas in which changes in existing laws and regulations are required to provide more direct assistance and technical support to appropriate industries, which in this particular context mean those enterprises which help to improve the lot of the rural people by returning benefits to them that outweigh costs.

Sio reports on the results of an analysis of the legal and organizational framework within which citizens of a developing country can and do participate in logging and wood processing activities in that country.

It is worth stressing that the law should in any one case address all aspects ranging from forest resource ownership/access through processing to product distribution and should have no conflicts within this chain. The law should provide reliable access by enterprises to all key inputs but should balance this against the needs or parallel claims on the same resources by other parties, traditional or modern. There should be assured security for major investments and fair apportionment of benefits to all parties.

In legislating for increased local participation in industry, however, special care is needed to ensure that local people first have the capacity to effectively discharge the required functions before the law gives them responsibility for this. Legislation should therefore be accompanied by efforts at skills transfer to people and their groups in all essential disciplines, otherwise the desired benefits may prove illusory. Detailed analysis of issues is in subsequent parts of this report but certain elements are singled out below for special attention.

## 2. KEY ISSUES

Relatively little of existing legislation, dealing with general industrial practices, is designed to enhance the opportunity for local people to actively organize, manage and benefit from local forest-based industries. Legislation should be updated to cover a number of issues which have a direct bearing on those forest industries which rely primarily on local human and natural resources for their operation. These issues include:

1. Land tenure and land availability: local people should have access to the means of production (land, tools, seeds or seedlings) and should have an incentive to manage the forest resources wisely.
2. Customary laws and usage rights: indigenous rural populations exercise various usage rights on forest lands by virtue of custom and tradition which in most cases are unwritten. In many countries these unwritten rights exist side by side with more recent statutory laws. It is, however, often the case that the customary laws are known and exercised by the rural people, while the statutory laws are neither known nor understood or observed.
3. Timber harvesting and processing: rural people should have access through permits or licences to timber stands suitable for small scale harvesting activities or for sale to large industry.
4. Credit: rural people should also have access to credit facilities, enabling them to purchase the required equipment, supplies and materials necessary for operation of their enterprises.
5. Timber utilization agreements: concession agreements should be designed to promote domestic processing - which has already been done in many countries - thereby making them effective instruments of social and economic development.
6. Taxes and fees: some countries impose a wide range of charges, fees and taxes on various types of forestry-related activity which for small local operators are sometimes prohibitive.
7. The large, often foreign-owned companies operating forest industries in developing countries have all the advantages, such as easy access to forest resources, export markets, credit facilities, technical and managerial skills. This makes it extremely difficult for the local entrepreneur to enter this field of activity even though under the governing legislation he has just as many rights and obligations as the foreign entrepreneur.
8. Development of local skills is a prerequisite for success and should precede any attempts to take over foreign-owned enterprises if success is to be ensured.

## INSTITUTIONAL REQUIREMENTS

### Summary of Discussion

#### 1. GENERAL

Many issues influence institutional requirements and national situations considerably so that generalizations may be misleading. It is nevertheless important in all cases to ensure that people's institutions as well as those of government and industry are adequate. Elements of the institutional framework include statements of overall official priorities; clear outlines of policy to reflect such priorities; a legal code as an expression of policy; and organizations to plan and implement the desired goals. To achieve all this it is necessary to have the capacity to train adequate manpower for the institutions and to coordinate the diverse interests related to industrial developments. In all cases it is essential to mobilize adequate financial resources to finance the inputs of all institutions who will participate in a given venture or programme.

With regard to the legal aspects it is necessary to ensure that all aspects from forest resource tenure through processing to marketing are covered. The law should provide for reliable access to raw materials by users of all scales of operation without neglecting vital traditional rights and usages of local people. It should also provide for security of investments, rights to a fair return and provision for their fair sharing between the entrepreneur, his workers, local communities and the state.

In addition to suitable laws, certain institutional factors can predispose a project toward success. These are for instance, strong people's organizations, efficient government facilities and well organized entrepreneurial firms. Coordination at all stages is also essential.

Although strong institutions and sound laws are very important, the overriding role of politics in decision-making for the sector should be recognized. It is therefore desirable to develop the basis for improved overall long-term plans that can better survive political changes.

Key issues of institutional development relate to increasing local people's participation and benefits from forest industries, the role of foreign participation, and ensuring successful transition in promoting greater citizen's control and ownership of forest industries.

#### 2. ENHANCING PEOPLE'S PARTICIPATION AND BENEFITS

Close involvement of local people and cooperation are essential for success and this depends largely on improving the benefits they derive from forest industry operations.

With regard to forest resources for industry, people must share responsibility for their management. They will often need technical assistance and inputs at least initially to enable them to take on the responsibility and tap the benefits.

Greater involvement by local people requires suitable incentives as well as training for them to effectively discharge technical, managerial and marketing tasks on their own. Their organization into cooperatives or other forms of traditional or new associations is usually best in order to pool efforts and enhance chances of success.

Skills and management capabilities can only be increased in stages and it may be best to promote initially small enterprises which are within the reach of the capabilities of the people and then build up toward more complex ones. Sometimes initial involvement could be limited to harvesting operations but each situation should be evaluated and decided upon individually.

In industrial enterprises, consideration should be given to discriminating in favour of local people in employment for certain categories of workers and to sharing of revenues with local authorities. Such revenue can go into development activities meeting local priorities, into development of sustainable forest resources, or can be reinvested in new forest industry capacity.

Traditional rights and procedures should be taken into account in legislation for forest utilization and in concession agreements but with recognition of industry's interests also.

### 3. FOREIGN PARTICIPATION

Where there is scope for foreign participation in forest industries, such investors need to be allowed adequate returns and stability in operations. The law and institutions should ensure this but also allow a fair sharing of benefits for the host country and community.

### 4. TRANSITION TO LOCAL OWNERSHIP OR CONTROL OF INDUSTRIES

In situations where citizen or local participation in industry is to be increased or to replace external ownership, efforts should be made to ensure an adequate transition period during which the external partner should be encouraged to transfer technical, managerial and marketing capability to the local owners. Some incentives may be needed to attract such cooperation.

Experience has shown that suitable means exist for local people's organizations to hold a financial stake in forestry and industrial operations under appropriate legal provisions. Local people can increasingly exercise influence on operations and eventually control and manage the enterprises themselves.

It has been noted that where local participation has been implemented abruptly, very often the enterprises have suffered losses and the expected benefits have turned into costs so that the local communities suffer. Enterprises sometimes even close down, with unemployment and social hardship as a result. The pace of transition should therefore be selected in accordance with local ability to take over effectively and in line with complexity of the enterprise under consideration. Training of local people and of staff in supporting institutions to enable them to shoulder increased responsibility must be pursued in a timely manner and on a suitable scale.

## PEOPLE AND INDUSTRY

Introductory Note  
by the Secretariat

### 1. INTRODUCTION

Traditionally, when forest industry enterprises are planned or established, various organizations or groups are contacted. Thus land-owners are contacted to secure land for the mill site and township and for possible tree plantations if they will be established on private land. The government, on the other hand, is contacted to secure forest concessions, for land for tree plantations, participation in the establishment of infrastructure, to ensure that the pollution abatement measures suggested are acceptable and to obtain financing or at least guarantees for loans. Banks and lending organizations are, of course, approached to obtain the necessary financing of the project and trade unions are contacted to ensure appropriate labour relations. Finally, agents are possibly contacted to provide the marketing network for the products to be manufactured.

Attention is also paid to government and local regulations to meet with the requirements on pollution abatement and safety measures. Special attention is often paid to the requirements of the mill staff in order to attract skilled labour and salaried personnel so that training becomes a very important activity in the early stages of the project, as well as establishment of the necessary social facilities. However, very little thought is given in this context to people - those who lived in the area before the establishment of the industry, and want to continue to live there, or those who have been encouraged to move there at an early stage of the project to provide the required infrastructural development.

### 2. WHO OWNS THE FOREST?

The ownership structure of forest land in industrialized countries is quite clearly defined although, even there, some controversial issues may arise. Some forest land is owned by private landowners or farmers, some of it is owned by the industry and some by the government. The boundaries between the different land lots are clearly defined and recorded. In developing countries various groups may claim the ownership of land, some with legal support and some based on traditional rights. Private landowners may own forest land in some developing countries but most commonly today the forests are owned by the government. Concessions are granted by the government to various enterprises for logging either for export or to supply raw material to a forest industry enterprise. However, the tribes and the people who live in these forest areas have done so sometimes for several generations and it is very difficult for them to understand how the right of use of "their" forest can be given to someone else by a "government" which for most of them is an entirely unknown entity.

To avoid conflicts between the local population and the concessionaire/industry enterprise, it must be clearly understood how far back the claim of ownership goes in each case. Although traditional rights may not have any, strictly speaking, legal status at government or enterprise level, they may have a decisive effect on how the local people view their rights to the land they live on.

Lack of recognition of the fact that forest industries are in general not only surrounded by trees but also by people may cause a major conflict between the local population and the new industry. There is, accordingly, an interaction between the people and the industry. Examples of this are described in the background papers, which quote both positive and negative experiences.<sup>1/</sup> They highlight problems like those involved in moving people as part of a land development scheme to a forest area; the introduction of agro-forestry to provide raw material to established or future forest industries; introduction of a large scale project in a rural area with an already significant population; the interaction between the people and an industry established in an area where the size of the rural population originally was practically nil.

### 3. SOCIAL IMPACT OF THE INDUSTRY

The establishment of industries in rural areas requires careful planning with regard to activities which relate to the social impact which the new industry will have on the life of the local population. Such populations usually have very deep rooted traditions and a set structure of earning of the family income. If these cultural traditions are not respected by the project, its success might be seriously jeopardized. The local population may see the industry as an intruder, encroaching on the traditional rights of the people to use the forest, threatening their livelihood. This can lead to sabotage, for instance, in the form of destruction of tree plantations or outright armed conflict. The industry may also consider the presence of the original local population as a threat to its security of wood supply and take measures to keep the people away from their concession areas. Needless to say, the response of the local population to such measures is usually not positive.

If there is already some rural infrastructure available in the area where the industry is being established, the pressure of the project on the local facilities such as water and power supply may be considerable not to mention on availability of goods and the price of food.<sup>2/</sup>

Establishment of forest industries should essentially aim at rural or national development rather than at industrial development in its own right. In such a context, "What is in it for me?" becomes a very relevant question. The "me" referred to here should be both the industry project and the rural population, so perhaps it should be phrased more appropriately and more positively "What is in it for us?". If the needs and cultural traditions of the rural population are respected and well understood there may be a chance for the industrial project to be understood by the rural population as well. In other words, once the rural population realizes that benefits will arise from the establishment of the

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<sup>1/</sup> Balcker, J.E. Training of labour in a new cellulose pulp mill Alto Parana S.A. at Puerto Esperanza, Misiones - Argentina.

Mangundikoro, Apandi. General plan for timber estates development in Indonesia.

Picornell, P.M. Technology and people at Paper Industries Corporation of the Philippines.

Webster, Alexa. The Kesedar Project in Kelantan, Malaysia: A study of the socio-economic dynamics in a new land development scheme.

<sup>2/</sup> Balcker, J.E. Training of labour in a new cellulose pulp mill Alto Parana S.A. at Puerto Esperanza, Misiones - Argentina.

forest industry enterprise, it becomes in their interest to support the industrial activities. But how can they understand this unless proper communication is established between the population and the industrial project already at the planning stage?

To avoid costly conflicts between the industry and the rural population and to maximize the mutually obtainable benefits derived from cooperation, a strategy of approach to the foreseeable problems needs to be designed. This strategy in turn has to be based upon a thorough study of the local conditions at an early stage of planning.

#### 4. INVOLVEMENT OF RURAL POPULATION

The involvement of the rural population in the industrial project during its various stages can vary considerably depending on the nature and the size of the project. The minimum involvement relates of course to employment in the various activities of the mill, for instance in the supply of wood raw material but can grow considerably from this basic level. Through provision of training, better jobs and consequently better wages can be offered. The so-called multiplier effects of establishment of forest industries in rural areas should not be forgotten in this context, i.e. where the rural population benefits from the supply of services, not only to the mill but to the people employed by the mill as well.

However, is provision of employment in or around the enterprise the only way in which rural development can be achieved? Rural institutions, such as cooperatives, play an important part at various levels of sophistication of the industry. Depending on their level of development and strength, they may be able to manage and operate, as employers, fairly complex industrial enterprises. A high level of sophistication cannot, of course, be reached quickly, but there is great long-term potential for development in these organizations. In developing countries, the financial possibilities of rural organizations for involvement in forest industries may at present be limited. It may in the first stages be restricted to mainly organizing the supply of raw material to comparatively small industries. A subsequent stage would be getting involved in the ownership of the industry itself and in marketing of the products. This requires that the necessary rural institutional framework is developed concurrently with the industry itself.

#### 5. ITEMS FOR DISCUSSION

- A. Which are the most common cultural characteristics and traditional uses which need to be taken into account in planning forest industries in rural areas and how should the problems arising from these be tackled?
- B. Which are the best means of communication with the rural population which have been successfully used in the past in various forest industry projects?
- C. What types of activities tend best to attract the cooperation of the rural population in the implementation of the project? For instance, tree farming, logging, mill employment, food production and provision of goods and services.



- D. Which are the experiences of training the local rural population for various tasks in the mill operation at unskilled, semi-skilled and skilled levels, including log harvesting?
- E. Which are the experiences of involvement of cooperatives and other rural organizations in the activities and the operation of forest industries at various levels of complexity?

## PEOPLE AND INDUSTRY

### Summary of Discussion

#### 1. TRADITIONAL RIGHTS OF PEOPLE

The presence and activities of people in forest areas prior to establishment of forest industries are based on traditions. Their use of the forest relates to a cultural heritage which goes back several generations. As far as they are concerned, the forest belongs to them. Accordingly, they very easily question the ownership claimed by governments or enterprises who maintain that they have purchased the right of use of their forest area from the government.

Regardless of official, legal aspects, the traditional rights of the people and their cultural traditions need to be respected when a forest industry is introduced in what is usually referred to as "backward" areas. After all, the claim to ownership made by the government is usually of fairly recent origin and the population may not even be aware of this claim. Insensitivity to the pattern of forest utilization of the people can cause serious conflicts between the original population and the industrial enterprise that tries to establish itself in a forest area. The result of this may in milder forms lead to some sabotage of the industrial utilization of the forest resource. In more serious cases, it may lead to security problems and outright armed conflicts.

To introduce an industry in a remote forest area therefore requires time. In the preliminary stage, 6-12 months of discussions with rural communities may be required. Meetings, accordingly, need to be organized with the people affected - not only village chieftains - to clarify what the industry can do and what it cannot. At the same time, it must be clarified to the original population that establishment of the industry in the area has positive objectives for them to ensure their acceptance of the project. In other words, the project must be adapted to the local environment to maximize benefits accrued to both parties. In this context, it is especially important to explain to the local population what the benefits will be in the second phase, after the trees have been felled.

If, on the other hand, the industry will establish itself on marginal lands through introduction of plantations, the situation may be entirely different. Since a new resource and environment is introduced as a first step, this may be clearly seen by the local population as a means for improving their lot and earnings. In such a case, there is no traditional use of the forest, only a traditional use of land, which even the local population may consider unsatisfactory from their point of view. The situation may therefore be entirely different from the case of establishment of forest industries in a natural forest area.

#### 2. LACK OF CONSIDERATION FOR LOCAL REQUIREMENTS

An industry may be established in an area and be able to operate successfully. However, its main target market may be international or geared toward major urban centres. To meet the market requirements, depots are built up in the capital or in ports for exports. This may be implemented to the extent that a shortage of timber arises with regard to

the requirements of the area where the industry is located. An artificial situation might then arise where the people around the industry have to purchase timber for their needs from the major marketing depots. The transport cost of return freight then artificially increases the price of timber so that it is beyond the limit acceptable to the population involved. A certain part of the production should, therefore, be set aside for local consumption.

### 3. INDUSTRY AND SETTLERS

Once roads are built and the industry established, there will inevitably be an influx into the area of settlers which realize that new land has been made accessible to agriculture. Their activity in the area in the first instance takes the form of shifting cultivation. Although this is a negative phenomenon from the forest conservation and forest industry point of view, it must be recognized that about 200 million people in the world depend on this activity for their livelihood. The traditional approach to solving this problem is trying to stabilize the population and to involve them in other activities. This may include tea planting, animal husbandry, fishery, tree planting to supply raw material to the forest industry, etc. It is a very complex issue which requires that several institutions on a national and local level get involved. The coordination of their efforts, however, is a must and needs to be provided on a government level.

An activity which has proved to be quite successful in stabilizing the activities of settlers is tree farming as practised, for instance, in the Philippines. In the schemes applied now, 10 percent of the land allocated to settlers is for food crops and 90 percent is for tree farming. However, this presupposes that there is a market outlet for the wood so that the tree farmers recognize the income potential of this activity. It could be added in this context that in the Philippines the wood produced in tree farming activities is classified as an agricultural crop and, therefore, is not included in the log export quotas which are considered in the case of harvesting of wood from natural forests.

Well-meaning legislation in this sphere of activity may, however, be counterproductive. For instance, settlers may be allowed by government decrees into cleared, logged-over areas. Land hunger may then cause destruction of industrial efforts of plantation establishment after logging. It must be borne in mind that the settlers are primarily interested in agriculture and systems must be designed to be adaptable to this.

### 4. PEOPLE, INDUSTRY AND CONSERVATION

There are also political implications in this context caused by environmentalist public opinions. According to these, industry is seen as a major destroyer of forest resources and settlers are acceptable. Although in the latter case the destruction of forest per settler is quite small, the overall impact on forest depletion is considerable, simply because of the number of people involved. Establishment of an industry, on the other hand, may considerably contribute to conservation of the forest, which in that case has a direct commercial value.

Once the local population realizes that the forest as such has a direct commercial value, their interest in protecting the resource will increase. This can be further enhanced through community involvement in forest protection. For instance, in the Philippines, government incentives are provided to communities to achieve fire protection. These incentives are granted on the basis of the past achievements of the community in fire protection in the area for which it is responsible.

#### 5. PROBLEMS IN ATTITUDE TO REGULAR EMPLOYMENT

In a population with a way of life set to meeting a subsistence level, the regular, 8-hour work-day with 5-6 days a week is often an unknown and alien concept. Employment is in such cases considered to be either a source of income to purchase a specific item (for instance, a bicycle) or an activity to supplement the normal family income. Higher wages have been suggested as a remedy to this, but have usually proved counterproductive and led to even shorter periods of work.

The industry usually requires a regular, reliable work-force. In some activities, a certain flexibility in attitude of the industry may alleviate the problem. For instance, people can be employed on a more or less daily basis to carry out tasks which do not require specific skills. However, if the requirement of skills needs to be met by training, selection of trainees with regard to their attitudes to regular work becomes essential.

#### 6. ATTRACTION OF OUTSIDE LABOUR

In the establishment of an industry or in the establishment of the prerequisites of an industry (infrastructure, plantations), people need to be attracted to the area to meet the basic requirement of size of the labour force. Experience in various countries has shown that a very similar pattern of actions is needed to meet these requirements. In general, a study must be carried out under those circumstances to take into account the needs of both the original population and the people the project expects to attract.

In such a context, roads need to be built to get the original population out of their isolation and irrigation systems might be required for agriculture. Furthermore, the housing standard needs to be improved for the original population to be on the level which will be required by the expected immigrant labour. Otherwise, a counter-productive separation of the two groups may result if better housing is only provided to the new labour force and its families.

In some cases government agencies have tried to improve the facilities in villages to attract skilled and semi-skilled labour from other areas. If the facilities supplied have been below expectations, the efforts have failed to attract industry which instead has been established in more acceptable centres. On the other hand, the cost of land (mill site) and labour in these centres is usually significantly higher. Therefore, it would seem advisable to develop in deficient areas industries which could use the labour already locally available.

7. CONFLICTS BETWEEN ORIGINAL AND IMMIGRANT POPULATION

In the process of introducing a forest industry, it is essential that training is provided to the local population to increase their direct benefit from the industrial activity. However, it is usually necessary to employ skilled workers, for instance skidder operators, from the outside. Unless the crews contain a reasonable proportion of local labour, a conflict will arise between "locals" and "foreigners". In the case of expatriates, the conflict may be even deeper, due to wider cultural differences.

Another reason for a conflict between locals and immigrant labour may be that the government or industry, in their effort to attract labour to the area, provide better facilities to the new population than to the old one whose presence is taken for granted. This has also been emphasized in Section 6. For this reason, an effort to treat these groups equally is essential.

8. INDUSTRY AND THE GROWING COMMUNITY

The development by the industry of an infrastructure encourages the influx of a new population around the mill complex. This poses a different set of problems.

- (a) The question arises as to who is responsible for providing for the community that is created when the area is opened up. The company may feel responsible for its own employees but not for the other people attracted to the area. The government may not be able to help in this regard.
- (b) Two levels of community quality may develop; a well appointed community of company employees and a poorly appointed community of immigrants who are not directly employed by the company. The legal and practical responsibility of the company for this second community is a question of adaptation to an unexpected problem. A company might be willing to assume a role of leadership in community development but may then be accused of trying to control the community. One might therefore ask, is industry responsible for its impact upon local people who moved in after the industry was built?

The only possible solution to this set of problems seems to be to accept that engineers, lawyers, economists, foresters, etc., are unable to arrive at an answer. Specialized social scientists need to be called upon to evaluate the actual needs of this new population. After this, an assessment needs to be made by the management to decide on appropriate measures.

9. CO-OWNERSHIP OF INDUSTRY AND SUBCONTRACTORS

Co-ownership of the local population in the industry enterprise can take many forms and should essentially be built upon existing local organizations. In this way, disruption of existing, traditional systems is avoided. This can, in its basic form, consist of a cooperative type of enterprise.

In a somewhat idealized form, the local farmers could, for instance, be encouraged to invest in a local veneer/plywood/blockboard mill. At the same time, they would be encouraged to establish and operate small sawmills using small diameter wood, unsuitable for the central processing facility.

The above solution seems to be a very attractive model, but may have its potential dangers as well. If the farmers, due to land tenure policies, are in control of the log supply to the sawmills and the central unit, they may decide, after some time, that sawing of large diameter timber is more cost efficient. This may lead to lack of raw material for the central processing unit. This is, of course, a special case.

#### 10. OTHER EXPERIENCES

In some cases conventional logging, product transport and marketing systems may be inadequate for a full utilization of the industry throughout the year. Under such circumstances, the industry will be unable to provide the facilities required by the labour force. It would also be simply impossible to provide full-time employment under such circumstances. Although the latter may not be an entirely negative aspect, development of new methods of logging and product transport methods adapted to the local conditions may prove beneficial and contribute significantly to rural development.

## EDUCATION AND TRAINING

Introductory Note  
by the Secretariat

(Consultant: M. Aho)

### 1. INTRODUCTION

The success or failure in planning and organization of appropriate educational and training components as part of a forest industrial development programme may be decisive for the success of implementation of the whole programme. From the viewpoint of the decision-maker, therefore, it is of great importance to analyze the quantitative and qualitative needs for improvement in training services. In addition to taking into account the specific needs of the programme under preparation, the types and methodologies of the training and education services have to be planned with consideration given to the

- cultural
- social, ethnic
- political
- organizational
- technical
- professional
- economic, financial

aspects of the country concerned.

### 2. APPROPRIATENESS OF EDUCATION AND TRAINING

Education and training for forest industry should be appropriate with regard to both existing conditions and future requirements. Its objective is to develop human resources to correspond to the requirements of the forest industries.

### 3. FRAMEWORK FOR DECISION-MAKING ON PRIORITIES OF EDUCATION AND TRAINING

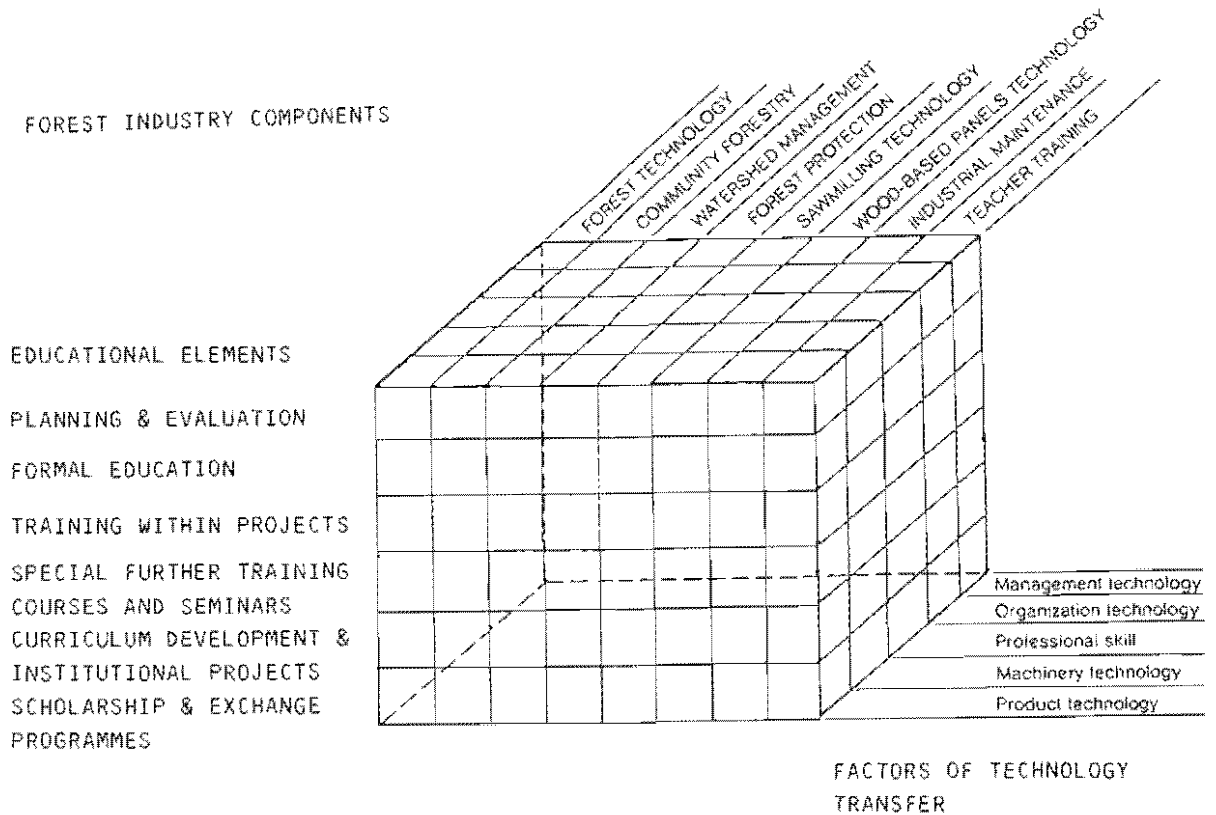
Despite the application of efficient planning, management and monitoring systems in industrial development programmes, project execution is normally carried out under difficult field conditions, where complex situations arise for reasons that appear to be beyond the control of the management. Therefore, it is equally true that additional qualifications, in addition to those obtained through the traditional concept of forestry education, are being expected of the managerial, professional and technical staff and their respective training programmes.

A comprehensive framework will be of assistance when preparing for decision-making on priority areas for training development. The dimensions of such a framework can be described as:

- educational elements
- forestry components, and
- factors of technology transfer.

This three-dimensional approach is demonstrated in Figure 1.

Figure 1



In Figure 1 above, every "window" can again be described and interpreted as a set of alternative priority areas for industrial development and the related educational and training inputs, which play a key role in industrial development and transfer of appropriate forest industry technology.

It may be maintained that a combined application of these elements, components and factors ensure, under positive ecological, socio-political, organizational, financial and technical conditions, introduction of improved and appropriate technologies.

#### 4. TARGET GROUPS

Even when all the conditions referred to above have been taken adequately into account, forest industrial development programmes are implemented under uncertainty and relative or absolute shortages of



resources, especially trained, skilled manpower. This is especially so in the case of a rural forest industry development scheme, where new cultural values are often also introduced to village communities, simultaneously with new technologies.

Especially when adequately covered, education and training constitute a substantial and costly investment in addition to other necessary investments for forest industry development. Therefore, it is essential to identify target groups for whom the improved training services should be produced. This is best carried out after the strategic setting of priorities discussed in Section 2 has been completed.

Table 1 illustrates how, for instance, roles and functions of training organizers vis-à-vis target groups may be analyzed bearing in mind the unavoidable interlinkages that do exist between target groups and within work organizations.

Adequate attention should in a multi-disciplinary way be paid to the important role played by linkage agencies. These are not directly involved in the implementation of forest industry projects, but produce technical and training services which can have an important bearing on incentives and activation factors within the forest industry project, especially in the context of long-term rural development programmes.

TABLE 1A

Roles and Functions of Training Organizers in Formal Education

<u>Agency</u>	<u>Expected impact on forest industry development target group</u>	
	<u>Direct</u>	<u>Indirect (linkage)</u>
1. Executive Management	University - faculty of technology - faculty of forestry	University - faculty of engineering - faculty of agriculture
2. Operational Management	- Forest College - Forest Industry College	- College of Business Administration - Technical College
3. Supervisors	- as above - - Forest Industries - Training Institute (technical-vocational)	- as above - - Technical schools - Agricultural schools
4. Operators	- Vocational schools - Forest Industrial Training Centre	

TABLE 1B

Roles and Functions of Training Organizers in In-Service Training

<u>Agency</u>	<u>Expected impact on forest industry development</u> <u>target group</u>	
	<u>Direct</u>	<u>Indirect</u>
1. Executive Management	- Forest Industry Corporations - Forest Departments	- Agricultural Dept. - Wildlife Dept. - Fisheries Dept.
2. Operational Management	- as above - - Forestry projects	- as above - - Agro-forestry/social forestry projects
3. Supervisors	- as above - - Forestry extension training projects - Training project for work instructors	- as above - - Agro-forestry/social forestry extension training projects - Agricultural extension training - Rural water supply and sanitation projects - Rural health education projects
4. Operators	- Vocational training courses for upgrading - On-the-job training	- Families as target groups for motivational linkage activities

The analysis of training requirements and impact of training in forest industries 1/ is crucial for effective formulation of a sound programme for education and training.

Methods used in such analysis should be comparable within regions to enable training institutions in neighbouring countries to co-operate in planning and arranging training programmes and to evaluate their effectiveness and efficiency and impact on forest industrial development.

As stated above, the previous discussion refers to formal forestry education and in-service training.

In the preparatory phase of specific training components which form parts of projects, and when special continued training courses not covered by national training institutions are planned, attention should be paid simultaneously to two issues. These are the need for and the possibility of improvement of the existing technology and the new technologies which are planned to be introduced.

Strict criteria, including career development planning of the proposed trainees, should be used when selecting candidates for continued training.

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1/ FAO Secretariat. Measuring Training Requirements and Impact of Training in Forest Industries, (FO:AFI/85/8.3)

In addition to accelerated training programmes needed in industrial management, production management, and for supervisors, the presently inadequate training systems of skilled workers deserve our special attention. Hampered by lack of training of work instructors, the present system of mainly training workers on-the-job does not correspond to the need of skilled workers in the industries. Vocational training programmes of skilled workers should be conducted in the national language spoken by the trainees, and curricula and syllabi should be planned by professional curriculum development experts specializing in vocational training. Training material and educational aids should be produced and introduced in the national languages.

The present situation in this key area of appropriate training for forest industry development leaves much to be desired and, therefore, explains partly the bottlenecks in capacity utilization and output quality of the industries as well as the problems of transfer of appropriate technologies.

#### 5. CURRICULUM DEVELOPMENT, TEACHERS' TRAINING AND INSTITUTIONAL DEVELOPMENT

Curriculum development and the related teachers' training can play a key role in the development of appropriate forest industries. Even if the specific curriculum development work can only be done at national level, giving due regard to cultural characteristics and special features in the choice of alternatives, regional cooperation in this field, as well as in management training, can be of great benefit to the participating countries. Through arrangement of regional forest industry technology teachers' training courses, national cadres of instructors can be formed. Training capacity should be established at the national level in order to meet the demand of industries by providing adequate training for the required number of trainees representing selected target groups. The great number of trainees prevents training from being organized regionally, and regional training programmes would not adequately provide for the specific needs of each country and industry.

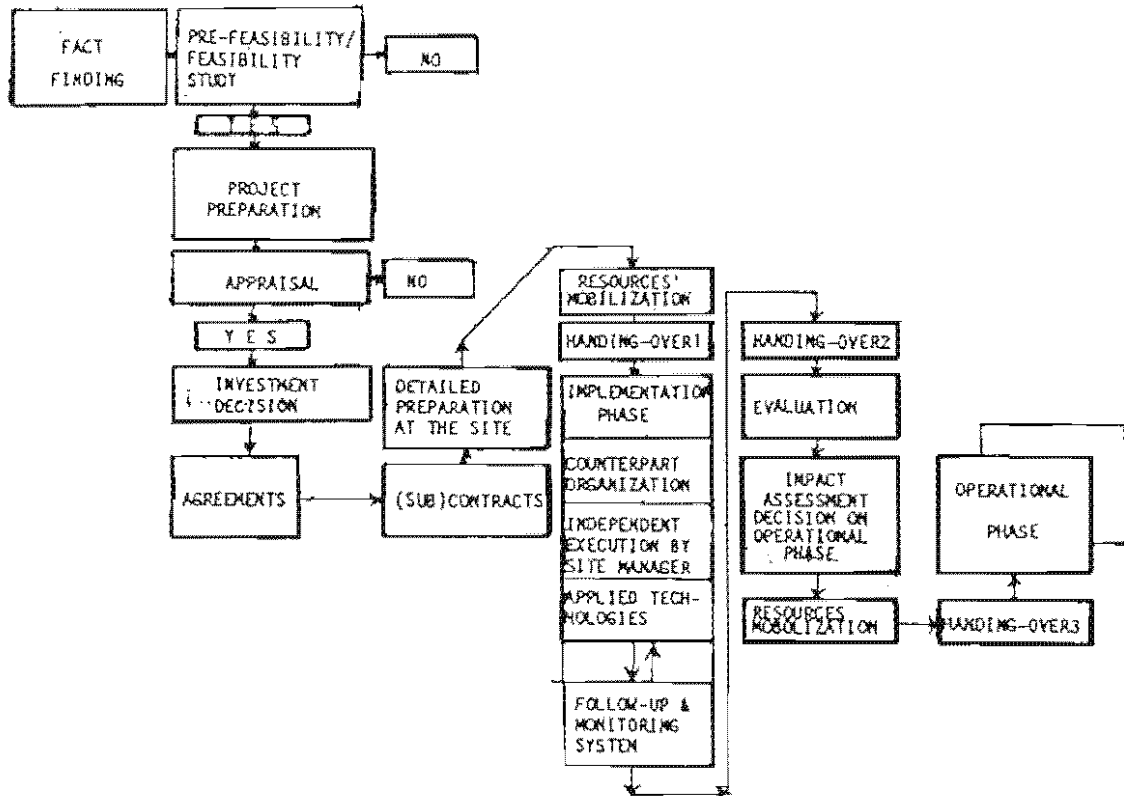
Depending on the scope and objectives of the forest industry development programmes in a country, training institutions should be established and existing institutions strengthened through educational planning, curriculum development, teachers' training programmes and investment in physical facilities and institutional development.

#### 6. TRAINING-ORIENTED MODEL ORGANIZATION FOR IMPLEMENTATION OF TRANSFER OF TECHNOLOGY PROJECTS

Below in Figure 2, a model is presented for implementation of projects where the objective is transfer of appropriate technology. Education and training play an important role in the implementation of such projects.

As a result of the technology transfer, a certain dependency is established between the "owner" of the technology and the recipients. Normally, this dependency is demonstrated by the release of the "secret" know-how relating to the efficient utilization of the new technology applied in the organization of the recipient. In addition to the effect of introduction of new technology in a physical plant or production line, it also has wide-ranging effects on the whole organization of the enterprise, for instance, in management and marketing.

Figure 2



In the following, some further review will be made of the various stages of a project, to highlight some of the items shown in Figure 2.

#### 6.1 Prefeasibility/Feasibility Study Stage

The first phase of a project is usually an identification stage during which a number of facts of local importance are identified. After this, one or several project ideas are studied. Already in this phase, national and regional training capability is reviewed in order to analyze whether the potential implementation of the proposed project should include investment on education and training. During the feasibility study phase, this analysis should cover both training within the project as well as an impact assessment of the project on the overall educational system of forestry in the country, at all relevant levels of education and training.

#### 6.2 Project Preparation

If, on broad terms, the outcome of the analysis of the feasibility study is positive, green light is shown for the detailed preparation of the project. Setting of priorities was already discussed

in Section 2. In addition, a thorough analysis of the required training inputs is carried out by an independent specialist, not a representative of the technical partner supplying technology to the project.

#### 6.3 Appraisal

An independent team is appointed to appraise the implementation plan of the proposed project. The appraisal is carried out in respect of ecological, technological, financial, social as well as educational aspects. An educational planner/evaluator should as a rule be a member of the appraisal team. The appraisal shall as well assess the planned set of priorities of the project in order to form an opinion on whether the objectives set for the project can be attained by the requested resources. This assessment must not exclude education and training.

#### 6.4 Investment Decision

After a positive result of appraisal, the national executing agency of the proposed project makes an investment decision, which depends on the availability of financial resources for the implementation of the project. The implementation of the project proper does not yet start at this point in time.

#### 6.5 Agreements

Following issuance of tenders for the required services, technology, etc., for the project, the national executing agency negotiates and enters into agreements and contracts for implementation of the project. Special agreements are also concluded on education and training programmes and components. These agreements and contracts do not become effective as yet.

#### 6.6 Detailed Preparation Phase

During the detailed preparation phase, as will be stipulated in the separate agreements to be made regarding this phase, site-level project preparation will commence as authorized by the respective Government Agency. The national executing agency is responsible for the successful implementation of the preparatory phase. Combined with the necessary mobilization of national and site-level resources, ample time should be reserved for this important phase of the project.

The training programmes specified in the project plan will be implemented at this stage whenever practicable, in order to secure that lack of training is not causing delay and inefficiency during the main phase of the project. Therefore, training programmes have their separate budget and schedule of execution as provided for in the special training contracts, not excluding special arrangements made with national training institutions. Training programmes may include specifically planned institution-building projects so as to raise the level of national training capability to a level required on a long term by the realization of sectoral development plans and programmes.

During this preparatory phase, resources are mobilized for the implementation of the main phase of the project at the site level through an inter-disciplinary team of specialists representing both directly involved agencies, linkage agencies as well as local communities and non-governmental organizations as will be applicable. Special attention is also given to motivational factors and incentives.

#### 6.7 Handing-Over I

When the national executing agency is satisfied that the preparatory phase has been successfully carried out, the actual implementation of the project will be handed over to the local project management. Financial, technical, managerial and decision-making power and resources shall be made available and given to the local management responsible for the attainment of output targets. The executing agency will maintain its follow-up and monitoring function, for which a system has been developed specifically for the project.

#### 6.8 Implementation Phase

Following the handing-over of the responsibility for project execution, the implementation phase will commence by releasing the project budget for disbursement by the national executing agency. Previous phases have been budgeted separately. During the implementation phase, training will be an integral part of the project and it will be carried out through a counterpart organization. The monitoring system feeds back data to the national executing agency on the progress, cost and impact of project work. Adequate resources should be allocated for proper follow-up and monitoring.

#### 6.9 Handing-Over II

At the projected termination time of the implementation phase, the project will be handed over to the national executing agency by the management responsible for the project. By definition, the length of the implementation phase should not be extended beyond the original deadline, to ensure necessary discipline in project execution. It will be simultaneously appreciated that, normally, work is carried out in difficult field conditions and therefore, timely handing-over will assist the project management in project execution.

#### 6.10 Evaluation

The Headquarters appoints an independent team of specialists for the evaluation of the project. One of the key factors, determining the impact of the project on the set objectives, is the success of the training programmes. Therefore, special attention will be paid to the evaluation of these by specialists. The evaluation will provide an assessment of as to how foreign experts will be gradually replaced by national, trained staff. This is a key criterion of technology transfer.

In the evaluation, the same factors are used in impact assessment as those which were used when the project plan was appraised.

#### 6.11 Decision on Operational Phase

The national executing agency will make a decision regarding the operational phase of the project. This decision is based on the evaluation carried out by the independent team appointed, and on the impact assessment of the project made by the management of the executing agency. The resources needed in the operational phase may differ considerably from those employed during the implementation phase. Training and education programmes continue to be implemented also during the operational phase.

#### 6.12 Resource Mobilization/Handing-Over III

The national executing agency hands over the responsibility for the operational phase of the project to the local management, which may have been revised during evaluation.

The content of the operational phase depends on the nature of the project and the recommendations made by the evaluation, as well as on the subsequently made impact assessment.

### 6.13 Transfer of Projects

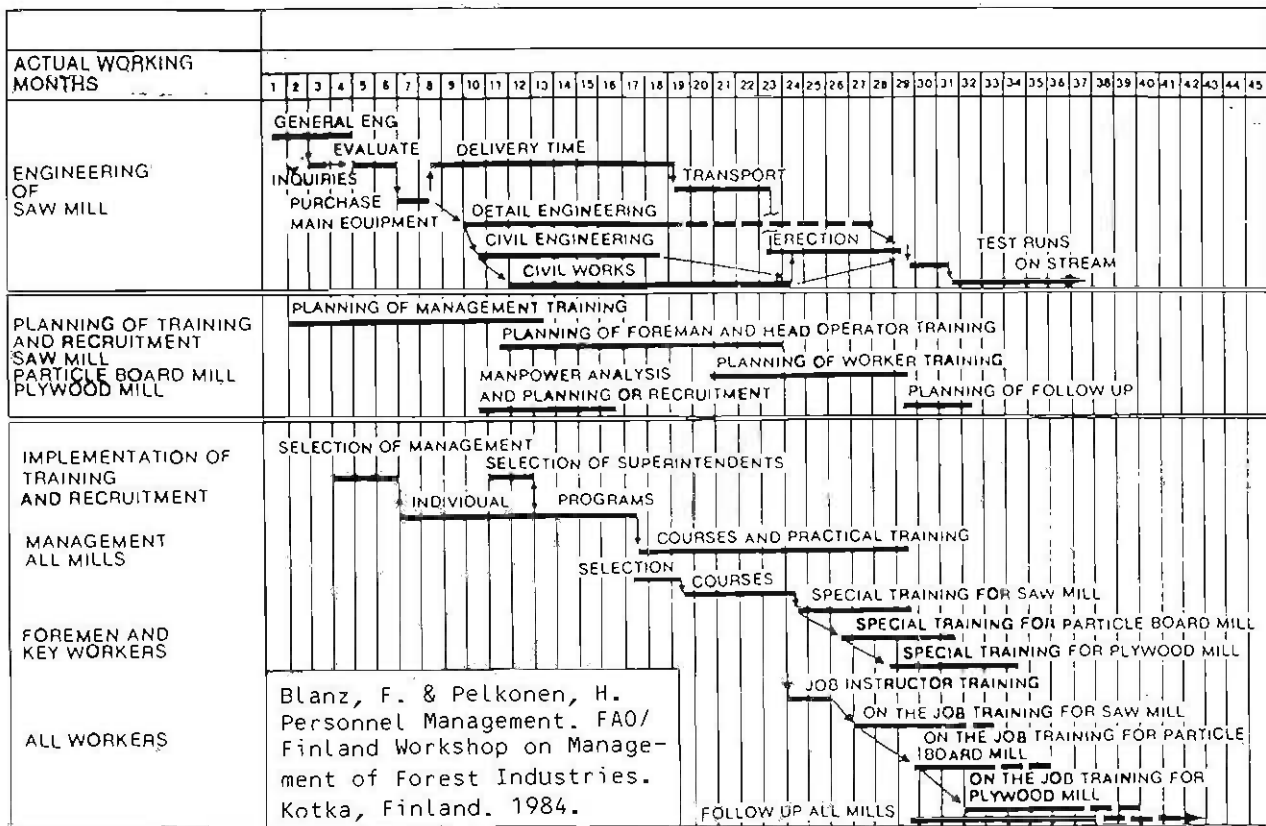
At the end of the successfully completed operational phase, the finalized project will be entirely transferred to the organization of the national executing agency and project functions become an established routine of that organization. Foreign partners will disengage themselves from project activities.

### 6.14 Training as Part of Project

An example is shown in Figure 3 of how training components within a project have been coordinated with other project activities.

Figure 3

Coordination of Training with Other Project Components



7. ITEMS FOR DISCUSSION

1. What would be the most relevant factors influencing decision-making on priorities for training?
2. Have analyses been carried out on training requirements and impact of training? Are such analyses needed and which institutions should be responsible?
3. Which types of specialized forest industrial training institutes exist at present? Are there plans to establish such institutes?
4. How have various linkage institutions been taken into account in forest industries training programmes?
5. What are the experiences of
  - technicians' training
  - training of skilled workersfrom the industries' point of view?



## EDUCATION AND TRAINING

### Summary of Discussion

#### 1. PLANNING FOR APPROPRIATE EDUCATION AND TRAINING

In planning of education, it is essential that the viewpoints of industries be taken into account as the purpose is to satisfy their needs of trained manpower. Moreover, there is a need for improved methodology of analysis and impact assessment of training in establishing the requirements. In these efforts, adequate attention should be given to ecological, social, organizational technological and financial aspects.

#### 2. FIELDS OF TRAINING

In forest operations, training should give special attention to forest resource assessment, inventory and management, logging methods and organization of harvesting operations. Training in selection and maintenance of tools and machinery is also essential.

New approaches, such as agro-forestry/social forestry extension and methodology, will play an important role in afforestation in the future and, therefore, should be included in training programmes for forest industry together with conventional methods of afforestation in natural and man-made forests.

The role of linkage agencies, such as agricultural extension services, should be taken into account and effective inter-agency coordination established in training related to forest operations and in fields of training directed toward the populations involved.

In wood processing and manufacture of wood products, balanced attention should be given to sawmilling, wood fibre processes and wood-based panels technology, as well as secondary wood processing.

Pulp and paper technology deserves special attention in countries and regions which have raw material and other resources available for this industry. In addition to planning of industry, training should be organized in factory design and construction and in training of engineers, technologists and chemists.

Specialized training services should be provided for training of key personnel, such as mechanical and civil engineers, mechanics, sawdoctors, machine operators and maintenance mechanics, graders and quality controllers, accountants, production supervisors and managers.

In the field of management, training in corporate development should be arranged for executives and production managers. Due consideration should be given to personnel management methods and career development systems.

Special attention should be given to training of supervisors and workers involved in wood supply and operation and maintenance of plant machines.

In organizing the above-mentioned training services for forest industries, efficient coordination between training institutions such as technical universities and colleges and technical vocational schools should be established in order to utilize effectively the scarce resources available for training and for streamlining the contents of training curricula of the respective institutions.

### 3. SELECTION OF TRAINEES

Training programmes should be based on analysis of requirements in the fields referred to above, as well as experience gained on impact of various types of training methods.

Trainability of candidates is an important aspect which should be assessed prior to the final selection by using job analysis and individual tests. Such tests should be finally developed nationally to pay due attention to cultural characteristics, even if model tests are available internationally.

### 4. FORMAL EDUCATION IN FOREST INDUSTRY

There is a general lack or non-existence of formal training institutions especially for forest industry-related education in management and technology, organization, accountancy and marketing. In addition, specialized institutions are required as well in research and development of forest industry products and wood utilization.

Because conditions differ from one country and/or region to the other, such specialized training institutions should be established for each country on a national level and in the form and size required by the existing industry and justified by national development plans for the forest industry sector.

Special attention should be given to starting up new industries when efficient running of new mills may depend on experienced staff recruited from existing industries, especially with regard to executive management. These may, during the early years of operation, also be expatriates, especially when the type of industry is new to the country.

In these cases, special training inputs may be necessary in order to secure timely transfer of projects by expatriate management to the national agency. In view of this, experienced personnel and expatriates should be backed up by well-educated and trained nationals from universities and schools.

Education is primarily a responsibility of the government and the industry ought to be able to rely on the government to supply education and training in conventional industry-related disciplines.

Some developing countries cannot afford the expensive and specialized resources needed for first-class graduate education. Furthermore, the demand for certain specialities may be too small to justify the support of a graduate programme. Scholarships and fellowships to institutions in other countries may alleviate the situation, but even if such scholarship and exchange programmes have proved to be beneficial for executive and medium-level management and for special training such as sawdoctors, a long-term solution should be found in order to ensure efficient training of key personnel through a regional

programme. The objective of such a programme should be to strengthen national training institutions, as well as to arrange specialized continued training on a regional basis. There is accordingly a need for a coordinated effort to identify which existing training institutions could participate in such a regional network and programme. The cost of organizing regional training courses may be partly covered by host institutions on a rotation basis, to cover local costs such as per diem and facilities, in local currencies.

There is also a need for assessing whether establishment of regional training institutes is justified in some cases. In any case, priority should be given to strengthening national institutions and exchange of experience and staff between countries and institutions.

Training programmes should be planned in cooperation with industries, e.g., by establishing advisory committees with members from both governmental bodies and industries to secure good cooperation. Industries should in this context support training programmes in the provision of lecturers and scholarships.

## 5. CURRICULUM DEVELOPMENT AND TEACHERS' TRAINING PROGRAMMES

Some developing countries do not provide the breadth of education required to support a sound forest industry. Forestry education in most developing countries is heavily oriented toward biology and to meeting the needs of the governmental forest services. The education in technology and managerial skills which is very important to the industry is typically insufficient. Education in engineering and business management often lacks background information and case studies that provide examples of the types of problems and issues faced by the forest industry. This is in contrast to some developed countries where forest products technology, pulp and paper technology and forest products management are important curricula.

Education in forestry and forest products extension is most important, particularly to provide a base for sound development of small scale industries. At present, some institutions of higher education in forestry are in the process of revising their curricula in order to give high priority to social/community forestry and agro-forestry approaches. This reflects the fundamental changes taking place in the forest policy of many governments. This trend is also positive from the industries' point of view because it will secure in the future the supply of wood raw material to the industry, as well as the availability of forestry products to the local people, most essentially in the form of fuelwood.

However, this trend makes it ever more justified to plan for specialized curriculum development programmes for education and training in the field of forest industries. This objective is also justified by the need to direct more investment to development of capacity in secondary forest industries. Regional programmes and national projects should be urgently designed and implemented in this field, and cooperation and exchange of views between ongoing projects should be intensified.

Curriculum development programmes should be followed by teachers' training programmes in forest industries. In the beginning, regional teachers' training programmes may be sufficient as a first attempt, but this should be followed up by training on a national level.

## 6. SPECIAL TRAINING COURSES

Where industries have special needs not met by the conventional education system, it may be necessary to provide training by the industry involved. In some developed countries, the forest products industries have provided massive support to universities to encourage them to provide specialized education in forest products management, pulp and paper technology, forest products marketing, and similar fields. Industries may also provide for mid-career education to upgrade the capabilities of individuals which are promoted within the industry.

There is a need for personnel development plans in industries to meet the requirements of both normal staff turnover and those of corporate expansion. Industries should therefore actively participate in the organization of on-the-job internship training, on-leave education programmes and off-site conferences, short courses and seminars.

For efficient in-plant training as part of projects, training of the work instructors required is necessary. Also mobile on-site training and service units offer possibilities, especially in the case of rural forest industries.

Continued training of engineers, foresters, industrial economists, etc., may be provided in the form of in-service training by the company's personnel department through a specialized agency, training consultants, through contract with training institutions or through technical cooperation programmes.

In some countries, governments provide tax incentives, either to the company or to the individual, to encourage mid-career training and training in the use of new technologies for an industry as a whole. In the selection of trainers it should be recognized that education is a profession. Because a supervisor is highly skilled and very competent, it does not mean that he is a skilled teacher.

## 7. OTHER CONSIDERATIONS

The planning and production of training material and educational aids in the national languages of developing countries is quite inadequate and this activity should be strengthened in coordination with curriculum development and teachers' training programmes. Special attention should be given to vocational education.

In forestry education and training, as well as in the specialized training for forest industries, due consideration should be given to changes in the role of forestry and industry in society. Social and ecological orientations make it more and more evident that training related to ecology, mobilization of human resources and community participation, organizational aspects and non-formal extension for both rural and urban entrepreneurs, as well as occupational health and safety, has become increasingly important and they should also be covered by the curricula of training institutions.

Training in project design, appraisal, implementation, monitoring and evaluation should be arranged for forestry and forest industry planners and managers. Such training events should incorporate participants and lecturers from sectors closely linked with forestry and forest industry, in order to improve on the ability of these professionals to cooperate with each other in actual field implementation of projects in a multi-disciplinary organization.

## WHAT IS APPROPRIATE?

Introductory Note  
by the Secretariat

(Consultant: M. Simula)

### 1. INTRODUCTION

In recent years a new dimension has been added to the traditional requirements and criteria for industrial development projects, including those in the forestry sector. This new dimension is the requirement to judge whether the industry is "appropriate" or applying "appropriate" technology. But what exactly does it mean, in which sense should industry or technology be "appropriate", and how and by whom should the final judgement be made?

It is of utmost importance that a consensus be reached on the meaning of appropriate and appropriateness, so that this new dimension may be included in the requirements and criteria for evaluating sectorial development and individual projects or enterprises. There is a need for assessing the performance of existing industries with regard to broader criteria than in the past.

The purpose of this paper is to explore the definition of appropriate forest industries and how appropriateness could be evaluated. A number of criteria will be suggested and some related issues indicated. Finally, selected policy issues are identified for further discussion.

### 2. DEFINITION OF APPROPRIATENESS

Appropriate industry refers to a production system which is suitable for the particular environment where it operates. The dimensions of this environment are, on one hand, related to the necessary elements of the operation such as inputs, outputs and technology, and their interrelationships, and on the other hand, the economic, social, institutional and ecological impacts of the activity. The scope of traditional evaluation of suitability, limited to techno-economic considerations, is substantially widened through the concept of appropriateness which covers not only enterprise-related criteria but also the viewpoint of the whole society. The introduction of these broader criteria in planning forest industries should lead to more effective strategies, better use of policy measures, development of institutions, and improved success in projects.

It is important to note that appropriateness is to be considered, from the given group of people facing the particular situation, not only with regard to economic circumstances and available resources but also to value priorities. Appropriateness can be partial or selective, beneficial for some and adverse to others.

Appropriate industry is often associated with small scale production, labour intensity, low product quality, rural-based operations, the use of second-hand machinery, etc., versus the application of modern and advanced techniques. Appropriate technology is often used synonymously with "intermediate" technology that is midway between the traditional village technologies and the advanced capital-intensive technologies of the industrialized countries. In the wider context of appropriateness, all these interpretations may be misconceptions. Each case should be evaluated separately according to its own merits. Both small and large can be beautiful.

Appropriateness does not refer to the developing world only. There is a more general tendency from technological monocultures to diversity where there is less fragmentation in the functions of the human component in production systems. At the same time, industrial pollution has reached the proportions where increasing attention is needed to evaluate the ecological consequences of alternative technologies. Appropriate industry is an equally relevant concept in the industrialized and developing countries, although for partly different reasons.

### 3. EVALUATION OF APPROPRIATENESS

#### 3.1 Interest Groups

Those who are directly or indirectly involved in the decision-making on industrial choices, or who are facing the consequences of these decisions include:

- people living in project areas;
- people employed by the activity;
- people providing services to industry;
- owners of the activity;
- financing institutions;
- government institutions;
- society as a whole.

The above groups are not exclusive as the same people belong to two or more categories. Each interest group has its own criteria of appropriateness which may be overlapping, conflicting or complementary. This makes evaluation a difficult task. Planning horizons also differ, which further complicates decision-making.

It is the owner of the activity who finally creates appropriateness and the role of other interest groups may be contributory, neutral or repressive, depending on the case. In the following, little attention is given to differentiation between the evaluation made by interest groups as the main purpose is to identify possible criteria but not to establish their priorities.

#### 3.2 Dimensions of Industry

The main characteristics of forest industries which have relevance to the evaluation of appropriateness include (qualitative range indicated in parentheses):

- markets (subsistence - local - national - exports);
- wood raw material (natural - plantations);
- scale of operations (large - small);
- intensity in the use of individual production factors, i.e. labour, capital, wood, energy, etc. (high - low);
- efficiency in the utilization of production factors (high - low);
- technology (modern - traditional; sophisticated - simple);
- state-of-the-art (proven - new);

- source of technology (foreign - imported);
- dependence on imported inputs (high - low);
- focus of organization (centralized - decentralized);
- financing (local - foreign; loan - aid).

The list is not exhaustive but it could help in analyzing alternatives before appropriateness is evaluated in terms of various criteria presented in the following.

### 3.3 Criteria of Evaluation

The main criterion of appropriateness should be the contribution to development of the industry on national and/or local level. This does not necessarily involve the maximization of the economic returns of the sector as a whole. Various impacts of the industry should be measured before decisions are made, and as a continuous activity during and after implementation.

#### 3.3.1 Enterprise-related criteria

The conventional enterprise-related criteria of evaluation include considerations on wood raw material, markets, production technology, energy, human resources, capital and other resources. As these aspects have been discussed elsewhere in this Consultation, they are not dealt with again in this context.

#### 3.3.2 Economic criteria

Financial profitability is the most important owner-related criterion, but not necessarily the only one. Others may include strategic aspects such as market share, cost competitiveness, etc.

Application of accounting prices in profitability calculations reveals the project's desirability from the national economic viewpoint when capital is considered the most limiting factor of production. The project's contribution to other national economic objectives should also be measured through such indicators as value added, balance-of-payment effect, employment generation, cost of employment, economic diversification, regional economic development, etc. It can be questioned to what extent the dominance of the rate of return as an economic criterion reflects the true aspirations of development.

#### 3.3.3 Social criteria

The impact of forest industries on people, whether employed by the operation or living in the affected areas, is measured by means of social criteria focusing both on individuals and communities. The impact to be considered can be grouped e.g. under the following headings:

- population structure and geographic distribution;
- community structure and organization;
- land tenure;
- culture and traditions;
- employment and working conditions;
- income and its distribution;
- subsistence economy;
- community services, including housing;
- other infrastructure;
- political stability.

Systematic analysis on social impacts is generally lacking. Past experience shows that at least the following items require attention in planning and implementation of appropriate forest industries:

- possible conflicts and tensions between the local population and immigrant labour; forest areas and mill site communities require separate approaches;
- possible destruction of indigenous traditions, culture and power structure;
- damage to trees, sites or other feature of religious or other cultural values;
- employment arrangements that disrupt traditional living patterns;
- excessive strain, stress or deterioration in working conditions;
- who are those who really obtain the benefits and how the income distribution is affected; what kind of redistributory mechanisms exist in the community;
- impact on the subsistence economy of the emerging industrial community (e.g. food prices, crop choices, fuelwood, construction materials, etc.);
- intensification of shifting cultivation beyond the carrying capacity of a region;
- need to invest in new schools, public buildings, hospitals, roads, and recreational facilities;
- impact of the immigrant population on the standard of social and administrative services;
- waste generation that requires investment in new disposal facilities;
- emergence of new social costs such as crime, crowding, higher cost of living and housing, reduced amenity values and disease which offset socio-economic benefits.

When social criteria are applied, industry is no more neutral to value judgements. Quantitative information on social factors is scanty and scattered. It can be obtained through brief field surveys or comprehensive socio-anthropological surveys which are normally very time-consuming and costly. No established practice is available to include social evaluation in feasibility studies on forest industry projects. Even less clear is the weighting of the individual criteria which has to be done case by case. Pilot efforts should perhaps be carried out in typical situations to prepare practical guidelines.

#### 3.3.4 Institutional criteria

An industry should also be appropriate for its institutional environment which includes the legal framework, the public administration, the educational system, etc. No guidelines exist for how to deal with such an analysis but at least the following questions should be answered:



- what inputs are required from the institutional framework and what would be the costs involved, and what kind of spin-off effects can be expected elsewhere;
- what changes would be necessary in the institutional structure to implement the project; and
- what would be the impact of the project on institutions.

### 3.3.5 Ecological criteria

Forestry and forest industry operations can have several kinds of ecological impacts which should be taken into account in the evaluation of appropriateness. The environmental aspects to be considered include slopes, banks and shores, soils, sedimentation, water resource, climate and air quality, vegetation, wildlife and fisheries, epidemiology conservation, noise and aesthetic values. Evaluation takes the form of environmental impact assessment which is often nothing more than systematized common sense but thorough investigations may also be required. A stepwise approach is usually applied to obtain the necessary information as in the case of social analysis.

Some of the main factors to be considered include:

- slopes: landslides;
- soils: erosion, loss of nutrients, organic matter, etc.;
- sedimentation of reservoirs;
- water resources: denudation of forested watersheds, induced turbidity, change in water quality, down-basin decreases in flows, industrial water pollution;
- climate and air quality: alteration of ground temperatures and humidity levels, desertification, emission of gases, odours and particulates;
- vegetation: lack of regeneration, extinction of species, damage to seed trees of primary species, invasion of persistent weeds;
- wildlife and fisheries: elimination of rare or endangered species, important reduction in main species, destruction of key habitats, creation access to exploitation of vulnerable species.

It should be borne in mind that forestry and forest industries (which cannot be separated in this context) can also have positive ecological impacts which should be duly taken into account and emphasized in decision-making. Furthermore, the introduction of an industry gives an economic value to a forest resource and this can eventually provide the means for measures to protect the environment.

### 3.4 Application of Criteria of Appropriateness

In general, practical guidelines exist to carry out the evaluation in terms of technical and economic criteria. Another thing is to what extent they are and should be followed in practice (e.g., in the case of small rural industry projects where preparation easily becomes more costly than the project itself). However, a new effort at international level may be needed to prepare practical guidelines for the

assessment of the other dimensions of development in forestry and forest industries paying attention to the great diversity between nations and between regions within individual countries. In particular, it appears that the evaluation of social impacts would require further guidance.

If we assume the following sequence to sufficiently represent social values in practical decision-making, new guidelines may, however, be not absolutely necessary in this respect.

<u>Item</u>	<u>Involves</u>
Social values	Political institutions
Development strategy	National and sectoral development plans
Choice of industry	Project design

This would mean that a very close link should be built between various phases above to ensure the desired contribution of industrial operations to national objectives. Still the problem of conflicting objectives should be solved through value judgement. The experience on individual countries shows that some improvement in the current situation could be justified.

There is a danger that the amount of necessary information for comprehensive evaluation of appropriateness increases beyond proportions and can no more be handled in practical decision-making. Solutions not necessarily alternative) for this problem include:

- set threshold values for critical criteria and drop out all those alternatives which do not meet these;
- express the maximum amount of social, institutional and ecological impacts in money terms, and incorporate them as externalities in the economic analysis - even artificial price tags on various non-economic factors tend to facilitate decision-making; and
- establish trade-offs between criteria, so that it becomes clear, e.g., what economic costs have to be borne if an increase in social desirability is envisaged; use sensitivity analysis extensively for this purpose.

More extensive project preparation efforts than those employed at present appear to be justified, particularly in large forest industry projects, while the small ones may have to be evaluated in the context of a programme to avoid disproportional project preparation costs. In such programmes, policy issues would have to be considered in broader context than in the case of individual projects.

#### 4. ISSUES FOR DISCUSSION

Government policies influence the choice of industries and technologies and the ways and means for their acquisition and development. In a highly simplified way it could be said that governments would like to have technically and financially sound forest industries which would, within these limits, maximize economic and social development at large, which would be coherent with the prevailing institutional framework, and which would either contribute to ecological effects or at least not have undue negative impacts on the environment.

Policy measures have a tremendous potential for influencing technological and industrial choices, and the use of these measures would often be less costly and risky than direct public investment in productive activities.

A whole range of policy instruments is available as explained in the Secretariat paper on the impacts of modern forest-based industries.<sup>1/</sup> These instruments are generally expressed in the form of regulations or incentives. In the following, only those instruments which are specific to the forestry sector are included in the list of key issues.

- Has appropriateness been sufficiently defined for an operational concept, and would the suggested criteria of evaluation guide toward more appropriate development;
- Is there a need for better guidelines to incorporate social, institutional and ecological effects in our decision criteria, and how should these guidelines be developed;
- Is improvement needed in evaluating forest industries in terms of traditional enterprise-related criteria;
- Is the current supply of technology in forest industries appropriate for the prevailing conditions in developing countries with particular reference to small scale production; if not, is the market for such technologies large enough to attract development efforts on commercial basis; if the market is too small, what should be done to develop these new technologies;
- Is the current access to appropriate technology in forest industries satisfactory for developing countries; what could be done to eliminate bottlenecks, in particular in facilitating transfer between developing countries;
- Are the methods and approaches of technology transfer appropriate and do they sufficiently address the specific problems in developing countries;
- To what extent does tying financing and the source of technology influence appropriateness and how possible negative consequences can be eliminated in advance; and
- Does appropriateness influence the preference between private and public ownership of forest industry operations; have parastatals been more appropriate than private companies;
- How appropriate are tariff and duty barriers protecting forest industries in developing countries; what is the importance of time horizon and of knowing the total economic costs of such measures to the society;
- How appropriate are price regulations in domestic market;

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<sup>1/</sup> FAO Secretariat. Institutional Requirements.

- To what extent could regulations and taxes concerning the exports of logs and industrial forest products contribute to appropriate industrial development; how could the present approaches be improved (e.g., bases of export quotas, specification of species, value added, etc.), bearing in mind needs for and possibilities of effective administration;
- To what extent should the costs of infrastructure and social services be borne by forest industry companies in logging areas and mill site communities;
- To what extent do the current environmental regulations in developing countries affect the forest industries, and how will the likely trends in these regulations impact the existing production and technological development; and
- What should international organizations and financing institutions do to improve the appropriateness of forest industries development.

## WHAT IS APPROPRIATE?

### Summary of Discussion

#### 1. DEFINITION

Several definitions can be formulated for appropriateness, but few of them are simple and operational. On the other hand, a more exhaustive definition is likely to be more pragmatic than a simplified one. It is impossible to find a universal definition which would reflect the particular conditions and priorities in various countries.

Appropriate industry should refer to a production system which would be suitable for the particular environment where it operates, meeting various economic, social, institutional and ecological needs. The time factor is an important element in this context and the industry should have a built-in capacity to adapt to changing conditions. Industry is truly appropriate if it can provide long-term benefits to the largest possible number of people and develop and expand its activities. Appropriateness of industrial development also emphasizes balance and harmony with the ecological, social, institutional and economic objectives of the society. Appropriateness cannot be reduced to one single indicator but it tries to identify the type of activities which have the largest number of positive elements over various dimensions.

The level of assessment is important as an industry may be inappropriate at the local level but appropriate at the national level, or vice versa.

Industry is the key word in the definition, incorporating products, markets, raw materials, resources, etc., which form an essential part of the social and ecological system.

An industry cannot be considered appropriate if it is not in harmony with the prevailing government policies. As they tend to change over time, flexibility is also associated with appropriateness. Such changes may occur in the institutional framework governing the forest-based raw material supply system, imports of technology, efficiency in the utilization of resources, etc. It is important that companies try to foresee such changes and adjust their operations accordingly early enough.

The prevailing political system or priorities are also part of appropriateness. Difficulties arise when these priorities of the political system and the industry are not converging and lead to conflicting policy measures.

The evaluation of appropriateness cannot be limited to the viewpoints at the country level alone. The environment where the industry operates has also an international dimension since, through the participation in the world markets for forest products, individual producers or consumers have to consider themselves in the international context, as well.

Finally, appropriateness also depends on the interest group involved. People living in project areas, employed by the activity or providing services to it, financing institutions, the owners of the

industry or governments may all have different criteria for appropriateness. The one who bears the risk - usually the owner - has a special role to play in this since he eventually is the one who has to provide appropriateness.

## 2. CRITERIA OF APPROPRIATENESS

The criteria of appropriateness can be divided into two main groups: those related to the industry or the enterprise itself, and those related to the economic, social, institutional and ecological environment outside it. Clear distinctions are difficult to make between individual elements as the same criteria may appear under more than one group of criteria. For instance, employment is an enterprise-related criterion, but it is also important in assessing the industry's appropriateness from the viewpoint of the national economy or as a social issue.

The case studies provided in the background documents show a large number of elements of appropriateness and a few examples of certain elements of inappropriateness. However, these cases are not necessarily representative of the current situation in general in developing countries. Projects which are, in many respects, inappropriate, are often more common. The case studies highlight the overall importance of the enterprise-related criteria, particularly financial viability. Social issues are also clearly positive, even though it is apparent that the introduction of large scale industrial operations in rural areas cannot take place without some conflicts. They can, however, be resolved or ameliorated by various means through the initiative of the industry. The ecological impacts in these areas have also been positive, mainly due to reforestation. Industrial pollution can be effectively controlled by proper mitigation. The costs of pollution control cannot be considered excessive and they have not jeopardized the industry's financial viability in the cases studied.

The economic criteria on appropriateness have a broader scope as they evaluate the industry's impact on the whole national economy. The economic rate of return, based on shadow prices, has had the central role but other important elements include value added, foreign exchange earnings, employment, economic diversification, regional development, international cost competitiveness, forward and backward linkage effects which may be considered at local and national level and infrastructure - particularly for transport. Improved efficiency creates possibilities to reduce the output prices of the industry for the benefit of the consumer, which can be important, provided that the competitive situation contributes to such behaviour. Economic benefits can take many forms, i.e. wages and salaries, stumpage value, long-term lease of forest lands, etc. Each nation should find appropriate formulae to channel various economic benefits to participants and interest groups. The qualitative nature of the forward or backward linkage effects of forest industries may, in some situations, be a much more important aspect than their value in monetary terms. They should be considered both at national and local levels.

Forest industries often need protection through duties and tariffs. Such protection may be motivated by the adverse cyclical conditions in the world market or just the government's desire to have that type of forest industries. It is rarely established what total costs are involved in such situations compared to the various benefits that the forest industries directly or indirectly create. Such exercises could be useful in guiding future decisions.

The social impacts of forest industries are considerable and, therefore, criteria on this aspect should be developed. They could include issues relating to population structure and regional distribution, community structure and organization, land tenure, culture and traditions, employment and working conditions, including occupational health and safety. Other criteria are income and its distribution, impact on subsistence economy including the supply of minor forest products, social and community services, infrastructure, political stability, etc.

It is of utmost importance to identify the real needs and expectations of the local population with regard to industrial development plans. Their positive or negative attitudes may depend on very small inputs which are easy to incorporate in development plans. Special efforts, often in the form of socio-economic surveys, are necessary to obtain this information. It is apparent that forest industry cannot and should not address all possible social problems and issues and, therefore, such studies can be limited to the relevant issues only.

Need for compensation to the local population is apparent when industry is established in new areas. It can take various forms but it is important to arrange it without necessary delays.

Sufficient guidelines do not exist for addressing social issues in planning of forest industries development in developing countries. The approach used by the World Bank in the preparation of social forestry projects gives some guidance and a number of case studies can be found in research literature. A review of this information would be necessary to establish their applicability in forest industries projects.

Enough time should be reserved for planning the social components in forest industries because of the complexities involved.

Very little guidance also exists with regard to dealing with institutional criteria in assessing appropriateness. The legislative frameworks and structure of institutions vary extensively between regions and countries. The responsibility of resource sustainability may be an unclear issue if government policies are not sufficiently reflected in legislation and in institutional structures.

The rate at which the local populations is able to adapt to changing social conditions can vary considerably for cultural reasons and their needs have to be taken into account in setting the time frame for implementation. Lack of efficiency of the institutional framework can be detrimental to both the industry's success and its efficiency. The institutions, therefore, play an important role in appropriate industrial development. These institutions can be both governmental and non-governmental. Local public agencies are also important in dealing with industrial development. All these institutions need dynamism, efficiency and motivation to cope with their tasks and forest industries could give them support in their efforts.

Education and training is a particularly important area of the institutional framework because of its direct impact on the quality of the industry's human resources.

Ecological impacts to be taken into account in evaluating the appropriateness of forestry and forest industries cover a wide range of aspects from soil erosion and water resources to air quality and aesthetic values. These impacts cannot be measured independently from social issues.

Rational forest utilization is a precondition for positive ecological impacts in forest areas. As long as resources are not utilized or their use is irrational, the result tends to be ecological deterioration. If the resource has an economic value, people tend to look after it better, if its rational utilization is not in conflict with their basic needs.

Inter-agency coordination is essential in the task of taking the environmental aspects into account in planning appropriate forest industries. This can often be simply reached by contacting various authorities at local levels to find out what the critical factors are.

In the design stage of a project and in the phase preparatory to its implementation, ample time (three to nine months) should be allocated for preparation on a site level, including socio-economic and environmental surveys. In addition, the criteria for monitoring should be checked at this stage in field conditions in collaboration with various agencies involved, such as those relating to agricultural aspects, water supply, wildlife, watershed management, health and education.

### 3. EVALUATION OF APPROPRIATENESS

The evaluation of appropriateness involves several interest groups or participants ("stakeholders") who have multiple objectives. Development of forest industries can hardly take place without conflicts between these groups. This is because they differ in this respect from other industries which rarely involve social issues to the same, large extent. Conflict resolution between participants is mostly implicit, but there is perhaps a need to make it even more explicit. As the establishment of forest industries is a social intervention, its technology is not value neutral.

Analysis of appropriateness reveals who pays, who benefits and how much. Several methodologies exist for evaluation, such as goal setting and comparison (predominantly quantitative objectives), institutional network models (structural approach), process models and conflict models. They are not exclusive and the problem is how to combine them into an optimum approach in each individual case. Such an approach would make those who know their priorities to articulate them. It would, in a holistic way, reveal the interrelationships between participants, and it could also include the necessary long-term time element. This is particularly important in forestry where industrial development has to consider the intergenerational equity. In principle, forests should be handed over to the next generation in a better shape than they were received.

Financial evaluation is the most critical element from the investor's and financier's point of view, even though they may have different emphasis. The scope of evaluation may be wider at the level of financing institution compared to owners as they are more concerned with the long-term sustainability of industry which also depends on other factors than business profitability. The public sector as the third party brings in the institutional framework and norms which, as design criteria, have direct influence on planning.

Feasibility studies prepared by investors often tend to excessively reflect their own objectives, having a heavy emphasis on technical and commercial aspects. The actual availability of wood raw



materials may be overlooked and various development indicators have a low priority. The people affected by the project are often forgotten in these evaluations.

Financial viability is different from business profitability as local equity or risk capital and local loans have to be found to reach an adequate financing package.

The role of internal rate of return as the first criterion in project appraisal cannot be over-emphasized. Project boundaries employed in the calculation of this parameter may need adaptation to incorporate forward and backward linkage effects in the national economy.

Evaluation should provide objective information on several levels of impact. Therefore, a multi-disciplinary team with an independent status is in the best position to evaluate industry ex post. The main responsibility of the ex ante evaluation lies on the owner or promoter of the industry. Two important aspects deserve attention: reliability and validity of the information provided for decision-makers.

Successful evaluation can best be reached if the local participation is included as much as possible. Experience has shown that when designing projects with imported technology, the local planning component can eliminate many common pitfalls, which often jeopardize the whole viability of the industry. Local knowledge on social and environmental conditions cannot be substituted by high professional skills of expatriates.

Depending on the country, evaluation may involve a large number of agencies and organizations, e.g., the company itself, industry associations, national board of investment, national development bank or corporation, various ministries, etc. Furthermore, non-governmental or unofficial organizations and groups may often be of great value if represented in evaluation teams. Evaluation should take into account the criteria and information requirements of each body to avoid delays and duplication of effort.

Evaluation should be pragmatic and avoid excessive theory. The main purpose of forest industries is to produce goods which are needed by the society, not to provide social services. The main emphasis in the evaluation should be given to what extent the industry meets its primary purpose. At the second stage, it can be assessed as to what extent various demands, expectations and limitations of the surrounding society can be met. The final conclusion is always based on these two main elements.

In practice, among the various criteria which can be considered, the following three items can be identified as the most important ones:

- profitability
- market (volume and quality of products)
- employment.

After these, the subsequent ranking of other criteria such as economic, social, institutional and ecological criteria may vary considerably, depending on local conditions.

The political aspirations may often be overwhelming in project design. This can be dangerous and lead to disastrous projects. A maximum effort by professionals is necessary to avoid technically and financially unviable projects, and to proceed too far where it is, for political reasons, no longer possible to stop or restructure projects.

Schematic approaches may be dangerous in evaluating appropriateness, and imagination and creativity is needed in each case. Universal solutions to establish weights between criteria or their application do not exist. However, the need for better guidelines is apparent.

PART II

BACKGROUND DOCUMENTS

COMMON FEATURES OF FOREST INDUSTRIES PROJECTS

by

J.S. Bethel\*

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## 1. INTRODUCTION

Forest industry projects, like other natural resource based industrial projects, involve the organization of a set of technologies that can efficiently use available capital, energy and personnel to convert the resource into a commodity or product that can be marketed at a profit. Most industrial forestry systems have as objectives the conversion of forest trees into such commodities as lumber, plywood, particle board, fibreboard or pulp or into products derived from these commodities.

Occasionally the output of a forest-based industry is a non-timber product such as resin, rattan, thatch, wild honey, etc., but since these commodities make up a rather small fraction of the industrial output of forests, this paper will deal with timber-based commodities. In any case, the basic elements of industrial project design are the same.

The nature of the raw material supply is crucial to the design of an industrial materials project. Forests vary in their structure and organization and this variation poses a challenge to the industrial project designer as he undertakes to adapt manufacturing technology and marketing strategy to the available forest resource. A manufacturing subsystem which is highly satisfactory when matched with one forest may be an industrial disaster when matched with another. Just as forests vary as sources of raw material, industrial environments vary with respect to the availability of capital, the supply of processing energy and the quantity and quality of employable personnel. The industrial project designer must blend these ingredients into a technically and economically viable enterprise. Sometimes this cannot be done. If this is the case, an appropriate outcome of the industrial project design effort is to recommend that the project be dropped. But as often as not a first rate industrial design technologist can find a viable solution to the problem.

Perhaps the most inappropriate of all industrial design efforts is one which involves lifting the design for a manufacturing component of a highly successful industrial enterprise, transplanting it into a totally different forest environment, a quite different industrial and social environment and then expecting it to work. Many examples of inappropriate technology, that have been reported from developing countries undergoing industrialization, originate from this kind of technically flawed industrial project design. Here technology is transferred from a developed to a developing country without regard to the technical, social or political setting into which the industry is being introduced.

This kind of industrial project design error is, of course, not unique to developing countries. It occurs in industrially developed countries as well. Wherever it occurs, it represents inappropriate industrial design. The consequences of such an industrial project design error, however, can be much more serious in a developing country than in a developed country, particularly if the project is very large, very expensive and located in a poor country. Countries, whose economies are not strong, cannot afford the costly mistakes that can be absorbed by more robust economies.

## 2. RESOURCE BASE FOR FOREST INDUSTRY

In approaching a forest industry project design it is of crucial importance that the designing technologist have a thorough understanding of the nature of the forest that is scheduled to be the raw material base for the industry. Two major categories of forests that form such bases are those that are naturally occurring and those that are man-made. The designs of industrial forestry projects appropriate to naturally occurring forests are quite different from those appropriate to man-made forests.

Industrial design projects based on naturally occurring forests have much in common with the so-called non-renewable materials projects such as those based on minerals or fossil fuels. When a forestry utilization system is to be designed around a naturally occurring forest, the task is to seek out the usable components of the forest and then create an extraction and conversion facility that is matched to the resource.

The design of forestry utilization systems based on man-made forests is quite different. Here the commodity to be produced is identified and a system is designed to produce it. These forest production projects have counterparts in agricultural systems. The design of the forest is just as important as the design of the manufacturing component or of the marketing component.

### 3. INDUSTRY BASED ON NATURAL FOREST

Naturally occurring forests may be natural forests of the kind that are often referred to as virgin forests. These forests are the products of biological evolution where human influence is minimal. They may be secondary forests, i.e. the residual forests that are the evolutionary products of the prior exploitation of natural forests. Such naturally occurring forests are the type that characterizes the timber stands on more than 98 percent of the commercial forest land in the tropical regions of the world where most developing countries are located. They are often all-aged, mixed species forests that are extremely variable in organization and structure. Some species may be long-lived and grow to very large dimensions. Some are short-lived and may never get beyond the size of shrubs or brush.

All trees contribute to the vegetative biomass of the forest but many contribute little to the materials supply base. They may be of no use as a materials resource because they are too small, too defective, too rare or because they have poor anatomical, physical or chemical properties. Some forests of this type are rich resources, because a large proportion of the trees are useful for materials production. Some are rich resources because a large fraction of each useful tree is recovered as commodity. Still others may be considered rich, simply because they include a very small quantity of trees which is, however, of very high value. Such forests can often be exploited for their useful components at a profit.

Still other naturally occurring forests are so poor in useful trees or tree components that conversion to commodity is not economically feasible even though they support a large biomass. Such forests are not materials resources. But the vast majority of commercially available forests are neither rich resources nor poor resources. They are good resources provided that an appropriate industrial project design can be developed to use them.

One problem encountered in the exploitation of naturally occurring forests that must be dealt with by the forestry system designer is the task of dealing with the residual stands. These are the weeds of the commercial forest. They may be weeds because they cannot be feasibly converted into a marketable product. They may be weeds because they are too young and therefore too small. Because forests are renewable, the young trees in an exploitation forest may ultimately be commercial in some future exploitation project but for the initial project they are weeds. Unlike farm weeds they cannot be easily and inexpensively removed with a hoe or a cultivator. The more of them there are, the poorer is the materials resource from an industrial standpoint.

It is this phenomenon that leads industrial project designers to seek opportunities to market these unused or underused weed species. This is the origin of the so-called secondary species problem of the moist tropical forest.

### 3.1 Relation Between Forest Resource, Forest Industries' Products and Markets

Clearly the quality of the forest as a materials resource is not just a function of its structure, properties and organization, but also of the markets available to the forest enterprise. It matters little that a forest may have much biomass that can technically be converted to particle board if there is no market for particle board in which this forestry enterprise would have a competitive advantage. Regardless of how much biomass is contained in the forest, it is the portion of the biomass that can ultimately be sold that has to pay the costs of harvesting, transport and manufacturing operations. It is the market value of this usable biomass and the cost of extracting and converting it that establishes the economic viability of the forestry utilization system based on a naturally occurring forest.

### 3.2 Production Components Required to Convert the Forest Resource

#### 3.2.1 Logging component

The logging systems required to exploit naturally occurring forests for industrial commodities are commonly comprised of large and expensive road, railroad or water transport networks. This is true for a number of reasons. As previously noted, naturally occurring forests typically are varied in organization and structure and they yield roundwood in the form of logs, blocks and bolts that vary in size and weight across a considerable spectrum. The logging facilities must be built to accommodate the largest and heaviest load likely to come out over the transport network and to do it without damage to the facilities and at a reasonable cost.

Since naturally occurring forests are often located in remote areas far removed from major centres of population, general purpose transportation networks are typically not available for use in exploitation logging in naturally occurring forests. These frequently have to be built and paid for as a part of the logging component of the exploitation forestry system though they may be used as a general social infrastructure once they are in place.

#### 3.2.2 Manufacturing component

The manufacturing component of an exploitation forestry system must be designed to link the forest with the markets. In designing a forestry industrial system based on exploitation of naturally occurring forests, the project designer, in devising a manufacturing subsystem, encounters many of the same problems that he confronted in designing a logging subsystem.

Once again the fact that the usable roundwood logs are highly variable in properties, size and weight means that the manufacturing plant has to be very versatile and this is generally costly. Drying operations must be designed for a mix of species with substantial differences in drying characteristics. Sawing and cutting properties may vary over a wide range requiring elaborate knife and saw maintenance facilities and large stocks of knives and saws. The cooking and bleaching properties of woods may vary across a considerable spectrum when fibre commodities are being produced.

This need to accommodate a highly variable raw material generally means that the manufacturing subsystem design is expensive. In addition, factory production lines that are built to handle a highly variable raw material are rarely as efficient in terms of the utilization of time or materials as is possible when the raw material is less variable.

### 3.2.3 Choice of technology

Despite the fact that the nature of the raw material mix available in naturally occurring forests heavily influences the choice of manufacturing technologies used in exploitation forestry systems, there are usually a number of alternative technologies available to the industrial project designer. Choices of technologies may depend upon such factors as:

- (a) relative availability of capital and labour;
- (b) availability of process energy;
- (c) availability of skilled labour and experienced technical and managerial personnel; and
- (d) the rigour of quality demands in the market to be served.

Where capital for construction of the manufacturing facility is not easily available locally, the appropriate technology from a system design standpoint may be one that makes maximum utilization of labour and minimum demands upon the sources of capital. But these kinds of choices have to be carefully orchestrated in industrial project design by a very competent system designer.

Some highly sophisticated manufacturing equipment is included in a system, not for the purpose of saving labour, though that may occur, but for the purpose of achieving an elevated level of product quality. If the manufacturing enterprise is to serve a very demanding international market, then this capital investment, to achieve an acceptable quality level, may be essential even though it limits the size of the labour force. If the enterprise is to serve a less demanding local market, it may be feasible to forego the sophisticated equipment in favour of the greater use of labour.

Is product quality achievable only by making a major capital investment in high technology equipment? Not necessarily; a very highly skilled and well-managed manufacturing team can sometimes use well-designed and well-built, but simple manufacturing equipment to produce high quality forest products such as lumber and plywood. The key to such a trade-off between labour and capital investment is the quality of the labour and management available to the manufacturing enterprise. It is not feasible to substitute low technology and unskilled personnel for high technology equipment, and still sustain a high level of quality control. Unfortunately, the developing countries that cannot internally generate the investment capital required to purchase sophisticated equipment are as frequently as not the same countries that do not have a pool of skilled labour, expert technologists and competent managers. The opportunities to substitute personnel for capital demanding equipment without loss in the level of product quality vary from industry to industry.

Another reason for adopting a highly sophisticated manufacturing technology is to improve upon yield in the conversion of raw material to finished product. A very expensive raw material provides a great incentive to improvement in product yield. When raw material is costly, the development of large quantities of unutilized processing residues can be very expensive indeed. In many developing countries the price of raw material for forest industries has been very low and, accordingly, there



has been little financial incentive to make substantial investments of capital and labour for the purpose of improving on product yield. This condition is rapidly changing in developing countries. The unique resources of the naturally occurring forests are becoming increasingly scarce. Greater demand for these scarce resources results in higher prices in the market place.

Greater utilization efficiency and improved yield in processing the materials components of a forest can be achieved in several ways. An obvious way is to improve on manufacturing techniques so that commodity and product yield from the logs, blocks and bolts, fed into the factory, is increased. This can be accomplished by improving the quality of manufacturing equipment, factory layout and construction, and the competence of labour and management personnel utilized in the production operation.

Often efforts to improve yield take the form of introduction of sophisticated equipment. But just as in the case of quality control, highly skilled labour, able technologists and very competent managers can often substitute for high technology processing equipment in efforts to improve yield. The choice for the developing country, which is undertaking to achieve industrialization through the exploitation of forestry systems based on naturally occurring forests, may often be between the use of capital to buy education and training versus the use of capital to buy sophisticated machinery and instrumentation. It is not really surprising that this should be so. This is a case of substituting high technology personnel for high technology equipment.

Another way to improve on the utilization efficiency of an industrial forestry system is to provide a mix of manufacturing facilities designed to produce a variety of products. This is often seen to be a solution of the problem posed by the great variability of the all-aged, mixed-species forests of the humid tropics. The requirements in raw materials for one product conversion are different from those of another product conversion. Theoretically one product's weeds become another product's grist. The residues of one conversion are the raw material of another conversion. Certainly some of the world's great forest industry projects have consisted of groups of integrated conversion facilities of this type. But these present some of the most complex industrial design problems that can be posed to a forest products' technologist. Such integrated conversion industries must be not only internally efficient but they must also be matched together in such a way as to be efficient as an industrial complex. Demand for raw materials must be matched to raw product outputs from the forests and residues from the factories that are linked together. A reduction in demand for one product can result in a diminished supply of raw material for another.

The design and successful operation of a highly integrated forest industrial complex requires the use of sophisticated equipment and the highest level of technological and managerial talent. The latter two are frequently not available to exploitation forestry systems, because these systems are often developed in remote areas far from centres of business activity and of education and training. Here the quality of personnel is crucial.

#### 4. INDUSTRY BASED ON MAN-MADE FOREST

The problem of designing an industrial project which is based on man-made production forests is quite different from that of designing an exploitation forestry system. Here the creation of the forest is the first element in the design. This permits the project designer to bypass many of the costly raw materials constraints that are a part of the design process in exploitation forestry systems. The organization and structure of the man-made forest is much simplified compared to that of the typical

naturally occurring forests. Most frequently these are single-species forests. Species selection is made for the purpose of providing a raw material that is from the beginning adapted to the production of the commodity or product that is the objective of the industrial project. This species may be exotic and, in fact, quite different in its wood properties from any endemic species. The production system thus created may provide the opportunity to meet a local need or to serve a lucrative market in a way that might not be possible at all using a naturally occurring species.

The forest site in a production forest is more completely occupied by trees of commercial value than is the case with an exploitation forest. The occurrence of weed trees is minimized. The forest is most likely to be an even-aged stand where tree sizes are smaller and much more uniform than would be the case with a naturally occurring stand. They are converted to logs, blocks and bolts that tend to be small and relatively uniform in size.

#### 4.1 Production Component of Forest Industries

The equipment for logging, transport and manufacturing does not have to be so large as to accommodate raw material units far larger than the average. Uniformity in the anatomical, physical and chemical properties of the wood supplies also simplifies the selection of manufacturing processes. The greater uniformity in raw material tends to make quality control and yield control easier tasks.

The implications of these differences in the basis for industrial project design are profound. Since the forest is man-made, there is choice as to its location. It is not always necessary to harvest the trees from a remote location which requires the construction of a large and expensive virgin transport network to move raw material to factory and finished product to shipping point or market. Since much less land is required to produce the same annual requirement for raw material, the project, including raw material supply, manufacture, transport and marketing, can often be included in a much smaller geographical area. General purpose transport networks are often already in place and available for use. Infrastructure in the form of employee housing, schools, churches, service businesses and local government services may exist, whereas it often has to be created when a project is to be established in a remote area to exploit a naturally occurring forest.

### 5. TRANSITION FROM EXPLOITATION FORESTRY TO PRODUCTION FORESTRY

Since about 98 percent of the commercial forest land in the developing countries is in an exploitation forestry status, current activities in forest industrial design in these countries relate to exploitation forestry. This is, however, changing rapidly and the technological challenge for the future is likely to lie in the direction of designing production forestry systems based upon man-made forests.

During the past thirty years, vast areas of essentially undisturbed hardwood forests of the humid tropics, located for the most part in developing countries, have been committed to exploitation. This is the crux of the tropical deforestation problem that has received much worldwide attention in the recent past. Some of this exploitation has been for the purpose of providing fuelwood, for conversion to agriculture - either permanent or transitory - or for the purpose of providing supplies of industrial wood. In some cases all three purposes were involved. While

some of this land will gradually revert to secondary forest and be available for another exploitation at a future time, some will be permanently removed from forest use. It seems clear that, if the expanding wood requirements of the developing countries are to be met from a rapidly declining forest land base, then it will be necessary to take advantage of the high productivity available from man-made production forests.

A major task in developing production forestry systems is that of achieving an orderly transition from exploitation forestry to production forestry. This is a problem that has been confronted by many of the developed countries of the world, and is still being confronted by some. It is a major task for the developing countries for the next several decades.

It takes a relatively long time to grow a new and different crop of trees; the manufacturing and marketing subsystems, that are appropriate to an exploitation forestry system, are often completely different from those necessary for a production forestry system. Therefore, the time required to achieve transition can be long and painful. Indeed, in some countries where institutional structures are incapable of dealing with this problem, the transition may become stalled and not proceed to production forestry systems at all.

In other cases the players in the exploitation forestry systems including labour, technologists, managers and the supporting communities move smoothly into the production forestry systems. In yet other cases, the exploitation forestry systems exhaust their industrial opportunities and abandon the land, the factories and sometimes the communities. New production forestry systems are created with new players on the stage.

This sort of transition has occurred in the south-eastern United States, which was the major centre of forest product manufacture in the United States at the end of the last century. Production was primarily lumber, based on naturally occurring forests and it peaked in 1909. Following this peak, the industry declined rapidly and was replaced in the United States by an industry based on the naturally occurring forests of the western United States. But the west is now going through transition and the dominant position has been regained by the south-east with a totally new mix of forests, factories and products. The modern transition in the west is less traumatic than that which occurred seventy-five years ago in the south-east and it is taking place at a much faster pace.

A challenge to the developing countries and their industries is to advance the technology of transition as they confront the need for it.

One problem faced by the production forestry system designer is that of removing from the land the remnants of the naturally occurring forest so that a man-made forest can be grown. Sometimes this has been accomplished by deliberately removing the naturally occurring forest in a massive land-clearing operation and planting a crop of trees. This was the pattern for example in the Jari project in Brazil. Such a process provides a very fast transition but it is often costly and technologically difficult.

A more common procedure is to attempt to effect a gradual transition from natural forest through secondary forest to production forest. This is feasible if the production forest is likely to be similar to the natural forest in species composition, structure and organization. Such a pattern of transition has been used in places like the north-western United States and western Canada. One of the most effective transition patterns has been the use of abandoned but not degraded agricultural land.

Here the clearing had already been accomplished for the purpose of farming and the forest could be established at relatively low cost. The very extensive stands of Monterey pine in the south-eastern United States and the eucalyptus forests of Chile are examples of this sort of transition.

## 6. LONG-TERM OBJECTIVES OF NATIONS' FOREST INDUSTRY PROJECTS

A very important feature of forest industry design in the developing countries is a determination of the long-term objectives of a nation's forest industry projects. What needs are they designed to satisfy and what demands do they respond to? When exploitation of naturally occurring forests is the basis of forest industry projects, the industrial project designer has little choice but to examine the materials potential of the forest and to seek a market for the commodities and products that can feasibly be manufactured. But this is not the case with production forests.

It is conventional wisdom in many quarters that the developing countries are playing the role of the wood baskets of the world. They are being asked, it is said, to supply the raw materials required to satisfy the insatiable demands of the developed countries for wood. Nothing could be farther from the truth. Of the ninety developing countries analyzed by FAO in its study Agriculture Toward 2000, 78 percent had a negative balance of trade in forest products in 1981. Even the countries with positive wood trade balances imported very large amounts of wood. Exports from developing countries tend to be in mechanically processed wood, and imports are generally in fibre products. The former products may be exported to help earn the foreign exchange required to purchase other forest products not produced locally. As the developing countries proceed through transition from exploitation forestry to production forestry, they will find it possible to match the output of their forest industrial projects to their domestic requirements for wood-based commodities and products whether these are for local use or for export.

## 7. "APPROPRIATENESS" OF FOREST INDUSTRY

### 7.1 What Does "Appropriate" Mean?

Overlayed on the conventional criteria for industrial project design is now the need to consider the propriety of an industry. In recent years the literature of development has been replete with references to what has come to be called appropriate technology or appropriate industry. These terms seem sometimes to have acquired a generic connotation, i.e. an appropriate technology or an appropriate industry is something unique or different from other technologies or industries. The other side of this coin, by implication, would seem to be that all other technologies or industries are inappropriate. A dictionary definition of the word gives as its first meaning, "suitable or fitting for a particular purpose, person, occasion, etc." When used to define a technology or an industry, the term appropriate implies a judgement as to suitability of fitness. The outcome will depend upon who is making the judgement concerning the suitability of the technology or industry and upon what criteria of fitness are being used to make the decision.

### 7.2 Environmental Criteria of Propriety

In some of the developed countries, where the environmental movement originated some twenty years ago, industry has been viewed as inappropriate because it is a source of pollution deriving from the disposition of gaseous, liquid or solid residues of the manufacturing operation. It has sometimes been considered to be inappropriate because its

installations resulted in major modifications of the physical and biological composition of the industrial site and its environs. These concerns often focused upon such activities as land clearing, excavation, building construction, road and railroad installation and the like.

These environmental impacts often became ex post facto criteria of propriety. Established manufacturing installations were suddenly found to be inappropriate when criteria of propriety were applied which were unknown or not in vogue at the time the factories were built. Substantial non-productive capital investments frequently had to be made to permit older installations to conform to new criteria.

The proponents of environmentally based propriety standards for developing countries often wish to avoid what they view as the developmental mistakes of currently developed countries. There is merit in this position. It is less expensive to build effluent controls into a project at its inception than it is to add it to the project later. But these environmental control components generally represent investments that do not contribute directly to an increase in the quality or quantity of commodity produced. If such installations are too expensive then the project might be found to be economically unfeasible. In the final analysis, judgements concerning environmental restrictions on industrial development must be made by the country involved and implemented through government action. Where such action is taken, it becomes a criterion for industrial propriety and a constraint on project design.

### 7.3 Dimensional Criteria of Propriety

In applying the concept of "appropriate technology" or "appropriate industry" to industrialization in developing countries, the size of the installation is sometimes proposed as a criterion of propriety. Industry has sometimes been seen as too large and dominant in society. Those who propose a size criterion for industrialization are often inspired by E.F. Schumacher's treatise Small is Beautiful. The enthusiastic proponents of small mills are usually seeking something that is unobtrusive, low in capital and energy requirements and in the need for technically skilled labour but relatively high in demand for unskilled labour. These latter specifications can be legitimate criteria but size alone is generally a simplistic criterion. The U.S. Office of Technology Assessment in addressing the "Small is Beautiful" view of technology noted:

"Over the last decade a broader and more pragmatic concept of appropriate technology has emerged side by side with the first. A growing number of observers have pointed out that, while small may be beautiful in many ways it is not always sensible. For some jobs it is possible to scale down or decentralize a large technology but impossible or undesirable to do away with it entirely. In this view appropriate technology embodies the principle of selectivity in assigning, or developing, a mix of large and small technologies to meet specific tasks and conditions."

If one accepts this view of appropriate technology, then it must be concluded that size alone is not a proper criterion. What is needed is to match technologies to tasks and conditions.

### 7.4 Effect of National and Community Goals on Industrial Propriety

Another set of criteria used to define industrial propriety is that related to national goals. Developing countries with high population densities and often high levels of unemployment sometimes have as a national goal encouragement of labour intensive industries, which can provide employment for many unskilled people. Similarly national goals

that impact industrialization may relate to requirements for use of foreign currency or opportunities to earn foreign currency. An effort to increase value added in manufacture may be a national goal. The desire to minimize the consumption of imported fuels may be a national objective in a fuel short country. A common national goal related to industrial development is minimization of foreign capital investment and control of the level of foreign equity in a manufacturing corporation.

When these are stated and implemented national goals, they constitute criteria for industrial propriety. As in the case of environmental criteria, which define propriety, these goals must be imposed by government as social restrictions. And as is the case with most social restrictions on manufacture, these may influence the cost of doing business and, accordingly, the profitability of the industrial enterprise.

Other criteria for appropriateness of industry can arise from confrontation with community goals. This refers to the community of forest dwellers in the vicinity of the proposed manufacturing enterprise as contrasted with the national population. For example, a forest products manufacturing installation may satisfy national goals with respect to employment of domestic labour, but fail to meet community goals for employment of the local forest dwellers. Such an enterprise, if it does not benefit local forest dwellers, may be viewed negatively by that community. Situations of this kind arise when the local forest dwellers use the same forest for other purposes and see the industrialization as threatening these other uses. This is sometimes a restriction on industrialization that arises from historic and customary rights to traditional uses of the forest as a source of free goods. Such rights are often protected by law. Where these community goals are institutionalized, they may constitute criteria for industrial propriety.

If the introduction of new forest-based industry into a community will in fact infringe upon other uses of the forest that are customary for local forest dwellers, then the industrial reward system may have to provide these citizens of the community with compensation for such losses in the form of employment equity or some other value accruing from the establishment of the project.

Industries may be judged to be appropriate or inappropriate whether the technology is developed domestically or is transferred from another country. But historically these issues have often arisen when there is transfer of technology from a developed to a developing country. In the context of the industrialization of developing countries, the situation is in fact usually a question of industry or technology transplant; that is, the introduction into one country of a technology or an industry that was developed in another country.

Sometimes the question of industrial propriety in a developing country gets confused with such arguments as whether development and economic growth is itself appropriate or whether industry is inherently good or bad. If the search for an appropriate industry develops into a search for an industry whose technology will make no adverse impact on anyone, then the search is an exercise in futility. Whenever a new industry is introduced into a society, there will be an impact upon that society and its members. This is as true for the social systems of developed countries as it is for the social systems of developing countries. Some members of the impacted society will see the change induced by industrialization as positive and some will see it as negative.

One of the costs of development, that accrues to a developing society, is some level of social stress for some of its citizens. A sound industrial development project would favourably impact a far larger fraction of society than the percentage that were negatively impacted. Clearly some societies are more robust than others and can absorb a

greater impact as the price of development. Within a society, some groups, generally the poor, are more fragile in terms of their ability to absorb a negative impact. It is this group that often must be protected by government.

The introduction into project planning efforts of criteria for social propriety does not change fundamentally the basic principles of industrial design. Such propriety criteria constitute restrictions on the processing system to which a cost must be attached. If such restrictions are too limiting and, therefore, too costly, they may foreclose the opportunity to develop an economically viable industrial enterprise.

It has been pointed out several times in this paper that the availability of skilled labour, competent technologists and able industrial managers can contribute much to the development of sound forest industry projects. This quality of professional personnel can increase the options available to the project designer as he undertakes to develop a project that is fiscally sound and that meets the social restrictions that define propriety in a particular country. The development of such a cadre of personnel provides the best assurance that a country will be the master of its own fate in the development of forest industry projects.

SMALL SCALE FOREST-BASED PROCESSING ENTERPRISES:  
THEIR CHARACTERISTICS AND IMPACT ON RURAL EMPLOYMENT  
AND INCOME

by

the Secretariat

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## 1. INTRODUCTION

This paper is intended to increase awareness about magnitudes and characteristics of small scale rural non-farm enterprises<sup>1/</sup> based on processing forest produce. Such enterprises are now known to have considerable potential in increasing employment and income as well as production, but have so far suffered relative neglect by official agencies.

It is intended to highlight policy issues relating to these activities especially those which can be addressed within the forestry sector context. By concentrating on small scale enterprises, the intention is not to imply that these should displace conventional industries now or in future, but that an appropriate balance be struck to ensure that the complementary and favourable characteristics of both can be tapped to best advantage for improved forestry sector contribution to development. The achievement of such balance requires that the information base on small enterprises be improved: this paper is based on preliminary work in FAO, some of which is included in the bibliography.

## 2. DEFINITIONS AND COVERAGE

The terminology used in literature is yet to be standardized but, in this paper, small scale enterprises will generally mean only those employing 50 people or less. Only commercial units are included and "income" refers only to cash earnings. It is necessary to emphasize that in a study covering many countries, exact definitions have tended to vary. Thus the threshold size of "small" enterprise is not uniform. The activities to be included under "forest-based" have also varied with some studies only considering wood, others accommodating other forest produce; degree of inclusion for secondary processing has also varied. An important omission in all studies is of mobile activities which often include important activities such as charcoal-making. Despite these shortcomings, useful information can be given for forest-based small processing enterprises (FB-SSI). "Employment" will include part-time activity but wherever possible reported as full-time employment equivalent.

## 3. IMPORTANCE OF SMALL SCALE ENTERPRISES

The backdrop for FAO's interest in small scale non-farm enterprises is the worsening unemployment and poverty in most developing countries. Even simple unskilled jobs are in desperately short supply in many countries. Open unemployment as well as underemployment are commonplace. Agriculture, which has hitherto absorbed most new labour, is not now able to cope with labour force growth: the World Bank recently estimated that two in three new jobs will have to come from non-farm sources (World Bank 1978). Forestry in general and its processing activities in particular can provide just such opportunities. Small scale enterprises are also expected to contribute to development in other ways: they supply inputs to agriculture, they stabilize seasonal production/income cycles, provide goods and services to poorer strata of society which larger industries fail to reach, and introduce

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<sup>1/</sup> Small scale processing enterprises in general will be referred to as "SSI"; those based on forest produce will be labelled "FB-SSI", to mean "forest-based small scale industries".

vital skills into rural areas. Furthermore, being small, such enterprises are able to utilize valuable but scattered pockets of resources which would otherwise go to waste. In this respect, small enterprises appear to be an essential element in any strategy for adding value to the kind of scattered resources created through many social forestry efforts. They can also support wholesome development of larger industries through subcontracting to them.

Furthermore, previous concern that investment in SSE's may represent an inefficient or unprofitable resource allocation option now appears to be ill-founded: small enterprises are in fact often as profitable and healthy as larger ones and could probably be a significant factor in developing country industry if they enjoyed equal official support as larger scale enterprises. Their ability to supply markets which large scale enterprises are unable to reach is an important feature.

#### 4. THE TOTAL SMALL SCALE ENTERPRISES SECTOR

By way of background, it is useful to give orders of magnitude on sector size and on nature of small scale enterprises generally. In terms of employment, total small scale enterprises provide principal employment for between 20 and 30 percent of the total rural labour force in many countries for which recent information was collected. For Jamaica and Sierra Leone in recent years FAO has estimated employment in rural and urban forest-based SSI's to be two and nine times higher than in larger industries (FAO, 1985).

The reported proportion of total rural cash income derived from small scale enterprises ranged from 22 to 70 percent. The poor and landless seem to depend on non-farm SSE's more than normal, with some of them earning two-thirds or more of their income from non-farm sources (FAO, 1984). Thus in Sierra Leone households with almost no land had 64 percent of income from non-farm enterprises; those with moderate land had only a third of income from non-farm sources. The largest landowners obtained only 17 percent of income from this source. Similar patterns were detected in Taiwan Province of China, South Korea and northern Nigeria. In terms of contribution to the national economy, non-farm SSE's accounted for between 2.5 percent of GDP (Honduras, 1979/81) and 7 percent (Bangladesh 1981) which was equivalent to 22 percent and 45 percent respectively of manufacturing sector GDP.

Manufacturing/craft/repair activities<sup>1/</sup> seem to dominate among rural non-farm small scale enterprises and in some cases appear to be especially important among lowest-income households. In his survey in Northern Nigeria, Matlon (1979) for example showed that the proportion of households engaged in manufacturing as non-farm SSE activity ranged from 33 percent for low-income households to 8 percent for high-income ones. In most of the countries surveyed, the top three commercial manufacturing activities in employment terms appear on average to be textiles/apparel, food processing and forest products processing in descending order for the countries studied although, since rural people often engage in more than one non-farm enterprise, precise proportions are not easily determined.

In the sections which follow, emphasis will be given to information on forest-based processing enterprises except when relevant FB-SSI data are missing, in which case reference is made to similar non-forest based activities. The paper will first outline magnitude, key characteristics and sector development potential of FB-SSI's. Their inherent dynamism and growth determinants will then be analyzed, after which key issues affecting sector performance and prospects will be

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<sup>1/</sup> Hereafter called simply "manufacturing".

highlighted. The paper concludes with preliminary suggestions on creating conditions for better sector growth; emphasis is on policy and institutional improvements.

## 5. MAGNITUDE AND CHARACTERISTICS OF FB-SSI'S

### 5.1 The Place of FB-SSI in Total Forest-Based Processing

The relative magnitude or contribution of FB-SSI's in total forest-based processing context is not documented. Preliminary estimates show that they can be far more important than conventional industries in some respects. As mentioned earlier, surveys in Jamaica (1978/80) and Sierra Leone (1974/75) showed small forest-based processing enterprises to employ far more people than large ones even after adjusting for the former's seasonal nature. This section gives orders of magnitude for the sector and key characteristics (including size, association with other enterprises, use of machinery and nature of markets served).

### 5.2 Composition and Magnitude of FB-SSI

It appears that among forest-based enterprises the most common are carpentry/joinery, sawmilling and wood carving. Others are straw-based basket, mat or hat-making, production of cane furniture and charcoaling. <sup>1/</sup> In terms of enterprise numbers in Honduras and Sierra Leone over 70 percent of them were wood-based while in Jamaica and Egypt, over 70 percent were based instead on bamboo/cane/straw (FAO, 1985). In Bangladesh, there was a more even spread between wood-based and other forest-based SSI's. The variation may reflect relative resource endowment or market profile.

With regard to magnitude of the FB-SSI activities in broader context, the following examples illustrate the orders of magnitude: in Sierra Leone (1974/75), employment in FB-SSI was about 18 percent of the total for all manufacturing, most of this being in rural areas and settlements of under 2 000 inhabitants. In Haiti (1979), 14 percent of all employment was in FB-SSI, of which about a third was in towns or settlements of 5 000 or fewer inhabitants. In a small area of northern Nigeria (1966/67), nearly a fifth of total manufacturing employment was in wood processing, most of this being in truly rural areas (Matlon, 1979).

In more industrialized developing countries information is available for the Philippines (1972) and for Taiwan Province of China (1966). For the Philippines, FB-SSI's accounted for 6 percent of total manufacturing employment in household enterprises and very small workshops. In Taiwan Province of China the ratio was 10 percent of total manufacturing jobs with over half of these in rural areas (FAO, 1985a).

### 5.3 Selected Characteristics of FB-SSI

The most prominent feature is small size: for five countries recently surveyed, the average employment per SSI firm ranged from 1.8 to 3.8 persons of whom up to 71 percent are the entrepreneur himself and his family. Another 17 to 35 percent are hired skilled employees and the rest are apprentices and unskilled workers. In about 90 percent of the FB-SSI firms, the entrepreneur was sole owner of the enterprise.

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<sup>1/</sup> Due to its frequently itinerant nature, charcoal-making is often omitted from surveys into FB-SSI's which tend to concentrate on enterprises with fixed location.

Forest-based SSI's especially in sawmilling and carpentry appeared on average to be larger than other SSI's but the overall range for FB-SSI's is 1.7 to 2.7 employees (FAO 1985). The second key feature of FB-SSI is their predominantly rural location: from 80 to nearly 100 percent of enterprises being located in such areas (FAO, 1984).

Another important characteristic is that FB-SSI enterprises rarely exist in isolation: it is not unusual to have the motor of a sawmill also used to mill grain or for the owner of a carpentry shop to also operate a grocery, teashop/restaurant, maize mill or small scale tailoring shop. It is therefore difficult to study them individually and one should in the long run seek to know the nature and frequency of the various combinations so as to deal with FB-SSI's in correct perspective.

FB-SSI's differ in degree of dependency on machinery: in general the enterprises use few or no machines but considerable variation exists in this. Rural handicrafts, carving and mat/hat/basket weaving use almost no machines while certain carpentry and furniture works rely on machines to a considerable degree.

In terms of production, FB-SSI's characteristically adopt an "on order" rather than batch system due to their non-uniform and small markets. This system is well adapted for survival under limited markets but limits level of efficiency achievable. They have little access to institutional markets. Much of what they produce is similar to what other FB-SSI's nearby also market so that competition is severe. With few exceptions, the FB-SSI's tend to have geographically limited markets and sources for their inputs.

There is little information on how they are organized and it is at present assumed that many work independently rather than in associations/cooperatives; many are informal and the smallest ones may even be unregistered.

## 6. SECTOR DEVELOPMENT POTENTIAL

### 6.1 Past Trends

In this section, information will be given on growth rates for SSI's observed in the recent past. This will indicate the order of magnitude on whose basis one can gauge possible future performance of this kind of enterprise. Total SSI's show considerable growth over time both in absolute terms and in share of total rural employment: their reported annual employment increase rates range from about 3 percent (S. Korea 1960-74) to around 9 percent (Taiwan 1955-66), (FAO 1984). In Jamaica, woodworking only (carpentry plus carving) has recently grown very slowly in rural towns but at nearly 9 percent annually in medium sized towns and about 8 percent in Kingston, the largest city. It is not possible to generalize for all countries, however, that rural towns rather than truly rural areas themselves are the main growth points for SSI's. Annex 5 gives details for other countries and also illustrates the variation in growth rates by type of activity in one locality.

Relative growth rates of enterprises of different operational scale were estimated in studies for S. Korea (1963-75) and Taiwan Province of China, (1961-71). For Korean "furniture and fixtures", enterprises with over 500 employees each grew fastest followed by the smallest enterprises with all other categories showing intermediate performance. In Taiwan Province of China, for the whole "wood, bamboo, cane and cork" processing sector, the smallest enterprises declined to

varying degrees, medium scale ones grew, but more slowly than the industry average while enterprises in the 500 plus category increased most. In both cases a shift to large enterprises seems to have been in progress but in the absence of data on relative magnitude of the operational scale strata, the importance of this development is not clear.

The evidence on relative growth rates of SSI's versus larger scale ones is not always clear and consistent and in many cases does not permit valid comparisons. It appears that the FB-SSI sector may be growing just as fast or faster than the large enterprise sector for some products or in certain localities but not for others. The relative dominance of SSI's and their faster growth in a given activity may reflect inherent SSI comparative superiority in it, and therefore of growth potential, but could reflect instead the technological status of the country and the structure of relevant laws, incentives or institutions favouring small over larger enterprises or vice versa in a given situation. Further study is required on this.

For South Korea, an analysis for 1975 shows that out of 23 forest-based activity types, 43 percent existed only as enterprises with 100 or fewer employees. For another 22 percent, over half the employment was in small enterprises. For the remaining products, sector employment was principally in enterprises of over 100 employees. On the whole therefore, more forest-based activities were associated with relatively small than with larger scale processing units.

## 6.2 Inherent Sector Dynamism and its Determinants

The available information has with few exceptions shown FB-SSI's to be growing. It has also shown that certain products seem to be more often made by small scale units than by larger enterprises, so indicating possible greater suitability of SSI than larger scale formats for making these items under the conditions existing for a particular situation. These recorded patterns cannot be fully explained, but it is proposed to outline briefly below some of the determinants of growth such as efficiency, profitability, linkages with other enterprises and sectors, and adaptability of SSI's in changing circumstances.

### (a) Efficiency and productivity

Due to generally low use of equipment, SSI productivity per unit labour time is lower than for larger capital-intensive enterprises. However, for a given cost of capital, SSI's tend to produce more; they are also apparently generally superior in terms of value of production per combined unit cost of capital plus labour. The level of overall technical efficiency is high with 73 percent of expected output being achieved for furniture/carpentry in Thailand for example. The capacity utilization rate observed has in many cases been of similar orders of magnitude to that found in larger enterprises.

### (b) Profitability

Returns to capital are reportedly higher for surviving SSE's than for their large scale counterparts (Chuta and Liedholm, 1979). Actual levels of economic profit calculated for carpentry in Sierra Leone were 21 percent for modern processes and 169 percent for traditional ones. The returns were shown to vary with locality, truly rural firms being apparently less profitable than urban ones. In his analysis for Kenya, Child (1976) recorded very high levels of net returns to capital for the smallest enterprises and suggested that the

miniscule amounts of capital invested in them explained the misleadingly high "profitability" estimates. Other surveys have also revealed high SSI returns to capital investment. FAO (1985) reported average FB-SSI returns to total capital investment ranging from about 27 percent to 54 percent. These "profitability" estimates would doubtless be much lower if reported as a ratio of total costs or of sales.

In terms of net returns to proprietor and family, SSI's yield substantially higher incomes than wage employment in agriculture in all the countries surveyed. However, the wage rates for paid labour in FB-SSI's are in general apparently lower than in agriculture. This may well reflect the fact that FB-SSI's often operate most during slack agriculture periods when labour can be paid least due to limited alternative employment opportunities.

(c) Market and input aspects

Sector growth prospects depend on availability of markets and inputs for production. Both sets of factors are considered in depth under "Issues" below, but in brief the existence of an adequate and growing market for FB-SSI is a prerequisite for success. At present, many rural enterprises face limited and seasonal demand but nevertheless show growth because rural incomes are increasing in many countries. Agriculture as the principal income determinant often controls demand for SSI goods; it is also a major market for forest-based agricultural inputs like tools, cases, carts or basketware produced by FB-SSI. For some of these and other FB-SSI products, alternative materials or processes are emerging which FB-SSI's should adapt to in order to cope.

With improvement of infrastructure and growth of towns, access to more distant markets including institutional and subcontract ones is becoming possible, but at the same time reverse penetration of rural markets by larger urban industries is increasing. The future prospects will thus depend on developments in rural incomes, in infrastructure, urbanization and in the ability of SSI's to cope with changing market and competition situations. Adaptability to changes on all these fronts will be a major factor and must apply to technological and organizational aspects.

On the supply side, prospects are heavily influenced by availability within reach of raw materials at affordable prices, finance and manpower (especially skilled and managerial). The relationship of each of these inputs with the sector is discussed under "Issues" below. Central policies within or outside the forestry sector often determine whether or not these factors favour SSI prosperity. Policies also determine growth of rural incomes, development of infrastructure and other key parameters of the economic environment in which SSI's operate. The effectiveness of such policies in turn depends on suitable government institutions being in place to "deliver" support services and producers' organizations to improve entrepreneurs' access to them.

7. SELECTED ISSUES

The issues are conveniently introduced by outlining entrepreneur perceptions of their key problems as determined from surveys. On the basis of country surveys (FAO 1985), it appears that the main concerns of the entrepreneurs relate to:

- demand for their products;
- problems of access to raw materials and skilled manpower;
- problems of finding adequate finance.

In several cases entrepreneurs have also pointed to laws and regulations creating barriers to successful operation and to lack of know-how. Chuta and Liedholm (1979) suggest that most SSI problems can be linked to policy-induced distortions.

## 7.1 Demand-Side Issues

### 7.1.1 Market size

Field surveys reveal that smallness of markets due to the generally low purchasing power of rural people is a major problem for SSI's. The problem is worsened by seasonal fluctuation of demand in line with changes in agricultural incomes. Products with a significant tourist market (e.g. handicrafts) also have seasonality problems. Enterprises closer to major roads or larger settlements have access to other more stable and prosperous markets. Some FB-SSI products are sold to more widespread markets than others: thus in Haiti local sales account for between 38 and 83 percent depending on access to external tourist markets (Haggblade et al., 1979).

The geographical narrowness of the market base suggests inability to capture more distant opportunities. Thus, one can generally only expect rural SSI's to benefit from potentially larger markets only if the change occurs in their vicinity unless infrastructure development or better organization for marketing gives improved access to distant outlets.

Limited access to institutional markets (government, parastatal, corporate) also contributes to smallness of demand. This results from relative isolation of the SSI enterprises, entrepreneurs' unfamiliarity with this type of market, and inability to cope with its quantity, quality and delivery time requirements, as well as with often delayed payment by institutional buyers.

### 7.1.2 Market instability

Severe seasonal changes cause strains on production capacity: in batch production, peak market periods demand high working capital resources which are difficult to raise. Advance production for stock is rarely a feasible option as it ties up working capital unproductively for long periods. For "job-order" production, SSI's also fail to cope with the peak level of orders. An ironical situation may therefore exist whereby a sector that is generally short of demand fails to meet even the limited requirements fully, so possibly losing some customers to large scale competition and reducing its own market further.

### 7.1.3 Non-uniformity of products demanded

Lack of standardization has contributed to dominance of "made to order" operation. In Jamaica and Egypt, for example, 58 percent and 47 percent of total output respectively is "made to order", which reduces effective SSI productive capacity and ability to attract the interest of institutional markets.

### 7.1.4 Competition

Competition is reported to be severe among SSI's especially as they all tend to produce similar items for limited local markets. Thus in Bangladesh FB-SSI entrepreneurs estimate that 89 percent of main



competitors are other small scale producers compared to only 9 percent of large industry competitors. Information from Jamaica suggests that inter-SSI competition is more severe in rural than in more urbanized areas while that from large industry is greater in urbanized areas (FAO, 1985).

While competition is normally an incentive to greater efficiency, the observed levels of inter-SSI competition may be excessive and so destroy SSI ability to accumulate capital and to grow. The more modest competition from conventional industries and from imports has the following features:

- (a) For rural FB-SSI's its severity increases when accessibility of rural areas to large industry products improves for any reason. In urban areas this competition is always considerable.
- (b) The competition is greater where degree of qualitative overlap in the products of small and large industry is great. House (1981) reports for Kenyan furniture markets that at the extremes of the price range, little competition exists. Significant competition is in the middle quality/price brackets and therefore is most serious for small firms aspiring to "graduate" into more sophisticated markets or vice versa.

#### 7.1.5 The impact of incomes on demand

All surveys report positive income elasticities for SSI products. In the case of Sierra Leone and Bangladesh, the elasticity levels were about 1.6 to 2.2 for forest-based SSI products.

Although these high positive coefficients indicate an inevitable increase in demand for SSI products if incomes rise, the analysis of future prospects when incomes increase is far from straightforward. It is currently suggested (FAO, 1985) that the exact nature of income's impact will depend not only on magnitude of increase but perhaps on distribution of such income as follows:

- (i) At any one time, the lower-income strata of the population purchase exclusively or relatively more SSI products. High-income ones rely more on products of large enterprises or on imports. The middle-income groups use both, in proportions which depend on relative availability, price and other elements affecting consumer choice.
- (ii) If earnings rise more than proportionately for the higher-income strata, a shift toward products of large industries and to imports may well occur. Depending on how fast this occurs, the SSI's would then probably not adjust their quality and product range enough to cope.
- (iii) If future earnings rise more than proportionately for the lowest-income strata, a major boost for SSI products could be expected, especially if poor people's access to the other products or imports continue to be constrained by poor infrastructure or by quality or price barriers. However, normally a significant rise in poor people's incomes would be accompanied by infrastructural improvements, so greater penetration of large enterprise products into rural areas could be expected. The prospects for SSI product markets would then depend on how well SSI production adjusts in quality, product range and distribution to face the threat.

- (iv) If in future, incomes rise in the same proportion for all strata, it is thought that the market for SSI products would expand, but the degree would depend on changes in relative availability of SSI and competing products and on quality and product range improvement of SSI products. If these fail to adapt, customer loyalty could be lost. The question of technological adaptability to cope with changing quality requirements would thus be a key one.

The implication of the above analysis is that if one assumes that most future rural income changes will be due to agriculture, then the strategies of agricultural development will determine prospects for SSI markets. Thus, if agricultural incomes are raised on the basis of a few large scale farms, income may tend to be concentrated in favour of the upper strata. In this case market prospects for SSI products may well not be bright. On the other hand, if smallholder development is emphasized, more income would tend to go to the poor and prospects for SSI product markets would thereby be improved. Similarly, the impact of higher agricultural prices would depend on whether these are targeted at products usually raised by the lower income strata or higher ones.

It is noteworthy that in several industrialized countries and especially in Japan, small scale enterprises continue to thrive alongside very large ones and are a source of key inputs for the latter. The above analysis should therefore not be understood to imply that SSI's are enterprises relevant only to poor countries or poor people.

## 7.2 Supply-Side Issues

### 7.2.1 Raw material supply

Forest-based SSI's often face location-specific raw material problems especially in relation to the forest produce. In his limited 1981 survey of Thai furniture manufacture, Boomgard reports high entrepreneur concern about wood shortages, rising prices and about forestry regulations. The impact of such problems can be very great since forest raw materials are often a dominant production input. However, even shortage of non-forest raw materials can halt or severely reduce production. The major issues in forest raw material supply are the interrelated ones of availability, accessibility and reliability of supply, for which key aspects are as follows:

- (i) There is increasing overall shortage of wood and other forest-based raw materials or of desirable species which is particularly serious for SSI's because they cannot finance creation of their own resources. Thus, for example, shortages of straws, palm leaves, rattans (and other canes), etc., are leading to increased adoption of non-forest inputs such as plastics in some traditional crafts but, where alternatives are lacking, enterprise decline sets in.
- (ii) Poor accessibility of raw materials due to distance or to legal, administrative, price or infrastructural barriers is another problem. The following are some examples:
- legal restrictions or strict harvesting bans as in state forest reserves; denial of access rights due to exclusive allocation of rights to large scale concession holders;

- administrative barriers such as elaborate licensing or auctioning procedures including requirements for substantial financial deposits, guarantees or other preconditions beyond SSI capacity; sales may also be in minimum lots that are beyond SSI reach;
  - high prices due to monopoly position by state forestry agencies (note that some large concessions may at the same time attract low royalty rates due to long-term agreements);
  - poor transport infrastructure often worsened by opening of only a few distant areas for exploitation; on the other hand, SSI's are able to use small pockets of resources existing on farmlands and so continue to have raw materials when block forests have disappeared.
- (iii) Instability of supplies can be caused by predictable seasonal/climatic factors but can often also result from more inefficient and uneven enforcement of state forest agency regulations. In such cases SSI's are at a particular disadvantage as they have relatively few official contacts or leverage on the decision-making process while the larger industries do.

With regard to non-forest raw materials, problems often relate to distributional weaknesses which make access particularly difficult for small enterprises. Where items are imported under conditions of scarce foreign exchange, allocation quotas may tend to exclude SSI's. Problems are also significant for rural FB-SSI's when only a few distribution points exist in distant urban centres.

For all raw materials, shortages or supply instability can lead to cash flow problems due to high prices and through increased tying up of capital in hoarded stocks. What starts off as a raw material problem may thus have as main symptom a demand for financing or credit.

#### 7.2.2 Finance

Funds are required to pay for capital investment or for working capital. In the case of Jamaican SSE's, for example, 90 percent of finance problems related to working capital (Fisseha and Davies, 1981). The level of total capital input 1/ per enterprise and ratio between investment and operating funds varies considerably between activities, technologies, scale of operation and countries. Estimates of total capital input for the "average forest-based enterprise" range from US\$ 225 in Bangladesh to US\$ 3 030 in Jamaica with working capital being about a third of this in each case. In terms of cost per worker employed, these investment levels are often less than 10 percent of those in conventional large enterprises.

Selected observations on finance aspects of SSI's are as follows:

- (i) SSI profitability is particularly sensitive to overhead costs. In many cases, entrepreneurs reduce overhead burdens by sharing personal housing with the enterprise.

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1/ Capital input = investment plus operating expenses.

This has serious implications in terms of not accounting for enterprise expenditures on the house and so introducing financial leakages. There may also be transfer of capital to household consumption which goes unrecorded.

- (ii) Where equipment is used, the capacity of the minimum available items may exceed the needs of an SSI so that the effective costs in use of capital equipment can be high unless other SSI's share in the use.
- (iii) Irrespective of the purpose for which the finance is used, entrepreneurs think they need more funds through credit. However, in all countries surveyed, SSI's have enormous problems borrowing on the institutional credit market. The chief problem is that the SSI's are numerous and therefore costly to lend to, especially as lending institutions often apply the same elaborate appraisal procedures to SSI loans as to larger scale lending. Other problems arise from:
  - their inability to meet standard collateral requirements or to obtain official guarantees as an alternative;
  - their failure to furnish documented proof of viability (due to poor record keeping);
  - their lack of official and other useful contacts;
  - their inability to face or understand the elaborate and time-consuming loan procedures; furthermore, official or institutional lending agencies are often not physically near.
- (iv) Consequently SSI's tend to rely for their finances on unofficial sources. In the case of initial investment, personal savings (from agriculture, other SSI's or off-farm wage employment) are paramount followed by loans from relations/friends and from money lenders. The latter source is used in spite of high interest rates. In the case of expansion capital, the overwhelming proportion is reinvestment of an enterprise's own profits but supplemented with loans. Tabulated information for Sierra Leone, Bangladesh and Haiti is given in Annex 11. For working capital, commercial credit from suppliers is reportedly limited but partial advance customer payments for goods provide additional financing.

#### 7.2.3 Manpower

Household and enterprise seem to be often poorly separated in terms of manpower for SSI's. Of the average total 1.8 to 3.8 workers per firm reported in FAO (1985), the proprietor plus his immediate family accounts for 40 to 70 percent in terms of number of workers.

Significant proportions of entrepreneurs undergo informal apprenticeship within the SSI sector but, since this emphasizes technical skills, many enterprises have managerial weaknesses, a key symptom of which is poor record keeping. Availability of skilled manpower is often a serious problem but in a few cases, even unskilled labour can be scarce due to competition with agriculture in peak seasons. Competition for manpower with agriculture may be one cause of reportedly high turnover of manpower but urban migration to more remunerative employment may be another. Low levels of remuneration for hired workers and perhaps also poor working conditions are other causes.

## 8. HOW TO ACHIEVE SOUND SECTOR DEVELOPMENT

Although it has been shown earlier that SSI's have the inherent ability to grow, they face certain constraints in achieving their full potential development, but above all they seem to face discrimination in industrial development policies relative to larger enterprises. The latter are at present often heavily subsidized and protected, as well as being only lightly taxed and otherwise cosseted. This is a costly and often unwise path to development of any kind, and while it could be extended to SSI's, it would probably only lead to the kind of dependency which many large enterprises have acquired in developing countries. Besides, many governments have enough problems financing large industry support programmes without taking on the additional burden of small enterprises.

A prime thrust of any policies to permit sound FB-SSI development and their consequent greater developmental impact should therefore be to remove or reduce discriminatory assistance to larger enterprises and let enterprises of all operational scale compete on an equal footing. The resultant relative dominance of one or other operational scale or organizational format would then more accurately reflect the inherent scale-response and factor-mix characteristics of each product and the market niche it is intended to occupy. The technological level toward which each enterprise type would gravitate would then tend to be decided automatically.

This approach raises certain issues, the principal one of which is whether with reduction or removal of incentives large enterprise investment would continue at present levels and, if not, whether such decline is necessarily bad for the forestry sector or would be a blessing in the sense of eliminating parasitic industries. The second issue is whether in many countries the small enterprise sector would be capable of effectively and gainfully seizing the expanded opportunities presented and, if not, what assistance they would need to prepare them for their greater role.

The third issue is the technical one of whether, under the improved environment (which would among other things permit greater access by SSI's to capital), FB-SSI's would remain small or would tend to grow large and so lose some of the key beneficial characteristics which currently make them a valuable contributor to rural development.

Having said the above, much can still be done now to ensure sustained subsector growth even before elements which lopsidedly favour large enterprises are removed. These are discussed briefly below.

### 8.1 Demand-Side Policy Changes

The main demand-side issues were identified earlier as market inadequacy, instability and non-uniformity. Interventions which can help ameliorate the situation and so promote sector growth are outlined below.

#### 8.1.1 Expanding markets for FB-SSI products

##### (a) Increasing rural purchasing power

The problems of market inadequacy require coordinated policy interventions from many sectors. The first problem is one of low incomes and in many cases this would call for increases in agricultural produce prices and greater emphasis on

agricultural development generally, but with emphasis on achieving higher purchasing power for the poorer social strata which habitually use SSI products by favouring development of cash agriculture among smallholders instead of large scale operators.

(b) Improving access to institutional and industrial markets

Institutional markets are a potentially large extra outlet for some FB-SSI products. The interventions here would include both policy and institutional changes, the latter being to organize the producers and to educate the institutional purchasing agents in the potential of FB-SSI's. Firstly, policies should be made to permit government agencies to purchase from less formal sources, to adjust their procedures accordingly and to advertise their requirements through channels FB-SSI have access to. At the same time, the FB-SSI's would need to be educated in the special characteristics of this market and how to meet them through technological, organizational and other means.

With regard to industrial markets, FB-SSI's can act as subcontractors to larger establishments, for example through the manufacture of components or subassemblies for furniture. To tap this kind of market effectively, the legal framework should permit fair cooperation without financial enslavement of small enterprises or hardship from delayed payment and/or from restrictive agreements.

(c) Improving access to distant consumer markets

Policies to promote penetration of institutional and industrial subcontract markets automatically expand the geographical market horizon and boost the potential for expanding the product range. Access to distant consumer markets should also be expanded, however, as most FB-SSI products are consumer goods. The major thrust would in this case be institutional improvement for market intelligence, product promotion and identification or creation of marketing channels in cities, tourist spots, etc., not necessarily by government but through producers' own marketing bodies.

(d) Reserving selected products for exclusive FB-SSI manufacture

This is one of the most powerful policy instruments to ensure creation of markets for SSI products especially if it is accompanied by support for access to institutional markets as outlined under (b) above. India is a prime example of a country with a vigorous policy of product reservation for small enterprises. However, such a policy discriminates against large enterprises and should be as objectionable as the current reverse favouritism. It may also not be necessary and may even be harmful to consumer interests.

8.1.2 Unstable markets

Seasonality or other instability of demand is probably the second largest market-side problem after small market size for rural FB-SSI's. The overall solution is diversification of product range and market expansion through promotion of institutional and distant (urban) consumer markets. Seasonality could also be reduced by promotion of low-season commercial pursuits or diversifying agriculture to ensure yield of some marketable product at all seasons.

## 8.2 Supply-Side Policy Changes

### 8.2.1 Improving availability of forest-based raw materials

#### (a) Shortage of raw materials

With regard to shortage of forest-based raw materials, the policy changes should aim at ensuring FB-SSI access to raw materials while maintaining conservation/management of existing resources and creation of new ones. Since each SSI entrepreneur cannot create his own resources at present, government policy should be focused on creating or managing resources in required quantities (as is currently done for large industry) but with a spatial distribution that permits easy FB-SSI access. Where dispersed small scale resources already exist (such as those created through social forestry efforts), governments should support FB-SSI efforts to process them profitably.

Where only prime species are in short supply, the solutions are not so much of a policy nature as educational: SSI's must be given enough correct and timely information on use of secondary species. Normally such information is available from research efforts but it rarely reaches small industry.

#### (b) Access to forest raw materials

Policy and legal as well as institutional adjustments are necessary to improve FB-SSI access to forest reserves and to commercial concessions. On forest reserves, there may be need in some cases to relax restrictions on harvesting of selected products and allow local SSI's controlled access under licence since they cannot easily afford distant raw material sourcing. With regard to forest concessions, while it is normal to provide for subsistence harvesting by local people of most products, commercial FB-SSI's do not have such rights. This tradition could be changed so that FB-SSI could at least harvest discarded material, secondary wood species and non-tree raw materials - all of these being of little interest to most concession holders.

Finally, to ensure continued future SSI access to wood, it is necessary to encourage dispersed tree planting as mentioned earlier, wherever SSI's are or can be made an important sector.

To succeed, all policy adjustments would need to be preceded or accompanied by adequate organization of people for greater say in use of local forest resources including those in reserved state forests. On governments' side, there must be political commitment to a fair deal for the sector.

### 8.2.2 Improving availability of non-forest raw materials

Most problems relate to distribution and require institutional solutions but, where shortages are common, policy changes may be necessary to give SSI's access to official allocations of products or of the foreign exchange to purchase them with, as happens for larger enterprises.

### 8.2.3 Improving the basis for financing FB-SSI development

For SSI's just as for any other industrial category, some of the demand for funds or loans is a symptom of operational (or market) problems. Thus only a few aspects of finance can be handled usefully through broad policy decisions rather than on a case-by-case basis. If on the basis of analysis it is determined that financing is needed, any policy decisions and their follow-up must often be accompanied by technical assistance to help remove the technical problem leading to demand for funds.

Programmes for SSI financing should take into account the need to permit loans for working capital as well as capital investment funds. They should also cater for the financial needs of the target enterprise and for the entrepreneur's other commercial and household activities or needs which may often be intimately linked to the enterprise.

With regard to sources of finance, there is still insufficient evidence to suggest that formal financing institutions would provide better service than the informal credit sources currently used. Until this is ascertained, policy changes should probably aim at no more than improving access to formal credit sources and/or provision of guarantees for major loans from them as currently done for larger enterprises. In some cases, it would also be beneficial to study the possibility of linking "informal" channels to formal credit institutions with suitably modified lending criteria and procedures. Institutional lending itself could improve its accessibility even without major policy change by merely simplifying small-loan appraisal systems to make them more cost-effective. The heavy demands of loan agencies for formal accounts data, elaborate feasibility appraisals, recorded values of collateral, etc., need to be simplified to match the smallness of loans SSI's seek. Schemes for risk insurance may need to be created when such liberalization occurs, to encourage voluntary participation by lending agencies.

### 8.2.4 Improving manpower supply for FB-SSI's

The major SSI manpower aspect requiring intervention is shortage of technical as well as managerial/administrative skills. At present the sector is unable to attract and retain good quality manpower and therefore risks technological/organizational stagnation. Manpower issues are however not yet so well studied that even preliminary proposals can be made for broad policy changes. The lack of skills is however evident and this at least can be addressed by creation of training facilities and by greater official support for the existing informal apprenticeship schemes in a similar manner to support currently given to formal sector training. However, by making SSI trainees even more marketable, this might well lead to even greater "skills drain" from SSI's. To improve SSI skills retention through enforcement of "minimum wage", worker social security and other factory regulations would probably be impracticable given the large enterprise numbers and dominance of family labour in the subsector. It would also probably raise operating costs beyond reach of many SSI's and instead of helping to retain skills might decimate employment in the sector through enterprise collapses.

## 9. CONCLUSION

The purpose of this paper has been to give preliminary information on the magnitude, characteristics and growth potential of small scale processing enterprises based on processing forest produce which have so far been relatively neglected as one additional way to commercialize forest resources. This paper has indicated that:



1. Such enterprises already exist in significant numbers and contribute a lot to rural employment and income. Much of the employment is seasonal but, when it is adjusted to full-time work equivalent, seems to be at least as great and often greater than in large enterprises.
2. The enterprises are very small and offer much of the employment they generate to the entrepreneur and his family. For this group they provide higher incomes than could be made from agricultural wage work. However, for hired workers, the returns may often be worse than to agricultural wage labour.
3. The processing activities are based on a broad range of forest raw materials and not only on wood. Depending on what is being processed, the level of equipment use ranges from negligible to quite significant but on average is much lower than in larger enterprises. Output per unit labour is thus low but nevertheless returns per unit investment can be quite high.
4. Surveys show that the sector is in many cases growing, often quite rapidly although specific products may be in decline in some localities. The performance of small enterprises shows their considerable resilience and their continued existence even in more industrially developed countries suggests that they are not a transient phase to be inevitably replaced by larger enterprises. The degree to which small enterprises contribute to total output seems to vary however with product, but the determinants of such variation are only now being studied.
5. In their operations, small enterprises face a range of problems especially related to limited markets, poor access to forest and other raw materials, limited financial resources and shortage of manpower. For some of these items, the problem is worsened by official discrimination through policies that favour easier access by larger enterprises even within the forestry sector. This paper has suggested that removal of such discrimination alone might go a long way to ensuring healthier small-enterprise growth. It has been suggested that this be done by removing or reducing subsidies and other privileges currently offered to large enterprises rather than extending these costly support systems and incentives to small ones. A number of specific policy changes have also been suggested to reduce avoidable market, raw material and financial problems. It has also been suggested that the small enterprises' capacity to benefit from policy changes would be enhanced if they are organized into groupings.

ANNEX 1

Employment in FB-SSI in perspective of that in  
two other top small scale processing enterprise activities

Country	% of SSI manufacturing Employment			Country	% of SSI manufacturing Employment		
	Text.	Food	For.		Text.	Food	For.
Jamaica (1978/80)	25	7	35	India (1961)	39	20	16
Honduras (1979/81)	25	38	16	Taiwan (1966)	26	17*	11
Egypt (1981/82)	38	12	24	S. Korea (1970)	41	20*	5
Sierra Leone (1974/75)	51	5	20	Kenya (1979)	24	42*	18
Bangladesh (1978/80)	58	22	13				

Text. = textiles/apparel

Food = food processing

For = forest-based processing

\* Includes beverages and tobacco

Source: FAO (1985), Table 3.

Estimates of direct contribution to rural employment by various specific small scale wood-based processing activities - by country. (Note, ANNEX 2 that as activity lists are incomplete, these are minimum estimates of contribution).

Type of wood processing	% of Employment <sup>1/</sup> by Country																			
	TAIWAN <sup>8/</sup>		W. NIGERIA <sup>10/</sup> (1966/7)		W. MALAYSIA <sup>11/</sup>		S. KOREA <sup>12/</sup>		TAIWAN <sup>13/</sup>		S. KOREA <sup>14/</sup>		S. LEONE <sup>15/</sup>		HAITI <sup>16/</sup>		KENYA <sup>17/</sup>		EGYPT <sup>18/</sup> (1982)	
	1956	1966	True Rural	Rural Towns	1970	1970	1970	1970	1971	1973	1974	1976/7	1979	Fayoum	Kulyubiya					
	9/	10/	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1. Forestry and Logging <sup>2/</sup>	-	-	-	-	-	-	0.7	2.4	1.0	1.2	-	-	-	-	-	-	3.7	6.9	-	-
2. Charcoaling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.1	11.5	-	-
3. Sawmilling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	1.1	-	-
4. Veneer, plywood, panels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Wooden tools	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Wood carvings/handicrafts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Carpentry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Furniture & fixtures	0.52	6.6	0.48	4.4	-	-	0.1	0.4	-	-	-	-	-	-	-	-	-	-	-	-
9. Boat/ship/vehicle building	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Wooden cases packing <sup>3/</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11. Wood, cane, bamboo products <sup>4/</sup>	0.45	5.7	0.67	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12. Other or unspecified wood products <sup>5/</sup>	-	-	-	-	-	-	1.3	3.3	0.2	4.7	-	8.4	-	-	-	-	-	-	-	-
13. Subtotal Wood Processing <sup>5/</sup>	0.90	12.3	1.15	10.6	-	-	1.4	3.5	0.2	4.7	-	8.4	-	6.3	-	19.1	-	13.9	9.4	17.6
14. Cane, straw, bamboo products <sup>6/</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15. NUMBERS ('000) EMPLOYED																				
- Overall total	1956.6	2897.4	3.2	1.5	1716.1	5335.8														
- In all manufacturing <sup>7/</sup>	153.6	313.5	2.7	0.9	710.7	293.1			428.0	490.8	88.6								71.1	66.2
- In wood processing	17.6	33.2	0.5	0.1	24.9	13.8			35.9	30.9	16.9								2.8	3.4

Source : FAO (1983a) - Compiled from various sources listed in the original report.

- Notes: <sup>1/</sup> The % of employment is given as a proportion of total rural employment (A) or of employment in manufacturing/repair only (B) - see note 9.  
<sup>2/</sup> For Kenya read only "tree cutting". <sup>3/</sup> Includes non-assembled products. <sup>4/</sup> The ratio of wood to other is not indicated.  
<sup>5/</sup> This obviously totals only recorded items but other wood processing often exists in the countries which a specific study may not have detected or been interested in. <sup>6/</sup> Unlike item <sup>4/</sup> the cane-bamboo-straw products are reported separately in this case. <sup>7/</sup> Manufacturing often includes repair activities. <sup>8/</sup> Seems to include cities of under 45 000 people. <sup>9/</sup> A = as proportion of total rural employment in all sectors; B = as % of employment only in manufacturing (see note 1/). <sup>10/</sup> Based on limited sample in 3 districts only. <sup>11/</sup> A small element of cork processing is included. Agricultural processing has been added to manufacturing to comply with normal practice in other countries.  
<sup>12/</sup> Rural includes cities of under 20 000 people. <sup>13/</sup> Rural seems to include cities of under 45 000. Enterprises of up to 99 employees are included. <sup>14/</sup> Threshold city size unclear; includes enterprises with up to 99 employees. <sup>15/</sup> Includes only rural areas plus towns to 2 000 people. <sup>16/</sup> Information only for settlements of over 1 000 people. <sup>17/</sup> %ages are of households practicing a given activity, not of employment. <sup>18/</sup> Includes all townships in the area.

N.B. 1) In all cases the % for forestry and logging is excluded from the wood processing subtotals/totals.

2) For Taiwan read "China - Province of Taiwan".

ANNEX 3

Estimated composition of FB-SSI's by enterprise numbers  
in selected countries

Activity	Approximate % of all FB-SSI enterprises numbers				
	Jamaica* (1978/80)	Honduras (1979/80)	Egypt (1981/82)	Sierra Leone* (1974/75)	Bangladesh (1978/80)
Sawmilling**	1	3	na	0	1
Carpentry, cabinet making, upholstery	23	71	24	67	27
Wood carving        }	13	0***	na	6	1
Bamboo, cane works }		na	na	na	11
Mat/basket/hat making	63	11	70	24	32
Other	0	26	6	3	28
Total	100	100	100	100	100

\* where the whole country was surveyed

\*\* only motorized mills

\*\*\* "0" means present but insignificant

na = information not available

Source: FAO (1985), Table 7.

Estimates of employment in small scale enterprises (SSE's) based on wood processing: stratified by degree of SSE dominance in total employment for a given activity. S. Korea data for 1975. (less than 100 workers is considered small)

Activity / Product	No. of workers	% of employment	
		of all workers in this activity at all operational scales	In SSE wood/cane in FB-SSI only
A. Where SSE employment is 50% or more of particular industry total:			
1. Sawmilling	8 083	66	35.7
2. Furniture making - not upholstered	4 843	73	21.4
3. Handmade paper	1 322	60	5.8
4. Ship-building/repair	1 073	91	4.7
5. Builders' carpentry/joinery	792	100	3.5
6. Cane products	471	100	2.1
7. Tools	393	67	1.7
8. Lacquered articles	344	100	1.5
9. Cases, excluding packings	222	100	1.0
10. Preservation	(181) <sup>1/</sup>	(100) <sup>1/</sup>	-
11. Pulp manufacture	179	100	0.8
12. Straw products	178	100	0.8
13. Cooper, products	38	100	0.2
14. Store fixtures	20	100	0.1
15. Other wood products n.e.s. <sup>2/</sup>	31	100	0.1
Subtotal	17 989	73	79.4
B. Where SSE employment is 25 to 49% of particular industry total:			
16. Pulp, paper, board, n.e.s.	1 132	35	5.0
17. Matches <sup>3/</sup>	741	43	3.3
18. Wooden packings, (see also B)	736	47	3.3
19. Brushes, and brooms	585	34	2.6
20. Wooden/cane containers	261	39	1.2
Subtotal	3 455	39	15.3
C. Where SSE employment is less than 25% of particular industry total:			
21. Veneers, plywood, other panels	1 078	5	4.8
22. Newsprint manufacture	72	5	0.3
23. Reconstituted wood <sup>3/</sup>	41	13	0.2
Subtotal	1 191	5	5.3
D. TOTAL wood and cane processing SSE's <sup>4/</sup>	22 635	<sup>+</sup> 64	100
E. Wood/Cane processing as % of all manufacturing SSE employment:	Category A = 12.6% ( $\geq$ 50% of activity total) Category B = 2.4 (25-49% of " " ) Category C = 1.5 (under 25% " " )		

Source: FAO (1985a)- Table 7.

Notes: <sup>1/</sup> Data for 1971 - not given for 1975.

<sup>2/</sup> n.e.s = not elsewhere specified

<sup>3/</sup> Presumably mostly prepressed furniture components etc. but also sheet particleboard.

<sup>4/</sup> Excludes activities where wood processing is only a minor element or one which cannot be traced in the aggregate statistics e.g. in the total for "toys".

Estimates of growth rates in employment for small scale wood processing activities

Type of wood processing	Rate of increase in employment (% per annum)							
	S/LEONE 1974/80 1/		S. KOREA	TAIWAN**	PHILIPPINES			
	By city population ('000)		1968/75	1966/71	1961-72		1967-72	
	2 - 20	20-250 over 250			Households	Under 10 workers	Under 10 very small scale	Over 10 large scale
1. Forestry and logging								
2. Charcoaling								
3. Sawmilling								
4. Veneer, plywood, panels								
5. Wooden tools								
6. Wood carvings/handicrafts								
7. Carpentry	n.e. 3/	* 24.0 15.0						
8. Furniture/fixtures	-0.6	8.6 3.6 1.1						
9. Boat/ship/vehicle building								
10. Wooden cases/packing								
11. Wood, cane, bamboo products								
12. Other or unspecified wood products								
13. SUBTOTAL WOOD PROCESSING	0.5	8.8 7.6 4.4	24.3 4/ 123 4/					
14. Other wood-based products			55 5/	68 5/	n.a. 6/	12.0	6.2	
15. Cane, straw, bamboo products								

Source: FAO, 1985(a) Table 5: compiled from several sources listed in the original report.

1/ There were only 3 towns each in population ranges 2 000-20 000 and 20 000-250 000 but only 1 town over 250 000.

2/ A = increase in employment; B = increase in numbers of enterprises.

3/ n.e. = non existent.

\* = activity existed but accounted for insignificant employment.

4/ Gross increase over the 7 years (5 years for Taiwan) not annual rate; this applies also to 5/.

5/ Pulp, paper, printing and publishing in this case.

6/ Not accurate.

7/ Furniture - including upholstered.

8/ Rates of change very large but initial bases or absolute changes too small to be meaningful.

9/ In this case paper mills.

10/ Other wood and furniture.

N.B.: \*\* For Taiwan read "China, Province of Taiwan".

Selected characteristics of FB-SSI's

Characteristic	Country 1/				
	Jamaica (1978/80)	Honduras (1979/81)	Egypt (1981/82)	Sierra Leone (1974/75)	Bangladesh (1978/80)
<b>A. Firms</b>					
1. Share in total SSI firm numbers (%)	37	13	25	15	21
2. Located in rural areas (%)	88	100	80	99	97
3. With no machines (%)	69	69	93	?	99
<b>B. Employment</b>					
1. Share in all (manufacturing) SSI's (%)	35	16	24	20	13
2. Share in rural areas (%)	79	100	65	96	?
<b>C. Labour force</b>					
Average workers per firm (No)	2.0	2.7	1.9	1.7	2.4
1 worker (% of firms)	58	59	69	?	36
2 - 5 ( " )	38	37	28	?	60
6 and over ( " )	4	4*	3	?	4

Source: FAO (1985), Table 8

\* Read 7 employees and over

1/ Whole country coverage only for Jamaica, and Sierra Leone

ANNEX 7

Selected market-related data for FB-SSI

Item	Country 1/			
	Jamaica (1978/80)	Honduras (1979/81)	Egypt (1981/82)	Bangladesh (1978/80)
<b>A. Sales profile by destination (%)</b>				
- to final consumer	70	?	?	46
- to distributor(s)	19	?	?	42
- to Government	2	?	?	?
- direct export	1	2	?	9
<b>B. Proportion of total sales (%)</b>				
- "On order" basis	53	?	47	?
- On credit	10	6	18	11

1/ Whole country coverage only for Jamaica

Source: FAO (1985), Table 9

ANNEX 8

Geographical distribution of sales and channels for SSI marketing-data for Haiti

Product	Destination of sales					
	Local Markets		Other Markets within Country			Export
	Final Consumers	Traders	Subcontract Sales	Traders	Tourists	
Wooden Sculpture	26	12	12	14	12	24
Carpentry Products	30	3	5	11	0	1
Straw, Sisal, Bamboo	42	13	2	27	4	10
						Total

Source: Haggblade et al (1979)



ANNEX 9

Ranking of FB-SSI problems according to entrepreneur perceptions  
(where 1 = top)

Problem	Ranking 1/		
	Jamaica (1978/80)	Egypt (1981/82)	Sierra Leone (1974/75)
1. Finance	1	-	1
2. Raw materials	2	1	2
3. Demand	3	2	3

Source: FAO (1985), Table 11

1/ Whole country coverage only in Jamaica and Sierra Leone

ANNEX 10

Competition as a problem for small enterprises

How firm's production fared during last year	Entrepreneur's estimate of % of Competition							
	Rural*		Small Towns*		Urban*		All Jamaica	
	From SSE's	From LSE's	From SSE's	From LSE's	From SSE's	From LSE's	From SSE's	From LSE's
Increased	64	6	59	18	54	42	63	10
Remained unchanged	65	5	61	7	61	27	64	7
Declined	34	4	62	20	42	40	76	7

(Notes: 1) \* Population ranges ('000): Rural = under 2; Small towns = 2-20;  
urban = 20-100

2) Note that the percentages for competition from SSE's and LSE's do not add up to 100; the difference is for "not known", "no competition" and other replies

3) SSE = Small scale enterprises; LSE = Large scale enterprises

Source: FAO (1984), Table 32

ANNEX 11

Sources of funds for SSI's in selected countries (not only forest-based ones)

Source of funds	% of total funds					
	Sierra Leone		Bangladesh		Haiti	
	Initial invest-ment	Expan-sion capital	Initial invest-ment	Expan-sion capital	Initial invest-ment	Expan-sion capital
1. Personal Savings, gifts and reinvested profits	75.5	88.5	73.0	89.0	72.0	81.0
2. Loans	6.0	8.0	3.5	11.0	12.0	19.0
of which:						
Commercial banks	0.9	0.0	0.1	} 7.1	1.2	3.4
Government agencies	0.0	0.0	0.1		0.5	0.0
Moneylenders	0.9	4.0	0.9	} 3.9	1.2	6.5
Relatives/friends	4.2	0.0	1.8		9.1	9.1
Other loans	0.0	4.0	0.6	0.0	0.0	0.0
3. Other sources	18.5	3.5	23.5	0.0	16.0	0.0
4. TOTAL FUNDS	100	100	100	100	100	100

Source: Adapted from FAO (1985), Table 16.

# REFERENCES

- Boomgard, J.J. The economics of small-scale furniture production and  
1983 distribution in Thailand. Ph. D. Thesis. Michigan State  
University, East Lansing.
- Child, F.C. Employment, technology and growth - The role of the  
1976 intermediate sector in Kenya. University of Nairobi, Institute  
of Development Studies. Occasional Paper No. 19, Nairobi.
- Chuta, E. & Liedholm, C. Rural non-farm employment: A review of the  
1979 state of the art. Michigan State University, Rural Development  
Series No. 4, East Lansing.
- FAO. Rural non-farm employment and income generating activities in  
1984 developing countries: The contribution of wood-processing  
activities. Internal Working Paper No. 1, Rome.
- FAO. The contribution of small scale forest-based processing  
1985 enterprises to rural non-farm employment and income in selected  
developing countries. Report FO:MISC/85/4, Rome.
- FAO. Rural non-farm employment and income generating activities in  
1985 developing countries: The contribution of wood-processing  
activities. Internal Working Paper No. 2, Rome.
- Fisseha, Y. & Davies, O. The small scale manufacturing enterprises in  
1981 Jamaica: Socio-economic characteristics and constraints.  
Michigan State University, East Lansing.
- Haggblade, S. et al. Small manufacturing and repair enterprises in  
1979 Haiti: Survey results. Michigan State University. Rural  
Development Series Working Paper No.4, East Lansing.
- House, W.J. Redistribution, consumer demand and employment in Kenyan  
1981 furniture-making. J.Dev. Studies 17(4), pp.336-356.
- Malton, P.J. Income distribution among farmers in northern Nigeria:  
1979 Empirical results and policy implications. Michigan State  
University African Rural Economy Paper No. 18, East Lansing.
- World Bank Employment and development of small enterprises - Sector  
1978 Policy Paper. IBRD, Washington.

BAMBOO-BASED INDUSTRY IN KERALA STATE, INDIA

by

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## 1. INTRODUCTION

Production of mats and baskets using bamboos, especially the thinner reed species (*Ochlandra travancorica* and *O. scriptoria*), is an important cottage industry in Kerala State. Weaving was traditionally undertaken by landless agricultural labourers, particularly those belonging to the scheduled castes and scheduled tribes as a leisure time/off-season occupation and as part of their feudal obligation to the landed class. Production was directly linked to the needs of the local agricultural sector.

Expansion of trade favoured the growth of reed industry by enhancing the demand for products. Due to their low cost and durability, mats began to be used as a dunnage material in warehouses. Production and export of mats to trading centres like Bombay is more than a century old (Bourdillon, 1893). Of the total quantity of 12 million m<sup>2</sup> of mats used in India per annum, 10 million m<sup>2</sup> is produced in Kerala (Anon, 1981b). Large scale production of baskets is closely linked to the trade in fruits, vegetables, betel leaves and fish. Thus, within the traditional sector, there are two subsectors, one catering for local requirements and the other centred on bulk markets located mostly in other states.

## 2. BAMBOO REED INDUSTRY: AN OVERVIEW

About 300 000 persons are directly or indirectly dependent on the traditional reed industry (Govt. of Kerala, 1983). Although weaving is primarily a part-time occupation, it is an important source of livelihood for a sizeable section, particularly the landless agricultural labourers and tribesmen. Data on the extent of dependence of households on reed industry are not readily available. Nevertheless, it forms an activity which provides the maximum employment within the forest industries sector.<sup>1/</sup> The scattered nature of production and marketing makes it difficult to assess the contribution from the traditional sector. Based on the input-output ratios and the quantity of reeds removed from forests, the total value of production is estimated at about Rs. 90-100 million.

Household production to meet local demand is spread throughout the state. Production for bulk markets is, however, centred around certain localities. Easy accessibility to raw material source and transport facilities are important factors that have led to such concentration. A major proportion of mats for exports outside the state is produced in the Angamaly-Kalady region in Ernakulam district. Availability of reed in the forests of the Periyar river basin and feasibility of water transport have been important factors that led to the growth of reed-mat production in the area. Talappally in Trichur district and Nedumangad in Trivandrum district are important centres of basket weaving. Production of dining table mats is concentrated in Trichur district and is the result of the spin-off effect of imparting technical know-how to local workers by the first unit established about two decades ago.

Suitability of reeds for the manufacture of pulp and paper was recognized nearly a century ago and the Punalur Paper Mills established in 1890 continues to use reed as the most important long-fibre material. Of

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<sup>1/</sup> Sawmilling is one of the most important forest-based industries in the organized sector. In 1982 there were 1024 registered sawmills and the number of persons employed was 6980 (Nair et al., 1984).

the total requirements of 664 000 t of fibrous raw material by the three pulp and paper units in the State, reeds account for about 41 percent (Karunakaran, 1983). Especially in the case of the Punalur Paper Mills and the public sector newsprint unit, dependence on reeds is very high (Asari, 1978; Anon, 1981a).

### 3. EMPLOYMENT AND INCOME GENERATION

Reed-based production represents extreme situations in the whole spectrum of technological choice with the low capital input, labour-intensive basket and mat weaving representing one extreme, and the highly capital-intensive pulp and paper manufacturing the other. Given a product mix, flexibility in the choice techniques is extremely limited. Important characteristics of production in the two sectors are discussed below.

#### 3.1 Traditional Sector

A number of institutions, viz. households, private entrepreneurs, cooperative societies and the Government-owned Bamboo Corporation, are involved in the traditional sector. Availability of reeds in the immediate vicinity and easy access to local markets enabled the household producers to operate independently. Development of bulk markets in distant places and the increasing distance to reed sources facilitated the entry of entrepreneurs who were able to take advantage of the economies of scale in transport of raw material and products. Although these intermediaries play a useful role, most often they tend to exploit the less resourceful household producers. Organizations like the State Bamboo Corporation and cooperative societies were established to free the producers from the exploitative hold of intermediaries.

Employment in processing of reeds including the full-time equivalent of part-time employment is estimated at about 75 000. Almost 90 percent of the production is undertaken by households. In some cases cooperative societies and private entrepreneurs have resorted to workshed production.

Salient features of processing in the traditional sector are:

1. Capital intensity of production is very low, particularly in the case of production by households. A good billhook and a sharp knife or blade are the only tools required. Fixed capital investment per worker seldom exceeds Rs. 15. In the case of the Bamboo Corporation which maintains a number of collection depots and warehouses, fixed capital investment per person is about Rs. 50. In the case of workshed production, this is about Rs. 85. Production of dining table mats requires investment on weaving looms, storage space, dipping tank, etc. Even then the fixed capital per worker seldom exceeds Rs. 200.
2. Apart from labour and reeds, production of mats and baskets involves the use of no other inputs.<sup>1/</sup> Power and fuel consumption is negligible. The skill for weaving can be easily acquired and even children participate in the production process.

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<sup>1/</sup> Cost of reeds and wages together account for 92 percent of the production cost of baskets. In the case of table mats these two constitute 71 percent of the production cost and about 15 percent relates to the cost of nylon yarn.

3. For historical reasons the industry is dominated by socially and economically backward sections of society, particularly scheduled castes and scheduled tribes. Furthermore, women form the major work-force. Weaving can be combined with household chores and is easily acceptable in a society which sees women's domain limited to the household. Being a low wage sector, very few men are attracted to weaving.

Indirect employment arises from collection and transport of reeds and finished products, supervision and management of production and collection centres, etc. About 5 000 persons are estimated to be employed in the collection of reeds. Due to the arduous nature of reed cutting, it was an exclusive preserve of men. Growing unemployment and improved accessibility have facilitated the entry of women into this field. Transport of reeds (carting, rafting, truck transport, loading and unloading) and supervision and management are mostly undertaken by men. The total number of persons employed in these activities are about 2 000 to 3 000. Income per worker belonging to the different categories is given in Table 1.

Table 1

Workers' income in traditional reed industry

<u>Category</u>	<u>Income/year (in Rs.)</u>
1. Mat and basket weaver	820.00
2. Reed cutters and loading and unloading workers	3 000.00
3. Supervisory and management staff	7 500.00

Source: Estimated from the balance sheets available from cooperative societies, Bamboo Corporation and local enquiry.

Generally income earned by weavers is extremely low in comparison with other categories of workers. Payment is on a piece-rate system and wages almost reach the level of the opportunity cost of time. Daily earnings of reed cutters may be as high as Rs. 40 but, due to the seasonal nature of work, their annual income is low. Collection of mat-quality reeds requires extensive travelling and the reeds collected have to be transported to the river or roadside.

Managerial and supervisory staff are mostly permanent employees and, since salary is not linked to production, their earnings are high. In the case of private sector ventures, managerial and supervisory functions are performed directly by entrepreneurs themselves, and separation of income between managerial remuneration and profits is difficult.

### 3.2 Modern Sector

In contrast to household scale production of mats and baskets, the pulp and paper industry is highly capital and skill intensive. Processing involves complete physical and chemical transformation and, consequently, energy requirement is high. About 20 percent of the operating cost is accounted for by power and fuel while wages, salaries,

etc., constitute only about 12 to 15 percent of the cost. Direct employment in the pulp and paper units which use reeds as fibrous material at full capacity utilization may not exceed 10 000 and only a part of this can be considered as an outcome of using reeds.

As in the case of the traditional sector, collection of reeds is an important source of indirect employment. Since reed cutting is not as selective as in the case of the traditional sector, labour output is higher and, correspondingly, employment per unit of collection is low. Employment in reed collection and transport, when the total quantity allotted to the pulp and paper industry is removed, is estimated at 20 000 man-years.

Table 2 gives the income accruing to workers of different categories in the pulp and paper industry.

Table 2

Workers' income from the pulp and paper industry

<u>Category</u>	<u>Income (in Rs./year)</u>
1. Reed collection and transport	3 000.00
2. Factory workers	8 000.00
3. Managerial and supervisory staff	14 000.00

Source: Estimated from balance sheets.

3.3 Traditional Sector Vis-à-Vis Modern Sector

Obviously income per worker is substantially higher in the modern sector. However, other parameters like capital:labour ratio, raw material and power consumption per worker are also to be considered in investment decisions. Table 3 gives a comparison between the traditional and modern sectors.

Although earnings per worker are substantially high in the pulp and paper industry, employment potential is very low and requires high fixed capital investment. Fuel and raw material consumption per worker is also very high. Considering the problems in enhancing the supply of reeds, a rapid expansion of reed-based pulp and paper production will have significant negative redistributive effects.



Table 3  
Characteristics of reed-based industry

Input/output ratios	Traditional sector			Modern sector
	Mat weaving	Basket weaving	Table mat production	Pulp and paper
Fixed capital investment per worker (in Rs.)	50.00*	15.00	200.00	71 000.00
Power and fuel consumption per worker per year (in Rs.)	0.20	..	1.50	18 850.00**
Consumption of reeds per worker per year (in tons)	1.20	0.80	1.00	38.00**
Wages and salaries per worker per year (in Rs.)	900.00	720.00	800.00	10 775.00
Wages and salaries per ton of reeds (in Rs.)	750.00	900.00	800.00	284.00

\* Based on the accounts of the Kerala State Bamboo Corporation. Fixed capital mostly relates to warehouses for storage of finished products, office buildings, vehicles, etc.

\*\* Based on the accounts of Punalur Paper Mills for the years 1980-81 during which the capacity utilization was only 20 percent.

#### 4. OFFICIAL SUPPORT PROGRAMMES

In view of their contribution toward rural employment and income generation, the Government policy has always been geared to support the traditional sector. Official support programmes can be broadly grouped into, (a) creation of institutions and providing the legal and administrative framework for their operation and (b) direct support to the industry by supplying raw material at concessional rates from Government forests or by giving grants, loans, etc.

The Bamboo Corporation was established to free the traditional workers from the exploitative hold of intermediaries and thus to enhance the traditional workers' income. Initially the Corporation focused attention on marketing. Subsequently, it became necessary to take up collection and distribution of reeds. At present the Corporation has the monopoly for reed collection and all supplies to consumers in the traditional sector are channelled through the Corporation. As far as procurement of mats is concerned, its activity is limited to the Angamaly-Kalady region. About 15 000 weaver families are registered with the Corporation which undertakes to supply reeds to these families. Finished products are purchased from registered weavers and the Corporation sells the mats in different parts of the country. The Corporation has been exempted from payment of the minimum price fixed as per the Kerala Forest Produce (Fixation of Selling Price) Act 1978 and currently no stumpage value is levied from the Corporation for reeds supplied to traditional workers.

Weavers registered with the Bamboo Corporation can get a loan of up to Rs. 100 for procurement of reeds under a credit scheme operated by the Corporation and the State Bank of India. A number of welfare programmes, such as educational scholarships, house construction grants, accident relief, etc., have also been initiated by the Corporation.

There are about 40 cooperative societies involved in the reed industry with a total number of about 5 000 workers. The legal framework for the establishment and management of cooperatives is provided by the Kerala Cooperative Societies Act, 1969 and the Cooperative Department is responsible for implementation of the provisions of the act. Government also gives liberal financial support to cooperatives, especially to those whose members belong to the scheduled castes and scheduled tribes.<sup>1/</sup>

A major part of the share capital is subscribed to by Government. Other forms of assistance include, (i) grant for purchase of land, (ii) building grant and (iii) grant to meet part of the expenditure on pay and allowances of managerial staff during the first five years of the establishment.

An apex society formed under the initiative of the Government, Kerala State Harijan Girijan Cooperative Development Federation, helps the cooperative societies in marketing the products. Some of the cooperatives producing table mats market their products through the Kerala State Handicrafts Development Corporation. Government involvement in the functioning of institutions engaged in reed industry is thus quite significant.

## 5. APPROPRIATENESS

Appropriateness of a sector or activity has to be judged in the context of given socio-economic conditions and the objectives of development. In the conditions prevailing in a typical developing country situation, where a large section of the population lives below the poverty line, fulfilment of basic needs is a major objective. Based on certain predetermined criteria of appropriateness, a quantitative comparison between the traditional and modern sectors is given in Table 4.

As evident, the traditional sector has distinct advantages over the modern sector in several respects, clearly indicating its relevance in a typically underdeveloped situation as prevailing in Kerala.

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<sup>1/</sup> Most of the cooperatives involved in reed industry belong to this category.

Table 4  
Appropriateness of reed industry

Criteria	Basket and mat weaving	Pulp and paper production
1. Generation of basic needs income	High. A major part of the value added accrues as basic needs income	Low. The average wages are high and a larger proportion goes to fulfil non-basic consumption
2. Production of basic needs goods	A major part of the goods is directly or indirectly used in production of basic needs goods	The proportion that goes to satisfy basic needs is low
3. Employment	High	Very low
4. Capital/labour ratio	Very low	Very high
5. Raw material consumption per person	Very low	Very high
6. Skill requirement	Very low	High
7. Pollution	Negligible	Very high
8. Resource depletion	Mature reeds alone are selectively harvested. Rate of resource depletion is low	For pulp and paper manufacturing all reeds are cut. Resource depletion is high
9. Self-reliance	Promotes self-reliance at the local level	Promotes self-reliance at the national level, but this could undermine self-reliance at the local level
10. Multiplier effect	Due to dispersed nature of production and low value added generation multiplier effect very low	High. Due to the high forward and backward linkages
11. Foreign exchange earning	Negligible	Import substitution effect is quite high

#### 6. KEY SECTOR PROBLEMS

The traditional reed industry faces a number of problems largely arising from the changing economic and social environments in which it operates. Some of the key sector problems are discussed below.

- (a) A decline in the availability of reeds is one of the most important problems facing the traditional sector. Deforestation of reed-bearing areas for alternative uses,

especially agriculture, multi-purpose river valley projects, settlements and forest plantations are important factors contributing to this. Reed is primarily found in the evergreen and semi-evergreen forest tracts, in particular along river and stream banks, and it is these areas which are subjected to severe deforestation. No worthwhile attempt has been made hitherto to regenerate reeds artificially.

Growth of the pulp and paper industry utilizing reeds is another major factor affecting the raw material availability to the traditional sector. Annual availability of reeds from the forests of central and southern Kerala has been estimated at 300 000 t, of which 274 000 has been allotted to the two pulp and paper units (Asari, 1978). Furthermore, felling of reeds for pulp and paper is more intensive and this affects the availability of two-year old mature culms suitable for weaving mats.

- (b) Availability of substitute products has led to a decline in the demand for commercial mats. Thick polyethylene sheets which are cheaper than reed mats are being used as dunnage material in warehouses. Such a contraction of market is particularly harmful to the Bamboo Corporation. In response to this, the Corporation has initiated product diversification by establishing a bamboo board factory. Bamboo board is produced adopting the plywood technology using finely woven mats in the place of wood veneers. The product could be used for partition walls, ceilings, furniture, cupboards, etc.

Despite the increasing availability of plastic wares, demand for baskets and other household items remains buoyant. Considering the growth of the vegetable, fruit and fish industries, the demand for baskets is unlikely to decline in the near future.

- (c) Shortage of working capital is a serious problem confronting many of the units involved in traditional processing. Even cooperatives, which obtain substantial assistance from the Government, face this problem. Some of the cooperative and household enterprises are compelled to seek the help of traders and intermediaries, thus getting into their exploitative hold.
- (d) Enterprises, particularly the cooperatives and the State Bamboo Corporation, involved in the traditional reed industry, face a number of institutional problems. These are partly attributable to the structure of the organization and partly to the social and political environment in which they have to function.

Inefficiency in operation is an important factor and, even though support is available from Government, successful functioning of cooperatives is an exception. A large number of the cooperatives involved in reed processing have become defunct and lack of committed leadership is a major factor contributing to their failure (Nair and Muraleedharan, 1983). The vertical structure of the Bamboo Corporation has led to a polarization of employer-employee interests and politically motivated strikes are frequent.

- (e) Undoubtedly, the most important problem for the traditional reed industry arises from the low value added generation. This limits the ability of enterprises to raise sufficient reinvestible surplus. Value added per worker - and consequently wages - can be increased either by adopting production techniques and product mixes requiring high energy and raw material input or by producing items of high aesthetic value. Choice of the first alternative would completely alter the structure of the industry and, in the context of declining raw material supply, it has serious limitations. The second alternative faces the problem of a very restricted market.

Whether the vertical integration attempted by the Bamboo Corporation through production of bamboo boards will be an appropriate option is difficult to answer now. Bamboo board production is a capital-intensive investment and the employment generation effect is low.<sup>1/</sup> Linking the traditional sector with a capital-intensive modern sector could have negative feedback effects and economic compulsions may necessitate drastic modification of the weaving technique. If this happens, many of the advantages of traditional processing will disappear.

## 7. CONCLUSION

Reed-based traditional industries, like mat and basket weaving, play a crucial role in the rural economy of Kerala. Household scale production has been in existence for a very long period and the development of bulk markets has helped the growth of the sector. The sector has a number of desirable attributes of appropriateness, especially in comparison with pulp and paper manufacturing. The capital:labour ratio, fuel and raw material consumption per worker, etc., are extremely low. Also, per unit of raw material consumed, it generates more value added in the form of wages than the modern sector.

However, the industry faces a number of short-term and long-term problems. The low value added generated in the traditional sector provides little scope for reinvestment and bringing in technological innovation. Increasing the value added is now being attempted through highly capital-intensive investment, but then such investments drastically reduce the quantum of employment. The effort should be directed at improving the production through appropriate technological and institutional innovations.

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<sup>1/</sup> As per the project report, the total fixed capital investment for the project is Rs. 5.0 million and it will employ about 135 persons.

## REFERENCES

- Anon Report and accounts 1980-81. Punalur Paper Mills Ltd., Punalur.  
1981a
- Anon Kerala State Bamboo Corporation. Bamboo Board Project.  
1981b (Unpublished).
- Asari, P.K.S. Industry oriented management plan for reeds. Kerala  
1978 Forest Department. (Unpublished report).
- Bourdillon, T.F. Report on the forests of Travancore. Government  
1983 Press. Trivandrum.
- Govt. of Kerala. Economic review 1982. State Planning Board.  
1983 Trivandrum.
- Karunakaran, C.K. Demand versus supply of important raw materials from  
1982 forests in Kerala State. Kerala Forest Department. Trivandrum.  
(Draft unpublished).
- Nair, C.T.S. & Muraleedharan. Rural institutions for development of  
1983 appropriate forestry enterprises: A case study of the  
traditional reed industry in Kerala State, India. Research  
Report 18. Kerala Forest Research Institute, Peechi.
- Nair, C.T.S., Mammen Chundamannil & E. Mohamad. Intensive multiple  
1984 use forest management in the tropics: A case study of the  
evergreen forests and teak plantations in Kerala, India.  
Research Report 22. Kerala Forest Research Institute, Peechi.

PRODUCTION OF CHARCOAL IN SALTA PROVINCE (ARGENTINA)

by

Carlos Saravia Toledo

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## 1. INTRODUCTION

Argentina has a long experience in charcoal production. During the final quarter of the last century the railways built lines into the semi-arid forests in order to obtain the sleepers necessary for laying rails and fuel for energy.

Until the first world war consumption of firewood and charcoal was mainly for household uses, although firewood was already used by the steam engines of the railways.

Up to the first world war charcoal consumption was about 450 000 t/a, which rose to about 600 000 t/a during the war period (Dorfman, 1970).

The development of petroleum-based fuels and electricity gradually replaced charcoal for domestic uses which fell to an average of 150 000 - 200 000 t/a in the past ten years.

The use of charcoal for the production of iron and cast iron started in 1945 when the Altos Hornos Zapla plant in Juhierro Province was constructed. The present consumption of this plant, when operating at full capacity, is about 230 000 t/a.

## 2. NATIONAL PRODUCTION

In the past five years national charcoal production has fluctuated between 230 000 and 370 000 t/a (Table 1).

Table 1  
Charcoal Production (in tons) 1979 - 1983

Province	1979	1980	1981	1982	1983
Chaco	89 500	126 700	105 200	63 500	63 489
Salta	81 100	78 700	64 800	49 100	56 958
Santiago del Estero	88 800	95 100	46 700	44 900	61 521
Other Provinces	69 800	67 100	66 400	76 700	77 806
TOTAL	329 200	368 100	283 100	233 200	259 774

The above-mentioned three provinces account for 70-80 percent of the total annual charcoal production, while that of the other 12, included as "other provinces" in Table 1, fluctuates between 20-30 percent. The reduced consumption of Altos Hornos Zapla after 1980 was reflected in decreased production in 1981-1982; it was observed that this industry revived in 1984: a year in which production figures for charcoal are only available for Salta province (64 630 t in 1984). In relation to national production, Salta's charcoal output increased from 3.9 percent in 1967 to about 18-25 percent in recent years.

Because of the characteristics of the production structure, with a marked dominance of small producers who often work outside the regulations in force, 20-25 percent of charcoal production is not reflected in the official statistics.

### 3. PRODUCTION STRUCTURES

An analysis of the number of producers and the volume of charcoal delivered by each of them to Altos Hornos Zapla gives quite a clear picture of the charcoal production structure for the three above-mentioned provinces which supply 95 percent of that company's requirements. The volume of the supply varies during the year because of the household requirements which during the cold season, from April to September, increase and decrease during the summer. The supply figures at Zapla for the peak months are:

Table 2

Classification of producers by monthly volume delivered to Altos Hornos Zapla during peak months

Category	No. producers	Charcoal/month	Percent	Average t per producer
- 300 t/month	280	15 801	79%	56
300-1 000 t/month	2	1 600	8%	800
+ 1 000 t/month	<u>2</u>	<u>2 600</u>	13%	1 300
TOTAL	284	20 000		

The producers of less than 300 t include a cooperative which links some 60 small producers who work individually but deliver on behalf of the cooperative, and one producer who during six months of the year delivers about 1 000 t of charcoal; he purchases this from the small producers and only produces 200-300 t himself.

Table 3

Classification of producers by monthly volume delivered to Altos Hornos Zapla during slack months

Category	No. Producers	Charcoal/month	Percent	Average t per producer
- 300 t	280	7 100	59.16%	25
300-1 000 t	2	1 900	15.84%	950
above 1 000 t	<u>2</u>	<u>3 000</u>	25.0 %	1 500
TOTAL	284	12 000		

The "peak and slack" figures were established for those years when Altos Hornos Zapla operated at full capacity for the country's normal markets. Tables 2 and 3 indicate that 79 percent of charcoal supplied to Altos Hornos Zapla is delivered by small producers during the peak months, October to March. From April to September they channel part of their production to the domestic consumption market, decreasing their share of deliveries to the mill to 60 percent.

There are only four fairly large scale producers who supply about 21 percent during the peak period (October-March) of Altos Hornos Zapla's consumption and 40 percent during the slack period.

### 3.1 Small Producers in Salta Province

No statistics are available on the number of small charcoal producers either for the country as a whole or by province. There are an estimated 80 charcoal producers in Salta, of whom only two or three produce about 150-200 t/month regularly. Many small producers make charcoal during six or eight months and then stop production during the period of low demand.

The typical small charcoal-makers operate without any capital of their own. As a rule they depend on a large trader who supplies them with food while they make the charcoal and who in turn receives all or part of the production as payment. This type of operation has the following characteristics:

1. It is a family type of activity or one with very few salaried workers.
2. These operators do not comply with the legal regulations in force in the forestry sector and they evade payment of forestry taxes and for permits.
3. It is a transitional activity. As the forestry resource is exhausted the operators move. They constitute a truly migratory social group.
4. When these producers have salaried personnel, they almost never fulfil the requirements of the social security laws on retirement, social services, etc.
5. They react quickly to changes in market conditions, stopping or reducing production whenever prices or payment conditions deteriorate.
6. The activity of these charcoal-making groups, combined with overgrazing has caused the disappearance of about 20 million ha of forests in Argentina's semi-arid area turning them into unproductive wastelands.
7. Usually the small charcoal-makers enter in the second or third stage of forest exploitation. The first exploitation stage consists of log extraction for sawmills and posts for fencing, activities carried out by rather large scale businesses which possess sawmills but which are also migratory.
8. The capital of a small charcoal-maker consists of a small cart (called "zorra" locally) for transporting fuelwood, one or two mules for draught, a power saw, 200-litre drums for water and occasionally a tractor or light truck, several years old.

### 3.2 Organized Large Scale Producers in Salta

The figures in Table 2 show clearly that there are only four businesses making charcoal on a scale that justifies a business type of organization. Two of these firms belong to Fabricaciones Militares (military manufacturers), Forestal Zapla and Pirané which are located in Jujuy and Formosa province respectively. The other two businesses, Salta Forestal and Campos del Norte S.A. are located in Salta province. The first is a state enterprise owned by Salta province and the second is a privately owned company.

#### 3.2.1 Common characteristics

Both businesses use the same forestry exploitation system and have the following purposes and features in common:

- (a) They tend to establish permanently settled forestry population centres.
- (b) The design of the exploitation plan relating to roads and to the distribution of batteries of kilns is the same. Transport is based on utilization of traditional fuelwood transport methods.
- (c) Both enclose the areas to be exploited under their management plan with barbed wire fencing to restore the balance of the ecosystem and ensure forest regeneration.
- (d) To establish their management plan they first make a forest inventory, preparing maps on the type and condition of forest communities, topography, soils (from the transport standpoint) and pre-existing infrastructures (water supplies, roads, tracks, dwellings). They also make a social and economic survey of the pastoral groups occupying the area. In Salta Forestal the background information included a survey and inventory made by NOA II - Forestal (Frith, 1975).
- (e) They establish an administrative and supervisory system ensuring proper management both of production operations and administrative actions. This information provides knowledge of the execution of operations, forest yields, kiln efficiency, the fuelwood:charcoal ratio, progress in infrastructures, etc.
- (f) Forestry research is conducted by both businesses. The results have been published, presented at technical meetings and cited as agro-forestry models. (Whyte, A. and Burton I., 1983, Saravia Toledo 1984-1985; FAO 1983 and 1984).

Campos del Norte has research agreements with the Instituto Forestal Nacional [IFONA (National Forestry Institute)], the Instituto de Tecnología Agropecuaria [INTA (Agricultural and Livestock Technology Institute)], and the Centro de Zoología Aplicada (Applied Zoology Centre) of the Universidad Nacional of Córdoba carries out activities on its lands.

#### 3.2.2 Differences of operations between the two companies

1. Salta Forestal has a sawmill and exploits a forest which has not been subjected to previous extractions. Campos del Norte does not have a sawmill and the forest it uses at present was subjected to heavy extraction of logs and posts in the past.

2. Campos del Norte has a silvo-pastoral management plan, applies a controlled grazing system and establishes forest-cutting regulations which also ensure appropriate wildlife shelter, whereas in Salta Forestal the activity is mainly related to forestry activities.

#### 4. CHARCOAL-MAKING OPERATIONS

Charcoal-making involves several operations, some of them direct and others constituting support tasks.

The direct operations are the same for the small and large producer with some variation in their intensity or form.

##### 4.1 Direct Operations

- (a) Brush clearing, track making and limbing. These jobs are performed by two men with hatchets who cover 10-15 ha/month. Clearing and opening of tracks are done before the power saw operator fells the trees. After felling, limbing is done with a hatchet before bucking.
- (b) Felling and log cutting. A power saw operator produces 400-500 t of wood per month. He has two assistants who clear the brush, open up tracks and carry out limbing.
- (c) Clear-cutting. After the felling and bucking operations the forest is cleared intensively using a hatchet to eliminate the trees which were not cut with the power saw. In appropriate management of the forest mass, clear-cutting is necessary to ensure good forest regeneration. A worker produces 40-50 t/month in clear-cutting operations.
- (d) Fuelwood transport. The fuelwood is transported from the felling site with a small mule-drawn cart (zorra), which carries a load of 1 000 to 1 200 kg of fuelwood per trip and makes between 8 and 15 trips per day depending on the distance. The normal monthly output of a worker with his cart is 200 t/month.
- (e) Carbonization. This includes loading the kilns, control of the carbonization process and unloading the charcoal produced. This job is done by foremen of the battery of kilns with two assistants, producing an average of 100 t/month if ten kilns are operated.
- (f) Truck or trailer loads. Transport of the charcoal to consumption centres is carried out almost totally by truck.

A small proportion is shipped by rail. This requires intermediate transport movement from the kilns to the railroad which is also done by trucks or by tractor-trailers.

To load trucks by hand, teams of six people are used working about 5 to 6 hours to load 30 t.

Mechanized loading is carried out by a skilled worker and an assistant working two hours for 30 t.

#### 4.2 Indirect Operations

##### (a) Opening up roads and installation of batteries of kilns

In an organized operation roads 6 m in width are laid out which will link batteries of kilns with one another giving access to the trucks carrying charcoal, and a network of roads 3 m wide for animal draught carts. Each exploitation unit, called a "battery", has 900 ha of which 10.7 ha are cleared for the following purposes: 0.6 ha, battery of kilns; 3.6 ha, 6 m wide roads; and 6.5 ha of 3 m wide roads. If a worker does not have to buck the logs he can clear an average of 0.5 ha/month. A company that produces 1 000 t/month of charcoal with ten batteries of kilns should add two batteries per year to compensate for those that wear out. Four permanent workers are needed to maintain a clearing rate of 21.4 ha/a.

##### (b) Kiln and water tank construction

A half-orange kiln, 6 m in diameter, can be constructed in three days by three workers.

An operation with a 1 000 t/month output will require construction of 20 kilns per year to cover yearly losses through depletion under a five-year exploitation plan for each battery. This means that 180 working days per year are necessary to build 20 furnaces, equivalent to the work of three workers during two and one-half months.

Each battery has two water tanks with a capacity of 3 000 l. The construction of a water tank can be completed by two workers in one day.

##### (c) Water well

A battery of 10 kilns requires a water supply of 10-15 000 l/month depending on the season for household consumption, watering the work animals and use in furnace cooling operations. A 1 000 t/month charcoal output operation requires a tractor driver-worker using a tractor and tank trailer for distribution of water to ten batteries. Perforated wells are drilled to a depth of 80-120 m depending on the area, to produce the water for distribution. 4 000 to 8 000 l/h may be extracted from the wells depending on the diameter of the piping and the characteristics of the groundwater table.

The water supply equipment further includes a raised water tank with a capacity of 5 000-10 000 l, pumping equipment and an engine.

If the company's establishment is of a permanent character the first well and pumping equipment are located in the residential area.

#### 4.3 Administrative Management and Control

An output of 1 000 t/month requires a production manager, an assistant, three administrative persons, a warehouse foreman and two "weighers" if the firewood is received by weight.

## 5. PRODUCTION EQUIPMENT

Small businesses which produce 100 t of charcoal per month require the following equipment:

- 2 carts with mules and harness
- 1 hand cart
- 3 charcoal forks
- 3 drums of 200 l capacity each
- 1 power saw
- 3 axes
- 2 shovels

Occasionally these businesses may have an old light truck or tractor to supply water or goods.

A large business with an output of 1 000 t/month uses the same equipment, but instead of a used tractor or light truck it will need:

- 1 pick-up truck in good condition
- 1 80-100 hp tractor
- 1 3 000-5 000 l capacity tank trailer
- 1 10-12 t flat trailer without hand rails
- 1 grader or other road levelling equipment

## 6. INFRASTRUCTURE

### 6.1 Half-Orange Kilns and Water Tanks

As mentioned under 4.2 (b), the kilns are usually constructed with a diameter of 6 m. This size of kiln produces an average of 10 t of charcoal per month. Each kilning cycle yields 6.5 to 7.5 t of charcoal in 18-20 days or an average monthly quantity of 10 t per kiln. The kilns are constructed with bricks bonded with mud; they have two doors, one for loading and the other for unloading. In addition to the kilns, two cylindrical tanks of 3 000 l capacity each are constructed per battery of kilns, with bricks and cement. The purpose of the tanks is to store water for cooling the kilns.

### 6.2 Roads

They are constructed octagonally per operating unit with an additional four side roads of 500 m each. The kilometres of roads in a complex total:

- 6 m wide roads = 6 km
- 3 m wide roads = 21.5 km

### 6.3 Dwellings

The dwellings constructed by small scale companies are temporary and there would be no point in turning them into permanent homes because the population concerned is migratory; once the resource is exhausted, the population moves again, usually every five or six years.

In large scale companies businesses whose purpose is to create permanent production centres, the quantity of personnel employed justifies and necessitates the creation of a residential centre for 120 employees. In a plant with a monthly output capacity of 1 000 t of charcoal, the quantity of houses for workers, administrative and management personnel will be about 100 units.

#### 6.4 Perimeter Wire Fencing

Companies like Campos del Norte and Salta Forestal enclose their forest exploitation areas with wire fencing in order to obtain proper forest regeneration, and a recovering of forage productivity of grass and shrubs.

A team of three skilled workers can erect 3 km of wire fencing per month once a track has been cleared for this purpose. Normally a 5 m wide cleared path is opened up for the wire fencing, in other words half a hectare is cleared for each kilometre.

#### 6.5 Sheds and Depots

Large scale businesses need sheds to store fodder (maize, alfalfa), for maintenance and parking of vehicles and as warehouses for storage.

### 7. COMPARISON OF PERSONNEL REQUIREMENTS FOR SMALL AND LARGE SCALE BUSINESS

For a unit producing 100 t/month in the traditional manner and for one with an output of 1 000 t/month the permanent jobs created would respectively be as indicated in Table 4.

Table 4

Comparison of personnel requirements for small and large scale businesses

Activity	100 t/month unit	1 000 t/month unit
Brush clearing, tracks and limbing	2	24
Felling and bucking	1	12
Fuelwood transport	2	24
Carbonization	3	30
Truck loading (manual)	1	--
Truck loading (mechanized)	--	--
Clearing roads and installing batteries of kilns	0.1	4
Clear-cutting	1	10
Management and administrative personnel	--	6
Fuelwood weighing	--	2
Water and goods distribution	--	1
Construction of kilns	--	0.6
Road and fence maintenance	--	2
Driver-mechanic	--	1
<u>TOTAL</u>	10.1	118.6

### 8. COMPARISON OF INVESTMENT FOR SMALL AND LARGE SCALE BUSINESSES

Tables 5 and 6 indicate the investment required for a small and large scale charcoal business respectively:



Table 5

Investment required for a small scale business  
(Argentine pesos)

Item	Unit	No.	Per unit cost	Total investment
1) <u>Infrastructure</u>				
Kilns	each	10	30 000	300 000
Water tanks	each	2	5 000	10 000
Clearing	ha	5	40 000	200 000
2) <u>Equipment</u>				
Power saws	each	1	300 000	300 000
Carts	each	2	60 000	120 000
Mules	each	2	40 000	80 000
				1 010 000

Table 6

Investment requirement for a large scale business

Item	Unit	No.	Per unit cost	Total investment
1) <u>Infrastructure</u>				
Kilns	each	100	30 000	3 000 000
Water tanks	"	20	5 000	100 000
Clearing	ha	117	40 000	4 680 000
Roads (graded)	km	30	100 000	3 000 000
Wire fencing	km	90	250 000	22 500 000
Wells	each	1	500 000	500 000
Dwellings	"	50	1 500 000	75 000 000
Warehouses				
300 m <sup>2</sup>	ir	1	2 500 000	2 500 000
Sheds 300 m <sup>2</sup>	ir	1	5 400 000	5 400 000
Raised tanks	ir	1	400 000	400 000
				117 080 000
2) <u>Equipment</u>				
Power saws	each	12	300 000	3 600 000
Carts	"	24	60 000	1 440 000
Mules	"	24	40 000	960 000
Motors for pumps	ir	3	720 000	2 160 000
Pumps	"	3	92 000	276 000
Light trucks	"	1	5 000 000	5 000 000
Tractors	"	1	9 500 000	9 500 000
Trailers				
(12 t each)	"	1	1 160 000	1 160 000
Tank trailers	"	1	920 000	920 000
Power graders	"	1	45 000 000	45 000 000
				70 016 000

Investment costs recorded in February 1985 indicate that:

- (a) A traditional business invests \$a 1 010 000 to produce 100 t/month of charcoal of which only \$a 510 000 are for infrastructure. If we relate investment in infrastructure to 900 ha of a production unit, a figure of \$a 566.00 per ha is obtained; for the 6 000 t average charcoal yield, which the 900 ha would produce in five years, the relationship would be \$a 85.00 investment in infrastructure for that charcoal tonnage.
- (b) The investment of a large scale business in equipment and infrastructure amounts to \$a 187 096 000 for an area of 60 000 ha, in which a total of 67 production units of 900 ha each would be constructed in 35 years. At the final stage, the total investments in these production units including cost of roads and of 100 dwellings will be \$a 254 526 000 in infrastructure alone, with \$a 636 of charcoal for a projected production of 400 000 t during the total 35-year cycle. Relating investment in infrastructure to the area covered, the amount would come to \$a4 242/ha for the total 60 000 ha.
- (c) Comparing investment in power saws, mules and carts, the investment is the same for both systems, amounting to \$a 86/t of charcoal produced. However, the large scale business has more equipment (pumps, light trucks, tractors, etc.) which for a 400 t output amounts to an investment of \$a 160/t.

## 9. COMPARATIVE OPERATING COSTS

The costs refer to businesses engaged exclusively in charcoal production, in other words those not having sufficient forests to extract logs which would justify the installation of a sawmill. If they were to possess a sawmill and also to produce charcoal, the cost would decrease because amortization of roads would be distributed over different products.

To calculate the cost, an average yield of 1 t of charcoal for every 5 t of fuelwood can be taken. This is the ratio applied by the Instituto Forestal Nacional when preparing the Statistics Yearbooks. The figure is to be taken only as an average since the fuelwood:charcoal ratio varies according to species, drying time, quality of the wood, etc., and as a rule the yields of hardwoods are slightly below the 1:5 ratio.

Labour costs for small and large scale producers would be about the same. In practice, however, the situation is different because the large majority of small producers operate outside the ruling labour laws relating to social security, a factor that reduces direct labour costs by some 56 percent.

Table 7

Labour cost for 1 ton of charcoal. February 1985  
(in Argentine pesos)

Operation	Price of operation	Social charges	Total
- Brush clearing, opening tracks and limbing (5 t)	950	580	1 530
- Felling and bucking	1 250	700	1 950
- Fuelwood transport (5 t)	1 500	760	2 260
- Carbonization (per t charcoal)	1 200	672	1 872
- Hand loading (1 t)	<u>200</u>	<u>112</u>	<u>312</u>
TOTAL	5 100	2 824	7 924

Table 8 shows the influence of amortization and maintenance of infrastructure and equipment on the cost per ton of charcoal.

For small producers who only have kilns, tanks and roads the influence of infrastructure amortization and maintenance represents \$a 150/t of charcoal. On the other hand for large scale producers this item represents \$a 672/t of charcoal.

Under the heading of equipment, the influence of amortization and maintenance represents \$a 566/t for large producers and none for small producers.

The costs for administration, supervision and planning affect only the large scale producer and may be estimated at 15 percent over and above labour costs.

Table 8

Influence of amortization and maintenance of infrastructure and equipment on the cost per ton of charcoal  
(in US\$)

Item	Amortization	Maintenance	Total
<u>1) Infrastructure</u>			
Kilns	50	50	100
Water tanks	5	5	10
Roads	15	25	40
Wire fencing	95	50	145
Wells	5	5	10
Dwellings	200	62	262
Warehouses	5	10	15
Sheds	15	22	37
Raised tanks	4	4	8
			<hr/> 627
<u>2) Equipment</u>			
Power saws (1)	-	-	-
Carts (1)	-	-	-
Mules (1)	-	-	-
Motors for pumps (2)	60	6	66
Pumps (2)	3	3	6
Light truck	83	40	123
Tractors	80	40	120
12 t trailer	10	10	20
Tank trailer	8	8	16
Power grader	115	100	215
			<hr/> 566

(1) No influence, these belong to the workers

(2) Influence is only 30 percent

Consequently, the difference between the operating costs of a typical producer and a large scale business producer amounts to what is shown in Table 9.

Table 9

Comparative operating production costs per ton of charcoal  
(February 1985; in pesos)

	Small producer	Large scale producer
- Labour	5 100	5 100
- Social charges	--	2 856
- Amortization	70	753
- Maintenance	80	440
- Administration, etc.	--	1 185
- Supplies	250	250
- Taxes and rates	200	200
	<hr/> 5 700	<hr/> 10 784

The fact that small producers have lower production costs does not mean that they earn more than large scale businesses because:

- (a) They usually depend on a middleman who keeps the larger share of the profit.
- (b) During five or six months (April to September) they work at full capacity. During the other months they reduce production or stop it completely when the market becomes tight.

#### 10. COMPARISON OF FINAL COST

In order to determine the final cost, the influence of interest on the capital invested in infrastructures and equipment and the depreciation of the forest capital consumed must be added to the operating costs. Interest is calculated at an annual rate of 10 percent at constant prices and forest depreciation at 10 percent of the value of the charcoal ex site. Consequently the final cost for each of the operations would be as indicated in Table 10.

Table 10

Comparison of final cost per ton of charcoal, February 1985  
(in pesos)

Item	Small producer	Large producer
Operating cost	5 700	10 784
Interest	101	1 560
Depreciation	900	900
	<u>6 701</u>	<u>13 244</u>

The price of charcoal delivered to Altos Hornos Zapla in February 1985 was \$a 12 000/t which, minus freight, came to \$a 9 000/t ex kiln site. Consequently the large scale company had a loss of \$a 1,784/t on operations and \$a 4,244 in economic terms.

During December, January and February the small producer sold his charcoal at \$a 4,000/t ex kiln site, which means that he also lost about \$a 2 000/t both on operations and in economic terms, with the difference remaining in the hands of the middleman who delivers to Zapla. After March the free market situation was reversed and the small producer received \$a 8 000 to \$a 9 000/t ex kiln site.

The above values are given for cash payment terms; if payments are delayed the financial losses can reach very high levels particularly in a country where interest rates are about 20-25 percent per month.

#### 11. PROFITABILITY OF THE TWO SYSTEMS

In determining the profitability of a production system in Argentina it must be borne in mind that the figures are valid for less than one month if that, and that even during the same month the results of a business are unpredictable because:

1. Inflation fluctuates between 15 and 20 percent per month and consequently the prices of inputs and labour fluctuate continuously.
2. The value of the dollar which governs prices of imported inputs varies from day to day and, generally speaking, becomes devaluated at an unforeseeable but constant rate. Therefore the price of power saws, tractors, etc., which depend on imported spare parts, fluctuates every week or fortnight.
3. Labour prices are set by the state which normally establishes them at the end of the month, if not during the following month, which means that this cost component is an unknown factor during most months.

Apart from the preceding remarks, it must be borne in mind that there are two markets for charcoal each with different prices and forms of payment: the iron and steel market (Altos Hornos Zapla) and the so-called free market mainly for domestic purposes.

#### 11.1 The Iron and Steel Market

At full capacity this market consumes about 40-50 percent of national production and is characterized by:

1. A steady demand throughout the year except when market conditions oblige it to stop operating some smelting furnaces.
2. It fixes prices unilaterally according to the price it receives for iron and not the production cost of charcoal.
3. It establishes a charcoal purchase system based on quality premiums and discounts taking into account size grading, humidity and fixed carbon. The analyses are made by the purchaser without any control by the producer or an arbitrator.
4. When there is a shortage of charcoal the market establishes systems for premiums by volume and filling orders with better prices for larger volumes.
5. It establishes the price for the product delivered at the steel and iron works, paying different prices according to distance from the supplier. In other words, the further the distance the higher the price. It maintains or abolishes this system according to variations in the iron or charcoal market conditions.
6. The purchaser establishes the payment terms and fulfils them as long as he can.

This market is the nearest to Salta province and most of its production goes to that province. Until the end of October 1984 it enabled the large producer to make a reasonable profit. Since that time the price has fallen continuously and in February resulted in bankruptcies, mentioned in Section 10, of charcoal-producing firms that had complied with the labour laws.

## 11.2 The Free Market

This market has the following characteristics:

- (a) During five or six months the demand doubles or triples depending on the duration and intensity of the autumn-winter season and the price or availability of other gas and kerosene-type fuels.
- (b) The final consumer is the public which uses charcoal for heating and cooking purposes, except for a relatively small proportion which is used in small foundries, as activated carbon, and for other uses.
- (c) It reaches the public in paper or plastic bags containing 2-5 and 10 kg of charcoal. It is retailed in stores, supermarkets and service stations.
- (d) It passes through two or three middlemen before reaching the final consumer.
- (e) Only small producers supply this market. The large producers cannot participate in a market which operates mostly as a black market, at least in the producer-to-first middleman stage.
- (f) The producer sells the charcoal at source, i.e. ex kiln site price.

The market price, at least for the producer, fluctuates with demand. In the months from May to September the price is 50 to 100 percent higher at constant value than in the other months. This situation may not occur when the iron and steel market has a marked decrease, as it did in the years 1980 to 1982 (including 1982).

The circumstances of activities such as agriculture in marginal areas also affect prices. If the price of farm products is depressed, part of the farm producers will turn to charcoal-making, causing a drop in prices due to oversupply.

The price of charcoal on the free market begins to rise in March or April and starts to fall in September. During the months of low market prices for charcoal the small producer channels his production to Altos Hornos Zapla, if he has a surplus, or delivers it to middlemen who pay low prices.

The iron and steel market (A.H.Z.) also tries to buy in excess during the months of lower free demand so as to cover the supply shortage during the months of March to September. Another factor influencing prices and supply volumes are the rains which can affect the charcoal production of Eastern Chaco.

On the basis of all those factors it can be said that the profit of the small producer is reasonable and sometimes even large during five or six months of the year and then decreases or becomes negative during the remaining months. A large share of the profits remains with the first middleman who often facilitates production by advancing goods to the charcoal producer.

Briquette charcoal has begun to compete on this market in recent years, although it covers no more than 5 percent of the market.

## 12. ADVANTAGES AND DRAWBACKS OF EACH SYSTEM

### 12.1 Small Scale Production

The advantages of small scale production are due to low capital investment, flexibility in face of changes in the market and comparatively lower production costs (Table 9).

The drawbacks are:

- (a) This form of production is an anachronistic social system typical of "boom-or-bust" economies.
- (b) The small scale forestry activity, exercised together with destructive pastoralism, causes the elimination of forests. More than 20 million ha of semi-arid forests in Argentina have been destroyed and the rest of its forests are rapidly becoming degraded under the impact of these activities.
- (c) As a rule small producers are exploited financially by shrewd tradesmen or so-called "forestry operators" who split the profits without taking any risks.
- (d) In areas subject to this forest exploitation system the population tends to decrease progressively. Today the countless abandoned villages and railroad stations are evidence that the system only leads to desertification of the environment in the semi-arid Chaco. The formerly misnamed "large scale forestry businesses" merely exploited the system and withdrew as the areas became impoverished leaving behind them a pattern that only continues to create human misery.
- (e) In terms of space the cost of state service infrastructures (education, roads, railroads, health) is always insufficient and ineffective in face of the dispersed and migratory population pattern created by the system.
- (f) It is easy to enter and leave the system because it requires little capital and does not create any permanent obligation to wage-earners. This apparent advantage is the system's greatest drawback, because when the price allows a good profit margin this activity attracts a large mass of investors from other sectors (farmers, traders, professionals, etc.) leading to overproduction and creating problems of surpluses in the market which, because domestic demand is seasonal, is very vulnerable and consequently such investors cause prices to drop.

### 12.2 Large Scale Businesses

The large scale business with a sufficiently large forest area which allows long-term permanent activity, a management plan ensuring forest regeneration and appropriate grazing of fodder resources, has the following advantages:

- (a) It can settle permanent population centres with all the advantages this involves: it reduces the space cost of infrastructure and makes it more efficient.
- (b) It ensures the future of the forest mass, maintains a good level of fodder production and a rational wildlife equilibrium.



- (c) The infrastructure of fences, roads and watering points permits the establishment of multi-purpose agro-forestry systems which can diversify and increase earnings.
- (d) It allows both the state and private enterprise to plan for medium and long terms.
- (e) It can take advantage of the benefits of tax reduction for reforestation (capital tax) and for increased production on low productivity rural land.

The disadvantages of a large scale enterprise are:

1. During the months of low charcoal demand it cannot compete successfully because its cost structure is higher than that of the small scale business.
2. It reacts more slowly to unfavourable changes in the market, and when it needs to cut down its production it has severance pay compensation costs which the small producer simply does not pay.
3. It is responsible for the health of its personnel and has extra costs for transporting patients, financing treatment, etc., which also affect costs.
4. It fulfils all the laws in force which provide, for example, for depositing 18 percent added value tax (IVA) on sales. The small scale producer working outside the law receives this 18 percent but does not deposit it. If to this is added the difference in undeposited budgetary assets, the small producer obtains 44 percent more of the value (at given sales prices) than the large scale business. The gravest problem is that 44 percent of the extra illegal profit usually remains in the hands of the middlemen and not with the producer.

### 13. COMPARISON OF SOCIO-ECONOMIC EFFECTS: THE LARGE SCALE SILVO-PASTORAL SYSTEM AND THE TRADITIONAL SYSTEM

Based on the experience of the past ten years in Salta province which has two large scale production units, one focusing on forestry (Salta Forestal), the other operating a silvo-pastoral system (Campo del Norte), valid comparisons can be established with the traditional system. Both these large scale businesses are located in the semi-arid Chaco, which has 511 mm average annual rainfall, which varies between 228 mm in the driest year and 852 mm in the wettest, with years of 60 percent below-average rainfall (Bianchi, 1981, p.105). Absolute maximum temperatures reach 47°C and absolute minimums 5.8°C and the season of frosts is from May to September. During the warmest month the average temperature is 27.6°C and in the coldest month 14°C (De Fina, et al., 1960).

The results of the traditional system have been analyzed in different studies showing clearly that it leads to total impoverishment of the forest, which is disappearing as such, and of the natural fodder resources (Saravia Toledo, 1984).

After only 20-30 years of traditional forestry and pastoral activity, the population abandoned the area because the resources were exhausted, illustrating a typical "boom-bust" economy.

Concerning pastoral activity, Saravia Toledo (1985) analyzed the process of occupation of 60 000 ha with a traditional system, where in 30 years the livestock population decreased from 15 000 to 300 units, forcing the inhabitants to seek temporary employment outside the area to cover their minimum subsistence needs or else to emigrate outright.

Comparing the large scale business with the traditional forestry and pastoral exploitation system in a typical area of 60 000 ha, after 40 years of exploitation the socio-economic results would be as indicated in Table 11.

Table 11  
Comparison of large scale and small scale businesses  
(in US\$)

	Large scale business	Small business
<u>No. permanent jobs</u>		
- Forestry activity	120	-1/
- Livestock activity	30	202/
<u>Annual gross income</u>		
- Forestry	400 000	-
- Livestock	400 000	15 000

1/ During 10 to 15 years, while the forest lasted, it created forestry jobs.

2/ Employed temporarily outside the area for several months.

#### 14. CONCLUSIONS

Until now the semi-arid forests in the Argentine Chaco region have suffered the impact of the traditional forest and pastoral exploitation system, which can be defined as a "non-management" system. The consequences are frightful from any point of view, be it socio-economic or biological. Abandoned villages and railroads, biological desertification, human misery and chronic social instability are the consequences of this process which has destroyed more than 20 million ha of forest turning them into unproductive brush.

The experiences in Salta province indicate that the process of destruction can be reversed and that an appropriate balance of the ecosystem can be maintained in a stable silvo-pastoral production system, provided that experimentally-tested management norms can be applied.

How far these experiences could be extended in a country afflicted by one of the world's highest inflation rates which affects the whole production mechanism is a challenge that cannot be met easily.

Argentina seems to have two fundamental tools to organize exploitation of the resources in its semi-arid region, halt the processes of destruction and bring social stability to an area which until now has been one of population expulsion. These tools are:

1. State enterprises which are the natural market for the leading forestry products of the semi-arid forest, i.e. railroad sleepers and charcoal for Altos Hornos Zapla. All Argentina's railroads are state-owned and Altos Hornos Zapla belongs to Fabricaciones Militares which is also a state-owned company.
2. The semi-arid Chaco provinces have large forest reserves in their public lands. Probably 80 percent of the national forest reserve for sleepers and 60 percent of its reserve for charcoal can be found in the state forests.

These two factors would suggest that gradual coordination between the state market and the producers could lead to a rational exploitation of resources under state regulation and supervision, allowing a sound and permanent socio-economic evolution of the semi-arid region. In this scheme charcoal production would play a fundamental role because it is an activity that can generate a sizeable labour demand and it constitutes a necessary management tool in semi-arid forests, since it permits organization and improvement of the forests if exploitation is practised according to ecological standards.

In Argentina the known petroleum reserves are sufficient for ten years according to pessimistic estimates and 20 years according to the optimistic ones. Natural gas could cover the present demand for 100 years but, if the petroleum is exhausted, a higher demand for this product can be foreseen and, therefore, the reserve would last for a shorter time. All this means that it is of fundamental importance for Argentina to recuperate, preserve and improve its semi-arid forests, which are producers of fuels that constitute a renewable natural resource of incalculable value for the future.

The establishment of policies which can offer a reasonable framework of stability and profitability for large scale charcoal businesses and a gradual technological evolution of the small producer group would be a first step toward the attainment of objectives that can rationalize the system.

In the final analysis the problem is not to choose between two options leading to the same, or a similar, goal. The dilemma consists of whether to maintain the present production structure with all its negative consequences, or to introduce a social and technological change in harmony with the development stage which humanity is experiencing at present.

REFERENCES

- Bianchi, A.R. Las precipitaciones en el Noroeste Argentino.  
1981 INTA Salta.
- De Fina, A. et al. Difusión geográfica de cultivos índices en las  
1960 provincias de Salta y Jujuy y sus causas. Instituto de Suelos y  
Agrotécnica INTA. Publicación No. 67 Buenos Aires.
- Dorfman, A. Historia de la industria argentina. Ed. Solar/Hachette -  
1970 Buenos Aires
- FAO. Simple technologies for charcoal-making. FAO. Rome.  
1983
- FAO. Sistemas Agroforestales en América Latina y El Caribe. Oficina  
1984 Regional de la FAO. Chile.
- Frith, A. Plan de manejo 1975-80, Lotes Fiscales 35-36. Documento  
1975 No. 12 NOA II Forestal - Salta.
- IFONA. Anuario de estadísticas forestal. Instituto Forestal Nacional  
1982 Buenos Aires.
- Saravia Toledo, Carlos. Manejo silvo-pastoril en el Chaco Nor-  
1984 occidental Argentino. III Reunión de Intercambio Tecnológico en  
Zonas Áridas y Semiáridas. C.A.D.I.A. Buenos Aires.
- Saravia Toledo, Carlos. La Tierra pública en el desarrollo de las  
1985 regiones Áridas y semiáridas. I-La experiencia del Chaco  
Occidental Argentino. IV Reunión de Intercambio Tecnológico en  
Zonas Áridas y Semiáridas. C.A.D.I.A. Buenos Aires. (in press).
- Whyte, A. & Burton, I. The human ecology of the dry Chaco, in the  
1983 province of Salta, Argentina. Toronto. Canada.

LIBERIA: THE LEGAL AND INSTITUTIONAL FRAMEWORK  
FOR CITIZEN PARTICIPATION IN FOREST INDUSTRIES

by

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## 1. INTRODUCTION

The greater participation of citizens in the wood-processing industry is a natural development from Liberia's interest in seeing that a great proportion of benefits from forest exploitation remain in the country. For a long time, harvesting, processing and trade in forest products were almost exclusively in foreign hands. In addition, the industry's emphasis was on export of quality logs of primary species, resulting in large volumes of secondary wood going to waste.

Being aware that local processing would help reduce waste and increase the value of the forest products while also generating employment opportunities and increasing aggregate profits to the national economy, Liberia introduced a new timber processing policy that became effective in 1973. It stipulated in concession agreements that local wood processing per company should increase annually in increments of 20 percent starting from 1973 so that by 1977 all logs harvested would be processed locally. After the latter year there would be no more exportation of logs. However, by 1980 Liberia exported 64 percent of her log production. The policy was therefore never fully implemented.

In their analysis of causes for this failure, Gillis, Mescher and Peprah (1983) list the following as major factors:

- (a) Logging companies benefit more from exports of logs than from processed timber.
- (b) The companies do not want to make additional investments that will not yield quick profits.
- (c) The desire by concession holders to maintain the supply of logs to parent companies or business partners abroad.
- (d) Logging companies do not regard wood processing as their primary activity in Liberia.
- (e) The primary aim of companies is to export high quality species as logs to their processing plants or marketing outlets in Europe, which is the largest market for Liberian timber.

Regarding the host country itself, the failure to implement the above policy may have been due to lack of adequate staff to enforce the policy, a strong desire to obtain foreign exchange to back national budget and weakness in bargaining with the predominantly foreign concession companies because of the lack of experience in logging and timber processing industries. The forest resources, therefore, continued to be "creamed off" and other benefits including local employment remained small. In short, the forest industry sector as a whole was inappropriate relative to the country's needs.

A major step to increase local participation in the hope of thereby expanding local benefits from the sector was taken in 1976 with the amendment of rules governing concession agreements to require at least 25 percent local shareholding in every concession. This was in addition to the decree requiring increased local processing.

## 2. ANALYSIS OF THE SITUATION

### 2.1 Background

#### 2.1.1 Forestry in Liberia's economy

Forestry and forest industrial enterprises contribute substantially to the national economy. An initial target of twelve million dollars set for taxes to be generated by forestry was often increased until 1980-81. Because of high log demand this target was frequently exceeded; in 1979/80 by nearly three million dollars. Forestry was then the third largest earner of foreign exchange, after iron ore and rubber.

It is still playing a tremendous role in generating essential revenue for the Government. The depression in the timber trade since 1981-82 and the general economic problems have decreased the revenue contribution of forestry to only US\$ 9.57 million in 1981-82 and to US\$ 6.87 million in 1982-83. The reduction resulted mainly from the adjustment of the industrialization incentive fees, the major component of the forest revenue.

In spite of the decline, Gillis *et al.* (1983) calculated that in 1980 the forest sector, in terms of value added, contributed 5.1 percent of GDP, 7.6 percent of total taxes and 14 percent of total exports. It is generally believed that with wise management, Liberia's forests can sustain even higher levels of economic contribution in future. However, in 1976 the forest sector employed less than one percent of the total labour force in the country. This low proportion is a reflection of the low degree of processing within the country which leads to minimum employment.

#### 2.1.2 Forest resources

Liberia comprises a total land area of 9.84 million ha. Out of this, 5.71 million ha or approximately 58 percent is estimated to be high forest land. With this forest area Liberia was classified as one of the forest-rich countries in West Africa. Out of the total forest area, 1.68 million ha are National Forest Reserves. Approximately 3.9 million ha are classified as productive forest and are under forest management. These are rough estimates and there is an urgent need to update the data on forest size and quality. The updated information will enable Liberia to plan better and improve the management and utilization of its forest resources.

The land tenure traditions and policies of Liberia have some bearing on prospects for citizen participation. In addition to the state forest reserves, the Government owns most of the land apart from limited areas of freehold and leasehold property (including agriculture/rubber estates, etc.); nevertheless state land is often under *de facto* loose and unregistered traditional control. The forest resources growing on such land are freely accessible to local inhabitants for all non-commercial harvesting (fuelwood, etc.) as well as for clearing for subsistence agriculture. This "ownership" pattern is not conducive to efforts at wise management of the resource or its commercial exploitation. Thus the land tenure system in Liberia is a constraint which prevents local communities from establishing and maintaining forest estates for commercial use. Forest as a source of revenue could be used to develop rural communities if it was owned and operated by themselves. Where such communities are technically and financially unable to operate these forests, they could lease them to concessionaires directly like the national government does.

The Forestry Development Authority could assist with the management and facilitate entering or concluding and signing agreements with concession companies. In this case the benefits derived from the operation would go to the communities. As the fruits of their efforts are visible, the communities would be encouraged to show more interest in reforestation programmes.

In the case of forest reserves and other public lands close to human settlements which have been let as timber concessions, the tradition is to transfer all revenues therefrom to the central government and none to local people who therefore see little of the financial benefits to be reaped from forest-based operations. There is also no provision for significant influence by local people on whether and under what conditions concessions operate: their main role is to provide labour. They may additionally gain from schools, clinics, etc., which government may require a concessionaire to construct.

### 2.1.3 Logging, forest industries and the timber trade

There are not many industrial activities in the forest-based sector of the Liberian economy. Beyond the logging stage, few timber processing plants such as sawmills, plywood and veneer mills, or furniture factories have been established. Pulp and paper are not produced in the country. Lack of adequate knowledge and skills in timber business coupled with inaccessibility of the forest resources prevented Liberia from undertaking productive commercial activities in the forestry sector until recently. The heterogeneous nature of the forests (over 200 species), the small size of the Liberian market, funding problems, and absence of an appropriate and attractive timber utilization policy contributed to the delay. Serious efforts in this regard were only started in the latter part of the sixties. The present industrial activities consist of logging, sawmilling, and production of veneer plus plywood. Production in 1980 was 745 000 m<sup>3</sup> of logs (475 000 m<sup>3</sup> exported), 53 000 m<sup>3</sup> sawnwood (37 000 m<sup>3</sup> exported), 7 600 m<sup>3</sup> veneer and plywood (3 000 m<sup>3</sup> exported).

## 2.2 Ownership Aspects and Current Levels of Citizen Participation

Logging and processing activities are dominated by private sector operations working under a system of concessions granted by Government through its empowered agency, the Forestry Development Agency (FDA). Gillis et al. (1983) estimated that 92 percent of such concessions were granted to foreign companies (compared to 70 percent in Cameroon and 36 percent in Gabon). As of 1980, they report seven foreign firms are operating in Liberian forestry. The total accumulated foreign investment in the sector stood at US\$ 124.87 million compared to only US\$ 22.03 million local investment, which represents only 15 percent of the total.

A survey in December 1980 showed that of the 20 large mills which accounted for 90 percent of Liberia's installed capacity, 80 percent (16 by number) were mainly foreign owned and these alone accounted for 85 percent of the country's total sawmilling capacity. Only 10 percent were wholly Liberian owned and another 5 percent were Liberian dominated. These levels of local participation were a considerable improvement on 1976 when 91 percent of total installed capacity related to foreign-owned sawmills.

If other wood industries are added to sawmilling, the profile of ownership for 1980 was, according to Gillis et al. (1983), as shown below:



<u>% Local Ownership Range</u>	<u>Enterprises</u>	
	<u>Number</u>	<u>%</u>
75 to 100	2	8
50 to 74	3	13
25 to 49	14	58
0 to 24	5	21
<u>Total</u>	<u>24</u>	<u>100</u>

The logging activities and the timber trade both lack separate data on current participation levels. It is known however, that as of 1976, 76 concessions have been granted. A World Bank/FAO mission in 1977 remarked then that many of these activities were linked to overseas' end uses of logs, that they tended to concentrate on removal of high value species and that the future availability of these species was endangered. They also noted that there was insufficient involvement of nationals in sector management and furthermore that in industry, "the influx of strong foreign investors ... has made it difficult for the small Liberian entrepreneur to remain in a competitive position."

A significant shift was already occurring then (which continues now) whereby small operators - mainly Liberians - are subcontracting to larger foreign log buyers and processors in order to tap the latter's markets. These small operators otherwise find it difficult to provide suitable processing facilities, as required by law, if they wish to engage in log exports. For new and inexperienced companies that are not yet well established in the timber trade the simplest procedure is to sell through agents and brokers.

There is also a number of middlemen and brokers who purchase logs and other timber products within the country on behalf of foreign enterprises. Again other companies, which are experienced and established, can sell timber also on contract basis. The advantage of selling through these agents is considerable, particularly for newly established companies or local timber firms without experience and established commercial credit. However, the small firms have to forego some advantages that they would have if they were able to reach markets directly. ATLANTA (1978) discusses these various options of marketing procedures. It suffices here simply to indicate that these agents are capable of creating confidence between shippers and buyers, which local firms badly need in order to penetrate the timber trade.

Another problem which faces local forest enterprises is their weakness in grading and ability to determine the quality of timber intended to be sold. Here again expatriate firms have the advantage of experience over domestic firms.

## 2.3 Selected Sector Problems

In addition to problems of market access mentioned earlier, nationals face other barriers in forest industries. In all cases the problem may exist for both foreign and local operators but the burden is more insupportable for the latter due to their financial, technical and institutional weakness. The problem areas are the following:

- (a) Inadequacy of infrastructure in concession areas (especially roads and power supply).
- (b) Proliferation and level of fees and sundry taxes payable by concessionaires.

### 2.3.1 Infrastructural problems

The condition of roads plays a crucial role in logging operations. In concession areas, the construction of roads is the responsibility of the concessionaires. The Government of Liberia is only responsible for trunk and other major public roads to connect those constructed by the timber enterprises. This requirement has necessarily meant that only organizations with substantial financial resources or access to loans can participate to a significant degree. For most citizens, even if they group into cooperatives, their capability to raise funds for costly road networks is often an insurmountable problem.

The small operators are also increasingly at a disadvantage as forests close to ports are worked out and exploitation moves further inland into inaccessible locations; the cost of new roads is then even higher and to this must be added greater haulage charges to ports as well. Power supplies are another problem; often in Liberia, mains electricity is unavailable in the forested regions and concessionaires (who are required to invest in processing facilities if they want to export) must install their own costly diesel or steam power plants. This can push total investment costs beyond the reach of most citizens.

### 2.3.2 Concession and other fees

Liberia imposes a wide range of charges on forestry and forest industry enterprises, some as fixed amounts, others pro-rated on volume and variable according to value of species. The following is a list of the various fees, charges and taxes which may be charged depending on the type of forest-related operation:

- (a) Licence fees on concessions;
- (b) Land rental or annual ground rental;
- (c) Volume based charges on timber harvested;
  - (i) Reforestation fees;
  - (ii) Industrialization incentive fees (formerly stumpage fees);
- (d) Severance fees;
- (e) Export charges;
- (f) Corporation income tax;
- (g) Tree marking fees;
- (h) Forest products fees (sawnwood, plywood, etc.);
- (i) Fines (penalties).

They are fixed rates and are defined by schedules in the forest regulations promulgated by the Forestry Development Authority in keeping with Liberia's Revenue and Finance Law. The only exception is the industrialization incentive fee which is adjusted according to market conditions.

Just as for infrastructural costs, the level of such charges is not an issue but the impartiality with which they are levied on all concessionaires has implications for citizen participation.

Thus, establishing logging and wood-processing industries is not an easy task for the average Liberian. There are also constraints which must be overcome should he succeed in establishing an industry. While foreign firms possess managerial and technical skills and adequate working experience in the timber business, Liberians do not have such

qualities. Furthermore, they do not have the advantage of easily obtaining loans for investment in the forestry sector. On the other hand, the expatriate companies have access to financial institutions that offer them credit facilities. Acquisition of capital is consequently a considerably greater constraint to Liberians than to expatriate or foreign firms.

In granting concessions, the Forestry Development Authority offers the same conditions of contract to both Liberian and foreign companies. No distinction is made between the two groups. Consequently, the stronger always survives. In this case, the expatriate is very often at a great advantage in bargaining.

The Liberians who are in the timber business hardly penetrate the dominant European market directly, because they do not know the marketing channels well, that are often at the disposal of the foreign firms. On the other hand, the local market is not capable of absorbing the logs which are exported. Even if it were possible to sell logs on the local market, the prices for them would be very low in comparison with those on the export market.

## 2.4 The Existing Legal and Institutional Framework

### 2.4.1 An open economy

The overall environment for industry and commerce is governed by a laissez-faire approach to managing the country's economy. This has been confirmed in the Peoples' Redemption Council Government policy statement giving directives for the current development plan:

"... The Government of the People's Redemption Council confirms its commitment to the free enterprise system of economic pursuit ..."

"... Government will continue an open investment policy, encouraging both local and foreign private investment. Public investment will be used largely as an instrument to stimulate private investment. Priority will be accorded to productive investments which have a high domestic resource utilization impact, particularly in terms of furthering the employment of Liberians. There will be no nationalization of private business interests in Liberia."

Accordingly, Liberia provides generous incentives to investors as can be clearly observed from the Investment Incentive Code approved on 21 March 1966 and published 15 April 1966; and from the Act Amending that Code approved on 6 March 1973 and published 28 February 1975. These are further elaborated under "The National Investment Commission Act of 1976", approved on 6 September 1979. In general terms, the Acts provide for:

- (a) an open invitation to foreign investment generally;
- (b) guarantee of non-nationalization and non-sequestration;
- (c) the absence of restriction on the remittance of profits, dividends and repatriation of capital;
- (d) attractive tax and other investment incentives;

- (e) tariff protection for infant industries;
- (f) an opportunity for expansion of trade relations with other countries in Africa using Liberia as a base, since Liberia is a member of the Economic Community of West African States (ECOWAS) and the Mano River Union.

There is an additional attractive feature of the Liberian investment policy. It is the fact that the Liberian currency is fully convertible and there are no exchange control restrictions. This facilitates multinational investments and international transactions.

Provided in the Amended Investment Code of 1973 and published in 1975 are certain reductions or exemptions from customs duty and income tax and other benefits which the Government offers to new and expanding business enterprises for the purpose of promoting the economic growth and development of Liberia. In case of approved imports of machinery and equipment to be used in establishing the approved investment project, an exemption from import duty up to 90 percent of the dutiable value of such imports is permissible. Such exemption is granted for a period of five years and may be extended for an additional two years. The provisions of the investment code apply equally to citizens and foreign firms except for elements which can only interest foreigners.

#### 2.4.2 The legal basis for participation

The overall policy framework, under which the specific legislation permits Liberian participation in forestry exploitation enterprises, is Government's desire to see better spread of developmental benefits. The Peoples' Redemption Council has declared that for their policy "... A basic tenet will be to assure that benefits from economic growth and development will be enjoyed by a large and increasing number of Liberians."

In the forestry sector arrangements to achieve this have been made with regard to concessions by the issuance of appropriate regulations. Thus, although in concluding timber concession agreements the Government of Liberia (through FDA) treats both citizens and expatriates alike and there are no differential treatments meted out to nationals, one exception is the stipulation in foreign contractual agreements requiring that twenty-five (25 %) of shares sold by concessionaires be reserved for Liberian nationals. Under this provision citizens' Stock Purchase under Timber Concession Agreement is ensured as follows:

- (a) Commencing with the first issue of any voting shares and continuing with respect to all subsequent issues of shares, the Concessionaire shall offer a minimum of 15 percent of each issue shares to a cooperative or cooperatives in the County of the concessionaires operations and a minimum of 10 percent shall be offered to other Liberian citizens.
- (b) Should all or part of such shares so offered remain unsubscribed or unpaid for at the end of six (6) months, then the concessionaire shall deposit said unsubscribed or unpaid for shares with the National Investment Commission who shall hold them in escrow for a further period of two (2) years and six (6) months during which period a cooperative in the Concessionaire's County of operation or other Liberian citizens may purchase said shares from the percentages reserved for them as detailed in paragraph (a)

above. After said period of a total of three years, any shares that remain unsubscribed or unpaid for shall be returned to the concessionaire who shall then offer them to existing Liberian shareholders, said offer to remain open for a further period of six (6) months. After expiry of this last period of six (6) months any remaining unsubscribed or unpaid for shares shall revert to concessionaire who may dispose of them as he sees fit in accordance with the Association Law.

- (c) Should a cooperative or cooperatives in the County of the concessionaire's operations or other Liberian citizens who wish to take up the reserved shares be unable to make full payment, then said cooperative or cooperatives or citizen shall make a down payment of a minimum of ten percent (10 %) of the value of said shares and the concessionaire shall finance the remaining ninety percent (90 %) by dividends payable on said shares.

It would be hard to find more elaborate or generous arrangements for ensuring that citizens do participate; except for the very largest share offerings, the 10 percent requirement would on the surface at least appear to be within reach. It is not clear, however, if this law is responsible for most of the recent increase in local participation in sawmilling. Secondly, it is not known yet what degree of importance can be attached to participation in terms of shareholding only as opposed to more substantial control. It is also unclear if the benefits accruing to the country have improved with this provision.

#### 2.4.3 The institutional basis of participation

The legal provisions presented earlier can be said to indicate the potential or scope of what can be done; whether it is actually achieved largely depends on institutional arrangements. The available information suggests that the sectors' prime official organization is the semi-autonomous Forestry Development Authority (FDA). It is a government body charged with promoting sector development and has activities ranging from conservation, management, plantation, licensing/concessions, policing forest activities and the trade aspects, etc. It is a heavy burden and evidence suggests the FDA is not coping fully.

With specific regard to its role in assisting citizen participation, the FDA is not known to be specially required to promote such development and does not appear to have a special section or set of programmes directed specifically at aspiring citizen-entrepreneurs or their organizations. Furthermore, both the terms of reference for the FDA as a corporate body and the Forestry Act generally do not seem to give the agency discretion in interpreting the "open door" policy. In other words, it does not seem that the FDA can in its own right do anything but treat weak aspiring citizens in exactly the same way as it does powerful transnational corporations when drawing up concession terms, applying incentives, or setting the conditions for licensing.

On their part, the citizens seem ill prepared to do more than just buy shares in concessions. They do not have the skills to fully understand what else they could do and they very often cannot contribute effectively to enterprise success. The law does not seem to require the FDA or any other agency to set aside any funds or other inputs for strengthening the local peoples' skills and capabilities through training, through credit facilities, through cooperative resource creation/

processing/marketing. At the same time, it is well known that multinational firms always invest heavily in their own skills development and in all other aspects and thus the disparity in capabilities between the two groups tends to grow.

The multiplicity of regulations and especially of levies, fees and taxes related to harvesting, processing, and trading in wood could be another important area of problems in the sense that such a situation is more burdensome to small and new operators than to large established corporations.

The limited degree of private landownership is the last of the major factors with a bearing on participation. It seems plausible to suggest that if citizens owned their land and the forests on it or had other strong title to the resource, they might find enterprise start-up far easier than now when they have to satisfy so many preconditions on Government concessions.

### 3. CONCLUDING REMARKS

On the basis of limited available information, this paper has looked at Liberia's attempts to increase citizen participation in forest industry development with a view to increasing the benefits retained in the country. The emphasis seems to have been on making legal provisions for such participation. There is little evidence of significant institutional and other arrangements to convert the legal potential into feasible and beneficial reality. Nevertheless, the past few years have seen some measurable progress toward at least part ownership of individual enterprises; clearly more can be achieved and the benefits from such participation can itself probably be enhanced. At this stage, it seems desirable only to summarize some of the main issues raised in the analysis.

It is assumed that increased citizen participation is a valid goal and would lead to improving the sector's contribution to Liberia's development. The issues appear to be:

1. An overriding consideration relates to Liberia's commitment to an open economy and specifically to interpretation of this philosophy by the FDA to mean identical treatment of citizen and foreign firms. The issue does not seem to be whether or not the philosophy is correct, but whether it is reasonable to treat as equals two parties which very clearly differ in skills plus experience, access to financial resources, markets, technology and influence generally. The danger would appear to be that citizens being in the weaker position may never be able to achieve any prominence and through no fault of their own.
2. The second issue derives from the first and is about whether adequate provision has been made to create institutions or to empower/enable existing institutions to help citizens benefit from the legal provisions for participation. This does not seem to be the case and under these circumstances two main developments could take place: the first is that apparent participation could occur on paper as recorded shareholdings, etc., but real influence would remain elusive as would be the expected increase in national benefits. The second is that even "paper participation" would fail to fully occur and the country's aspirations would thus be openly frustrated.

Many more arguments could be raised and some tentative recommendations given, but it seems best to first observe developments for some more time. The country has clearly adopted a commendable policy but it may well have to follow this up with institutional arrangements to ensure that its objectives are achieved.

#### REFERENCES

- ATLANTA      Feasibility study on the logging and timber and processing  
1978      training centre. Bomi Hills Industrie und Unternehmensberatung  
         GmbH. Hamburg.
- FAO/IBRD      Draft report of the Liberia forestry project. Rome.  
1977
- Gillis, M., Mescher, M., & Peprah, I.      Foreign investment in the  
1983      forest-based sector in Africa. (Draft prepared for  
         FAO, Rome).
- Forestry Development Authority.      1982, 1983 Annual Reports. Monrovia.  
         1982: Forestry Regulations.

FOREST INDUSTRY IN ITALY  
CONSTRAINTS, SOLUTIONS AND POLICY ISSUES

by

F. Pàstina

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## 1. INTRODUCTION

It has been said that after the iron age and the age of artificial materials, civilization is now entering a "new" wood age. This statement may, however, only be partially true because the age of wood has never really vanished. From the early beginnings wood has contributed to the progress and civilization of mankind. Wood has always been the companion of man in his daily activities. This is particularly true for Italy where wood has contributed in many ways to the different periods of Italian civilization. It has played a role in the development and improvement of the way of life and in such areas as construction, ship building, art, etc.

In our time a rediscovery and a new appreciation of the value of this material is evidenced in a world in which other materials are even more scarce.

At present the Italian forest industry sector is facing many problems, of which the most serious one is a shortage in the production of domestic roundwood which is counteracted by considerable imports of industrial roundwood. The negative influence on the balance of trade caused by these imports and the imports of semi-finished forest products, mainly pulp and sawnwood, is, however, offset by exports of finished products, including furniture, manufactured by the very dynamic Italian wood-processing industry.

## 2. FOREST RESOURCES

### 2.1 Historical Background

Around the year 1500 some 15 million ha, representing 50 percent of the total area which now comprises Italy, was covered by forests. By the year 1925 the forest area had been reduced to about 5.5 million ha. In about four centuries the forest area had, therefore, been reduced by almost 60 percent. This drastic reduction was caused by irrational utilization, forest fires, overgrazing, foreign occupation, war-time requirements and other factors accelerating the destruction of the forest.

### 2.2 Distribution of Forests

Out of a total area of over 30 million ha, Italy is covered by more than 6 million ha of forests, which represent some 20 percent of the total area of the country. Of this forest area, only 43 percent provide roundwood for industry. The remaining 57 percent is composed of coppice from which wood is obtained for fuel, as fuelwood and for the production of charcoal. Eighty percent of the total forest area is covered with indigenous hardwood species and 20 percent with coniferous species. Distribution of the natural forest is uneven:

- 62 percent of the forests are located on mountains
- 33 percent are on hillsides
- 5 percent are on flat land

The geographical distribution is relevant to the issues affecting the wood-processing industry. The orographic location of a large part of the national forest precludes an easy exploitation. The forest distribution figures also imply that the natural forests in Italy serve a purpose which is basically "protective".

It is interesting to note that approximately 62 percent of the forest land is privately owned, 32 percent by municipalities and other national and/or regional public authorities, and only 6 percent by the State. Forests owned by the public sector are distributed between several

bodies, including municipalities, regional forest companies, national utility companies, the national oil agency, the national forest central authority, and other Government organizations. This fragmented ownership has made a rational management of the forests rather difficult, resulting in the production of roundwood low in quantity and poor in quality.

### 2.3 Sources of Wood Supply

Most of the roundwood produced in Italy comes from the northern regions. The natural coniferous forests are located in the alpine regions which provide 66 percent of the domestic supplies of industrial roundwood. Plantation wood, particularly poplar, has always played an important part as raw material for forest industries in Italy. In the past, 60-70 percent of the industrial roundwood extracted from plantations has been poplar. Other plantation grown species are Pinus strobus, Pinus radiata and Eucalyptus spp.

Between 1947 and 1979, 62 percent of the domestic supply of roundwood for industrial use came from natural forests and 38 percent from plantations. In the same period, 35 percent of fuelwood came from plantations.

### 3. STRUCTURE OF THE FOREST INDUSTRY

The Italian forest industry sector is composed mainly of small scale mills although large operations also exist. The primary advantage in the wood products industry in the northern part of Italy is the existence of wood resources composed of coniferous species. Most of the small producers in the northern regions use the local natural forests. There are, however, also many larger firms which base their wood products industry on imports of roundwood logs.

Technological changes in the wood-processing industry in Italy have been aimed at reducing production costs and improving the quality of the finished products. Increases in yield, savings in energy and reductions in labour requirements have been sought so as to offset increasing prices of raw materials, energy and the cost of labour. Mechanization and automation have substantially reduced the labour requirements per unit of output. A level of technology has been selected not only appropriate to local raw material resources and infrastructure, but also to the type and scale of production.

Labour intensive technology often remains the most appropriate choice, especially for smaller mills producing products for the local market. The majority of these mills operate very efficiently and the quality of the products is excellent.

Originally sawmilling was a labour intensive industry with relatively low requirements in capital and energy. Since then the trend in all developed countries has been to substitute capital for labour. At present the composition of the industry varies from small units with low technology to completely automated large units.

Man/hour requirements per cubic metre of output may vary from less than 5 to more than 50. It has to be pointed out, however, that productivity, profitability, recovery and quality have been improved more easily and at lower cost by better management, training, improved skills and maintenance, than by better machines.

Technological developments for temperate zone softwood include integrated multi-band saws, chippers and thinner cutting blades. Other advanced technology includes sensors to aid in sorting, location and optimal positioning of feedstock and programmable controllers and micro-computers. An important improvement in the field of managerial technology is computer-assisted optimization of production steering and scheduling.

These advanced technologies, although currently concentrated in the big mills, are influencing - through their impact on the relative competitive positions - the development of smaller wood-processing industries as well.

Many sawmills add value by further processing of the products through drying, preservation, planing, grading and, in some cases, stress-grading.

Sawmilling generates large amounts of wood residues (bark, slabs, edgings, shorts, offcuts, chips, sawdust), which represent approximately 40-50 percent of the roundwood. Economic utilization of these residues is a necessity and their value actually rises with the increasing prices for raw material and energy. Wood residues are mainly used as raw material in the production of particle board, fibreboard and pulp and paper; they are also utilized for the generation of energy consumed by wood-processing industries.

The cost of raw material constitutes a large proportion of the total production costs. The price of sawnwood, although fluctuating with general business conditions, has remained fairly stable. Sawmills have reacted to the increasing costs of raw material, labour and energy by increasing production efficiency through improved recovery and production speed, and savings in energy and labour.

The quality of sawnwood depends essentially on the raw material properties such as strength, durability, appearance, defect frequency, etc., and on the manufacturing technology (dimensional accuracy, surface quality, grading, defects elimination, etc.). Over 50 percent of sawnwood is used directly in building and construction. Higher quality sawnwood is used for secondary processing (quality furniture, joinery and engineered timber structures). Sawnwood is a bulk commodity and the market is sensitive to overall economic trends and especially to the level of building activities.

The majority of the secondary wood-processing industries is based upon imported raw materials and is located at a distance from national forest resources. Some units are integrated with primary wood-processing plants; other independent industries have been established within the same region as the latter. Sawnwood dominates as raw material for those secondary industries manufacturing products destined for the construction industry. Wood-based panels, mostly particle board, are used in the manufacture of furniture.

The level of technology extends from manual work with hand-tools in small workshops to large scale industries using automated machinery for streamlined production. Enterprises using modern technology and mechanical equipment are dominating in terms of value of output.

The increased local demand for forest-based products has been one reason for the expansion of the secondary wood-processing industries. Economies of scale in this sector are not such as to make the small company inefficient. This implies that factories start on a small scale and gradually expand operations as markets, capital and skilled labour become

available. To say that the industry is not characterized by pronounced economies of scale does not mean that there are no advantages in operating large plants, but these advantages are not great enough to shut the small producer out of the market.

#### 4. CONSTRAINTS TO THE DEVELOPMENT OF FOREST INDUSTRIES

Historically the production of roundwood in Italy has not been able to keep up with the internal demand. Until the period ending with the second world war, the deficit was approximately 20 percent of the total domestic requirements. In recent years, local production has gradually become even more deficient in supplying the rapidly increasing demand. In 1982, the total production of roundwood was about 12 million m<sup>3</sup> of roundwood equivalent and imports reached 30.85 million m<sup>3</sup> of roundwood equivalent. These imports were necessary to meet the total demand of 40.50 million m<sup>3</sup> of roundwood equivalent. Expressed in percentages, the demand in 1982 was met for 25 percent by domestic production and for 11 percent by internal recovery, i.e. a total of 36 percent and the remaining 64 percent by imports. This contrasts rather drastically with the 20 percent deficit mentioned above for 1945.

It highlights the shortfall in domestic roundwood production and the ever increasing dependence on imports to cover the country's requirements for wood-based products.

The main problem of the wood-processing industry of Italy, which employs hundreds of thousands of workers in the various sectors of the primary and secondary industries, centres around substantial imports of raw materials. The livelihood of so many people in the wood-processing industry depends on these raw materials that the production of domestic raw materials must be encouraged so as to guarantee an adequate supply of domestic raw materials.

In addition, the plywood, blockboard, particle board and fibre-board industry have some constraints which are related to the development of infrastructure and skilled manpower.

#### 5. INSTITUTIONAL FRAMEWORK

The forest policy in Italy is aimed at decentralization and the organization of its operational activities is decentralized in the country's twenty regions. Coordination is delegated to the General Direction of Forestry of the Ministry of Agriculture and Forestry, which is responsible for the forest policy of the entire country. The forest policy is based on the relationship between utilization of resources, production, and conservation of the environment. It has been designed to reduce the commercial deficit of roundwood, to ensure an active defence of the soil and to increase the income of the local population.

The aim of the regional authorities is to keep the value added of the forest inside their region. Priorities are given to integrated projects where locally produced raw materials are utilized in mills located in the same region.

Forest utilization contracts regulate duties and rights of timber harvesting companies. There are different types of contracts, depending on forest property and scope of the operation, and they include forest management contracts and timber harvesting contracts. Usually the forestry enterprise has the right to undertake logging in a determined area without the responsibility for forest management, although the silvicultural cutting regime is usually laid down and the quantity or area to be harvested annually or periodically is specified. In some cases, the only

form of forest disposal is under short or medium term harvesting contracts which leave considerable freedom to the grantee with regard to harvesting techniques, road construction methods and utilization standards. In other cases, the grantee will, however, have to plan and control the harvesting more intensively; the annual exploitable volume is fixed, the cutting area delimited and the trees to be removed marked by the forest service; the logged area will be inspected and wasteful logging methods penalized. In fact, the operations of the grantee are under close supervision by the forest service.

#### 6. THE NEED FOR A COORDINATION CENTRE

It is felt that, if the forest policy aimed at decentralization is to be more effective, integration between wood production and the forest industry has to be strengthened and to be supported by the regional forest departments. Forest property in Italy is held by the public and private sector in a ratio of approximately two to three, which shows the importance of the private sector in forestry. Forest industry and commerce are in the hands of the private sector and services, such as research and development, training of personnel, are public. These branches have in the past been left practically without any coordination, neither among themselves nor between the private and public sectors. Both sectors have realized the growing need for a comprehensive approach to the many problems common to the different branches and for a common policy.

In 1983 the private sectors of all branches of the forestry sector formally invited the public organizations operating any wood-related activities to establish jointly a voluntary organization for the coordination of the Italian so-called "wood system". "Wood system" in this context means all branches of forestry, forest industry and correlated activities managed by the private and public sectors.

#### 7. THE "PERMANENT CONFERENCE OF THE ITALIAN WOOD SYSTEM"

The principal aim of the Permanent Conference of the Italian Wood System is to promote a national policy for the entire "wood system". Membership assures the presence in the Conference of the interests of both the private and public sectors. A tangible result of the activity of the Permanent Conference has been the coordination between the different branches in both sectors. This coordination has been so successful that it is no exaggeration to say that, through the Permanent Conference, Italy has an organization which represents the entire "wood system" and which is able to speak with one voice as valid counterpart to the national Government and also to international organizations such as the European Economic Community.

It also institutionalized a relationship between producers and consumers of wood at the national level, which in the long run should optimize the Italian "wood system".

#### 8. INTEGRATED OPERATIONS

Bethel (1983) notes that:

"The structure of the forest utilization system includes four principal components, namely: the forest, the harvesting operation, the manufacturing operation and the marketing process."

An integrated forest utilization system includes all of these components.

It may be under single corporate ownership and management, which is the case when the firm owns the land, grows the trees, harvests the forests, manufactures the products and markets them, or it may involve multiple ownership and management, with each phase falling under different ownership. The Government may own the land, grow the trees and subsequently sell them. A logging contractor might buy the trees, log them and convert them into roundwood components for sale to one or more manufacturing firms, which then manufacture the wood-based products and sell them to the consumer. The manufacturing company may be a very simple one, consisting of a single sawmill only. On the other hand, the manufacturing company might comprise several highly integrated mills which, in combination, utilize most of the biomass of the forest. In any case, the four components - the forest, harvesting, manufacturing and marketing - are common to both systems.

Integrated processing is the key factor in achieving a better utilization of available resources. Integration can be undertaken stepwise, by successively adding new products which either make use of, or contribute to the production of already existing units. Utilization of wood waste and/or residues as raw material or as an energy source are crucial in the integration process. However, in Italy this process has not been a large scale, in-plant integration of industrial complexes, but it has resulted from combining relatively small and functionally independent units, wherever possible.

A stepwise integration on a relatively small scale is practically always possible and is stimulated by local and central authorities through incentives - financial, fiscal and social - to facilitate increased integration of small scale production units. An application of this concept is the formation of cooperatives formed by individuals engaged in logging operations which fell and transport logs to the cooperative's storage centre. The wood is then sold by the cooperative to sawmills. In some cases - and these are becoming more and more numerous - the same sawmills which buy the wood join the cooperative of the loggers who supply the raw material. The industry's rural character, at least in parts, is very well suited to the overall economic development of a given region.

Some regional authorities have developed procedures for integrating tree growing by the public sector with manufacturing and marketing carried out by the private sector.

The Italian experience shows that vertical integration of small individual processing units or plants is economically desirable in terms of increasing the utilization of the wood raw material, diversifying the product range and furthering the distribution of labour. Such integration has been, and still is, the main focus for regional development.

Small scale integrated units such as the ones operating mainly in northern Italy might also be suitable in different socio-economic surroundings and could be promoted in developing countries through technical and economic assistance programmes, once their suitability in a different environment has been evaluated.

The development of another type of integration relates to the New Forestry Enterprise. It was felt that the forestry enterprises, which traditionally had been engaged only in logging operations, should also become involved in those operations which follow logging, i.e. manufacturing and marketing. This resulted in the establishment of New Forestry Enterprises, which are owned by local regional authorities. The public forest enterprises constitute operational and organizational units in

which the participants are public organizations active in the promotion of all forest and forestry activities, including manufacturing, marketing and environmental protection. This promotional activity tends to develop industrial or commercial operations together with private investors and assures an optimum utilization of the standing forests. This development has also been instrumental in keeping people in the forest areas by giving them permanent employment in forest activities, which is particularly important for the economy of those areas which are usually marginal from an economic point of view.

## 9. TYPE OF ASSOCIATIONS

Improvements in specific areas, in the overall performance and in the development of forestry-related operations are obtained by engaging the services of specialists in the field of forestry, manufacturing and marketing. This may be done without any problems by the larger operations which can easily justify their employment. However, when small scale producers require the services of specialists, it may have to be done by a specialist serving several small firms. This is accomplished through different arrangements or associations.

### 9.1 Consortia or Cooperatives of Forest Owners

These are units (promoted and assisted by public-owned regional forest companies) managing forests which would otherwise remain unmanaged due to the small size of the members' property or other disadvantages such as the high degree of senescence of the owners, all factors which impede the utilization of the resource. Roundwood from these cooperatives or consortia is usually supplied to local small firms or to commercial sawmills.

### 9.2 Service and Repair Facilities, Technical Assistance

These are provided as a kind of indirect subsidy to small scale producers by public decentralized authorities. The service and repair facilities, which operate as cooperatives or as independent firms, supply common facilities for the repair and servicing of tools and machinery to a number of small firms. Generally these small firms do not employ engineers, mechanics or other specialists and they receive technical assistance from the service and repair facilities.

### 9.3 Specialized Services

For reasons of economies of scale it has proved advantageous in some cases to establish common specialized facilities for wood drying and preservation, or to provide other specialized equipment such as veneering and edge bonding for particle board for the use of firms which are too small to own and to economically operate such equipment. These services are also provided as a kind of indirect subsidy by public authorities.

### 9.4 Workshops and Warehouses

As mechanization of logging increases, so does the need for workshops and skilled technicians to maintain and repair the equipment. The same applies, in a different way, to the sawmills, veneer mills, etc. A few fortunate loggers may operate in areas well covered by commercial repair service facilities, but most loggers must supply their own. The more isolated the operation, the greater the need for self-sufficiency in maintenance facilities. In areas where communications and transport are poor, loggers may find it advantageous to provide facilities even for major overhauls in their own workshops. Similar considerations apply to warehouses and to stocking spare parts, fuel and lubricants.

Sometimes loggers form cooperatives to operate such workshops and warehouses.

#### 9.5 Manufacturers' Associations

These associations usually incorporate the large firms as well as the small. An important role of these associations is to set and maintain quality standards for production and products (the latter in conjunction with trade associations). Another area of activity concerns the environment. Although the risk of environmental pollution associated with mechanical wood-processing industries and with the use of certain wood products is low in comparison with many industrial sectors, the association is active in areas such as the promotion of fuller utilization of wood waste and residues, which will diminish the actual environmental and waste disposal problems.

Following the steep price increase of oil in 1973, much research and development work has been carried out in order to improve the economy of wood-processing industries. In Italy, as in most industrialized countries, this work has been focused on energy saving through the development of technology and machinery consuming less energy.

#### 9.6 Trade Associations

Trade associations further the interests of their members by assisting in setting product standards, promoting legislative norms for regional and national governments, preparing banking agreements or by engaging in research projects aimed at solving problems of common interest.

While the exchange of technical and marketing information tends to benefit the smaller firms, the larger firms benefit from the increased political base that the organization can draw on in seeking solutions to problems common to the industry as a whole.

Trade associations are often involved in training of management and workers.

### 10. RESEARCH

The wood-processing industry has a relatively low technology in comparison with many new, fast developing industries. The total research input, either by the public or private sector, has remained very low. The industry utilizes national renewable resources, is relatively labour intensive, and self-supporting in energy; these factors make the industry an important unit within the national economy and, therefore, an increasing share of public funds should be destined for research in the following areas:

- Forest management and plantation techniques, including the production of quicker growing trees, resistant to pests and disease.
- Industrial uses of a larger proportion of the total wood volume per hectare of forest. This should include research in processing technologies, utilization of forest waste and wood residues from industrial operations as raw material and as fuel for the generation of energy.
- Development of specific technologies for the drying, preservation and processing of the various species.



- Appropriate machinery and especially on cutting tools for the various species.
- Wood in construction.
- Structural designs for the use of wood in construction.
- Finger jointing and other jointing and assembly methods.
- Fire retardants.
- The environmental impact of the wood industry and research on technologies and mitigation measures to control the harmful environmental effects associated with harvesting and processing of wood.

#### 11. MARKETING AND PRODUCT PROMOTION

To maintain its position in the market, there is a need for the Italian wood industry to be competitive in price and quality, as well as technologically innovative to forestal competition from substitutes, to intensify promotional efforts, to improve transport and distribution channels, and to standardize and organize market information.

Preferences for and against wood are dependent on sociological and psychological factors. The promotion of wood products in Italy has tried to foster a more favourable image of wood. This entailed above all to demonstrate the suitability of wood in applications hitherto untried or little used in particular lines of products.

The Italian wood industry exports utility furniture and other finished wood products. The development of this export market has been important not only because it earned much needed foreign exchange, but it also enabled the Italian wood industry to expand output. However, marketing, together with design and technology, have been the factors determining success. It is obvious that in the furniture sector skilled designers are able to provide not only fashionable but also ergonomically correct designs.

Marketing can be made easier if product and quality standards are maintained and innovations are made in design and presentation of the manufactured products.

In all promotional activities, whether directed at the domestic or the export market, there is great scope for work by trade and manufacturers' associations. The marketing function is a difficult one particularly for the small enterprises which must examine all possible channels for marketing their products. Exports are usually effected through export consortia, which receive economic incentives and Government aid. These export consortia are formed by export firms, organized as trading companies and provide essential export marketing services.

#### 12. TRAINING AND CONTINUOUS EDUCATION

Mechanical wood-processing industries are relatively labour intensive industries; obviously, modern factories tend to be less labour intensive than older mills. Within the primary wood industries themselves, there is a great variation in labour requirements. Sawwood manufacturing requires, as a rule, most labour per cubic metre of output, the plywood industry requires less; the particle board and fibreboard industries have the lowest manpower requirements per unit of output in the mechanical wood industry.

Skilled labour in the wood and wood-processing industry are mainly graduates from the Italian equivalent of trade and vocational schools. They are often trained more as craftsmen than as skilled machine operators and, therefore, need extensive in-plant training in order to upgrade their skills to the level required in industry. The schools are independent from the industry, because they are operated by the Government, but some of them have connections with the trade's and manufacturers' associations as far as preparation of the curriculum is concerned. At present, however, there is a tendency for the regional authorities to be active in training for the industry, and it is very likely that in some of the northern regions of Italy one or more schools will be established to train skilled manpower for the wood industry.

Continuous education is a must today in the wood industry and here again the associations are active, promoting yearly courses at the University of Turin for the managerial level of the wood industry. Students are sent mostly by the industries and the majority of the teachers are experts from the industry, such as managers, men from the production line, from marketing and from the engineering field.

### 13. CONCLUSION

As has been illustrated, the private and public sectors involved directly or indirectly in forestry and forest-based operations are jointly undertaking efforts at reinforcing and improving the structure of the entire forestry and forestry-related sector, aimed at a more rational management of the forest which will not only meet biological and silvicultural demands, but also social and economic requirements.

REFERENCES

- Bethel, J.S.     Processes of optimizing and diversifying the materials  
1983     output from a forest. Proceedings, International Forestry  
         Seminar, Selangor.
- Conferenza Permanente per i Congressi del Legno.     Linee programmatiche  
1983     di una politica di sviluppo del "sistema del legno". (Unpublished  
         report).
- Cremonese, F.     Il Progetto Montagna della Regione Veneto. Cellulosa e  
1984     Carta, 4.
- Francillo, A.     Risorse, disponibilità di prodotti forestali e problema-  
1984     tiche tecnico-commerciali dell'approvvigionamento del legno.  
         Documenti FEDECOMLEGNO.
- Moruzzi, P.     Considerazioni conclusive e programmatiche. I<sup>o</sup> Congresso  
1981     Nazionale "Il legno nelle attività economiche del paese".
- Pastina, F.     Utilizzazioni industriali e chimiche del materiale legnoso  
1982     dei boschi cedui. Rassegna Chimica, 3.
- Pastina, F.     Una strategia forestale per lo sviluppo. Cellulosa e  
1984     Carta, 4.
- Prevosto, M.     Il problema delle utilizzazioni del legno. Cellulosa e  
1984     Carta, 2.
- Torsani, S.     Una nuova politica per le foreste.     Marsilio Ed.  
1984
- UNIDO.     First world-wide study of the wood and wood-processing  
1983     industries. Sectorial Studies Series No. 2. IS.398.
- UNIDO.     Wood resources and their use as raw material. Sectorial Studies  
1983     Series No. 3. IS.399.
- Vinciguerra, G.     Assestamento ed associazionismo; l'impresa forestale e  
1983     l'impresa di trasformazione boschiva. ASSOBOSCHI.

IMPROVING LEGISLATION FOR APPROPRIATE FOREST INDUSTRIES

by

the Secretariat

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## 1. INTRODUCTION

Legislation, i.e. statutory laws and the administrative regulations which implement them, is based on national policies which reflect the social, political and economic aspirations of each individual country. Legislation establishes the rules and guidelines under which society is to function in accordance with these policies.

Any forestry enterprise or industry is, therefore, subject to a wide variety of legislation dealing with such subjects as incorporation, taxation, investment, fiscal accountability, worker health and safety, environmental protection, trade, marketing, contracts and so forth.

However, for the purpose of this paper, which deals with what are called appropriate forest industries, it is assumed that one of the primary criteria for assessing the appropriateness of an enterprise is the contribution which it will make to rural development. That is to say, any enterprise is appropriate only if it helps to improve the lot of the rural people by returning benefits to them that outweigh costs. Appropriateness also implies acceptance by and involvement of the rural people. If the industry is not one in which the local people are willing or able to participate, it may well be inappropriate as a vehicle for building local self-reliance and sustainable income generation.

For that reason, the discussion which follows will not be directed to the more general type of laws mentioned above, which affect almost any business enterprise, but will focus on those forestry enterprises that rely primarily on local human and natural resources for their operation. It is here that improvements are needed in legislation in order to remove constraints to rural forestry development and provide greater support to appropriate forest industries.

## 2. SPECIFIC ISSUES CONCERNING LEGISLATION FOR APPROPRIATE FOREST INDUSTRIES

There are a number of issues which have a specific bearing on legislation for those appropriate forest industries which rely primarily on local human and natural resources. They relate to the production as well as the processing of raw materials and the marketing of semi-finished and finished products. These issues include:

- land tenure and land availability;
- customary laws and usage rights;
- timber harvesting and processing;
- credit;
- cooperatives and other local institutions;
- public administration of forest lands and resources.

While a number of these topics are primarily the subject of forest laws, other laws also come into play, including those dealing with land, agriculture and finance.

### 2.1 Availability of Land and Resources

Since one of the goals of appropriate forest industries for rural development is to involve local people in the entire process to the extent possible, it follows that participation of the local people in the production of raw materials is a component of appropriate forest industries.

This, in turn, requires that people have access to the means of production (land, tools, seeds or seedlings) and that they are assured that the benefits of their work will accrue to them.

The first question to be asked, therefore, is whether existing legislation provides access for rural people to the land needed for growing or gathering the raw material needed for their particular purposes. In general, this will be wood-fibre, but could also include other products such as nuts, fruits, reeds, and so forth.

Land tenure and land ownership vary from country to country. The ultimate power to control land ownership and use lies with each sovereign national government and is usually established by the Constitution or an equivalent document. In some countries, all lands are deemed to be state property. In other countries, communal and private ownerships are also recognized in various ways.

Closely related to land ownership is the question of land use. Whoever has ownership usually has the power to determine land use and can transfer that power to someone else through sale of the usage right, lease of the land, or some other tenurial arrangement.

From a legal viewpoint, a wide variety of tenurial arrangements are possible, depending on the land policies of a particular country. Where all land is owned by the government, various forms of leasing or assignment of long-term usage rights can provide a framework for rural people to grow forests and manage forest areas. A number of countries provide for the specific demarcation of land for community forests, with land ownership retained by the government, but use and management are taken care of by and for the local community.

In Nigeria, where forestry is a state rather than a federal matter, Native Authority and Local Government Council forests may be constituted to be managed by or for the community.

In Tanzania, the law provides for the creation of local authority forests in much the same manner.

In Nepal, Government lands can be turned over to local villages enabling them to create forests that are entirely under the control of the village. The Nepalese law also allows villages to take over portions of degraded reserved forests and to manage them on a profit-sharing basis with the Government.

There are also cases of government lands being made available to local communities or private groups for reforestation and management.

In the Ivory Coast, state lands can be set aside for reforestation by private and local groups, subject to rules and regulations.

In Thailand, the Forest Law provides that degraded areas of reserved forests can be leased to private concerns for reforestation and forest management.

A growing number of countries provide for the production of non-timber crops by local people in conjunction with government tree-growing programmes. In Indonesia, local people are allowed to grow food crops during the early years of teak and pine plantations to grow fodder grasses within some of the plantations, to grow medicinal herbs within older teak plantations, and to produce honey from forest lands.

When communal lands are involved - those owned either by a village or through membership in a clan or family - use and management can often be carried out by local people assisted or supervised by the forestry agency.

However, it sometimes happens that, while ownership of communal lands remains unchanged, the actual control and management of the land is vested by law in the government. In Ghana, for example all communal lands are under the authority of the President, who holds the lands in trust for the communities. But management and administration of the land is under Government control.

In other countries, varying degrees of government control are imposed on native owned lands, based on the theory that the landowners are not capable of providing adequate management and administration or in order to protect the landowners from land speculators. For example, in Fiji, native landowners cannot sell their land to non-natives, and all land leases to non-natives, including those for roundwood extraction, must be approved by the Native Lands Trust Board. In Papua New Guinea, similar restrictions are applied regarding the alienation of land and timber rights by native owners to non-natives. However, these restrictions would not seem to keep the native landowners from managing their lands to support local forestry enterprises. Papua New Guinea is, in fact, experimenting with forest development programmes which require that 75 percent of equity is held by Government and/or local landowners. In Fiji, the semi-autonomous Fiji Pine Commission is developing a pine industry on lands leased from native owners who, it is hoped, will eventually become the ultimate shareholders of the corporation itself.

In those countries where private land is involved, leases between private parties are possible, and the formation of cooperatives of small private forest owners can be a considerable aid to forest production, to which the government should contribute by providing assistance and supervision.

The role of legislation in this context is to provide the legal framework for whatever system of land tenure would be most appropriate for giving rural people and communities access to land on which to grow tree crops, either as forest stands or under various agro-forestry systems.

The point to be stressed is that, if rural people are to participate in the resource production component of rural-based forest industries, they must have access to land and a form of tenure secure enough to be able to count on receiving benefits from the work they are doing.

Laws which unduly restrict access to forest land for rural communities and populations will be a great constraint to the development of a truly appropriate forest industry.

Therefore, land and land tenure laws are one of the first components of legislation that must be reviewed and, where necessary, amended so as to support the development of rural forestry enterprises.

## 2.2 Customary Laws and Usage Rights

In many countries, indigenous native rural populations exercise various usage rights on forest lands by virtue of custom and tradition. These customary rules may be written, but in many cases they are not. In a number of countries, these unwritten systems of land-use rights exist side by side with more recent statutory laws. It is often the case that the customary laws are known and exercised by the rural people, while the statutory laws are neither known nor understood or observed. For this reason, a rural-based forestry enterprise must take account of the customary laws as well as of the statutory ones, since the operative rules of the local society may be those of custom rather than those of statute. This is not to say that the forestry enterprise should ignore statutory

law and follow only the customary rules, but from a practical point of view it does mean that, to the extent possible, the customary ways must be accommodated, at least in the initial stages, since it may be the customary rules with which the local people are familiar and which they will use to guide their activities.

Most forest statutes recognize customary usage rights and usually provide for their protection when forest development is contemplated as long as they do not significantly interfere with timber harvesting operations. Typical customary usage rights would include the rights of villagers to gather fuelwood, fodder, building materials for home use, and a variety of non-wood products such as nuts or fruits for non-commercial uses, to hunt and fish, to graze animals, and to clear land for subsistence agriculture.

In and of themselves, these customary rights can form the basis for a variety of appropriate forestry enterprises, without any need for specific additional legislation.

What may be required, however, is a change in existing legislation to identify the customary rights more specifically, i.e. identify who is entitled to exercise them and to what extent. If these rights are to form the basis for a rural enterprise (such as the gathering and processing for sale of fruits or nuts from forest trees), limits will have to be placed on the size of operation by the appropriate local regulatory authority based on the capability of the forest area to sustain increased harvesting. Over-use must be guarded against if the enterprise is to be sustainable. Also, laws that restrict the exercise of customary rights to only non-commercial uses will have to be amended to allow harvesting for commercial purposes.

The forest laws may also need to be strengthened to provide greater protection for the exercise of customary rights where these form basis for a rural forestry enterprise. In other words, there must be a form of legal protection for these rights, so that a timber concession or a population resettlement scheme cannot be imposed arbitrarily, which would eliminate the exercise of the customary rights, leaving the rural people without a legal right to claim compensation or some other form of relief.

As with other forms of land tenure and use, customary rights must be secured in law to provide the security rural people need to invest their time and resources in an enterprise based on the exercise of such rights.

In the overall picture of tropical forestry development, these small local forestry enterprises may seem insignificant, but in the rural development context they may make the difference between poverty and prosperity for the local people.

Therefore, the protection, identification and regulation of customary usage rights should be addressed by legislation in those areas where small rural forestry enterprises based on non-timber commodities are appropriate.

### 2.3 Timber Harvesting and Processing

Rural people have traditionally been employed in timber harvesting activities, but primarily as hired labour rather than as logging contractors or timber processors. The goal of forestry for rural development is to improve the opportunities for rural people to buy and operate their own logging and sawmill equipment and to have access to timber stands within which to operate.



This implies two issues which need to be addressed by law or regulation:

- assistance in the purchase of equipment through credit programmes;
- the availability of permits and licences, and of timber stands suitable for small scale harvesting activities.

Agricultural and industrial credit laws need to be reviewed and actions taken to make credit available to small local logging operators who meet the qualifications for a logging permit or licence, but who lack necessary operating capital.

Having the logging equipment is not enough. The local logger must also have access to suitable stands of timber, including marketable species. Opportunities may even exist for small loggers to relog areas that have been harvested in a larger operation if a market for the residual wood exists, such as for charcoal, fuelwood or local building materials.

Most countries have within their forestry legislation provisions for the issuance of short-term logging permits for relatively small areas which would meet the needs of the local timber operators and these are usually designed for covering local needs for building materials processed at local mills.

#### 2.4 Credit

Without access to credits, few forestry enterprises will ever be launched by those at the lower end of the rural income scale. Without credit for the purchase of equipment, supplies and materials, the rural entrepreneur will not be able to convert the raw materials at his disposal into a product for the market.

The small logger will need saws, axes, draught animals and machinery, and will have to find a way of transporting his logs to the point of processing. The small processor will need sawmilling equipment to convert the logs into lumber. The gatherers of food products from the forest will need some means of transportation, processing and storing their products. The maker of handicrafts will need to buy some materials and find a way of bringing the raw materials to the point of manufacture, and the finished product to market.

As the scale of the operation grows, so will the need for capital and the need for credit.

Credit, by its very nature, is least available to the people who need it most. Lenders require security for their loans, as well as some assurance that the money lent will eventually be repaid with at least a nominal interest. The landless rural people seldom have any assets on which to base a line of credit.

Past experiences with various government credit programmes for small farmers show mixed results. Some programmes report low rates of repayment and failure of programmes to survive. Others report that small farmers can be more relied upon when it comes to paying back loans than large farmers.

The small borrower may be more reliable with regard to paying his debts because he knows that, unless he does, there will be no further loans. The larger farmer, on the other hand, may feel that the lending institution will want to keep him as a client and may be more patient in collecting outstanding debts, as there is the prospect of continuing to make loans to the larger producers.

The biggest complaint against rural local programmes has been that they tend to be dominated by the better-off people. Those who already have collateral are able to capture most of the available funds, since lenders do not like to lend money to those without assets, which could be claimed if the debtor defaults.

It is unreasonable to expect that the commercial banks lend money to small speculative forestry enterprises with no assets and no track record of production or income generation. This is a job for the government. Small farmer loan programmes need to be established which provide loans to the small businessman with low interest rates, reasonable grace periods and low collateral requirements.

## 2.5 Timber Utilization Agreements

Many developing countries still rely heavily on the use of timber utilization contracts and concessions in the development of their forest resources.

In the early stages of forest development, many countries found themselves lacking in the capital and technical expertise needed to develop their forest resources. To foster such development, they found it necessary to grant timber concessions to foreign investors, often on terms that failed to capture the full value of the resources committed. Many developing countries still rely heavily on the use of timber utilization contracts and concessions for forest development, and are likely to do so in the future. However, most countries are modernizing their concession agreements, regulations and procedures considerably in order to make them effective instruments of social and economic development.

An important element in most timber utilization programmes today is a range of provisions designed to promote domestic processing, as opposed to the export of logs, and to provide support for the growth of rural forestry enterprises. These goals are addressed in a number of ways: certain countries have imposed total bans on log exports, others have commenced to reduce their log exports progressively, aimed at a complete ban within a few years, and still others have set a percentage of logs that can be exported, with the remainder to be processed locally.

These provisions accomplish two goals, they help retain more of the value added from processing within the country, and they encourage the development of domestic forest industries.

A number of countries also encourage domestic processing - not by banning log exports, but by taxing exports at a high rate - in order to make domestic processing more attractive. This method does not only obtain the same result as the ban on exports but also has the advantage of raising revenue to the extent that logs are exported.

These provisions are obviously related to the development of rural forestry enterprises in that they help to ensure that logs will be available for local forest industries. Ghana, for example, still permits a liberal export of roundwood logs with the exception of two species which are the most utilized by the local industry. The total ban on the export of these two species ensures a supply to the domestic processors.

Banning exports is not enough to ensure a supply of logs for harvesting by local loggers or processing by local mills. There must also be stipulations for allocating harvestable timber for these purposes.

Most countries now make specific provisions in their timber concession laws or regulations for small timber sales, which are designed to accommodate local needs. Even more importantly, a number of countries are providing flexibility in their timber utilization laws, so that a variety of contracts is possible in order to suit a given situation. Short-term permits for small areas, that do not require processing facilities, are the most appropriate type of licence for the smaller operators. As the size of the operation increases, longer term contracts for larger areas come into play and, at a certain level, processing facilities may be required as a condition for granting a larger concession.

Such flexibility is essential if a timber utilization system is to be developed that responds to the needs of the small local operators.

Ideally, the rural-based forestry enterprise will be one component of an overall national strategy for forest development, based on reliable forest resources inventories, comprehensive forest industry development planning, and long-range land-use planning that will help determine how land can be adjusted over time to meet changing needs.

The more efficient utilization of lesser known tree species is an area of interest to most tropical countries, and an area which has potential for benefitting the growth of local forest industries. Species which might not be suitable for export could form the basis of raw materials for the domestic market, where the need for species of high value and high processing quality is not as great as in the export trade.

A number of countries are encouraging greater utilization of these so-called secondary species through a variety of fiscal measures such as charging lower fees for these species and providing other incentives for their use.

Like all forms of resource disposal, the granting of forest utilization contracts on public land is subject to law. In general, it is the forestry legislation of a country which governs utilization contracts. The forest act lays down what types of contracts may be granted and sets out the principles governing logging and forest management in the granted areas. The forest regulations, which normally supplement the acts, may regulate in detail the legal, administrative, technical and financial requirements for the various types of forest contracts.

Forest utilization contracts also exist within the general framework of the national legal system and will thus be subject to numerous other acts and regulations such as land laws, investment laws, and contract and arbitration laws. In addition, the Constitution of the country may contain provisions relating to land use. In many countries, customary rights of local populations are also important considerations, as has been mentioned.

Effective forest contract legislation has several main requirements:

1. Legislation related to forest contracts must be part of a comprehensive forest legislation that is realistic and aligned to the needs of the community. Factors to be considered include the extent, legal status and future uses of the forest area; availability of manpower, technical skills

and capital; the existing type of land tenure; the extent to which customary rights are practised; the pressure for agricultural land; and the structure of the existing forest industries. Such legislation should also be based on those laws of a social and economic nature which may somehow affect the forestry sector.

2. Legislation should allow for a variety of types of timber utilization contracts to meet varying needs and conditions; short-term contracts for small areas to support local needs, medium-term contracts for larger areas and larger processing facilities, and long-term contracts where large areas and integrated operations are involved.
3. It is important to distinguish between those legal provisions related to forest contracts which should be a part of the Forest Act itself, and those which should be in the regulations. It is often wise to limit the Act to major factors, with details to be set out in regulations, primarily because regulations are easier to change than laws and provide greater flexibility to allow the government to respond to changing needs, both social and economic.

## 2.6 Cooperatives and Other Local Organizations

The purpose of a cooperative is to bring together the resources of a number of individuals or communities in order to form a single, larger and more powerful production or marketing unit.

Cooperatives, in general, have three functions:

- They provide an institutional structure which enables individual small producers to organize land use and to solve problems as a group that might be beyond the ability of individual landowners to handle.
- They provide an opportunity to bring many small units together and turn them into larger and more efficient production and/or marketing units.
- They provide an opportunity for more effective delivery of technical, financial and production inputs than could be the case if many individuals had to be served.

Cooperatives may be constituted either under statutory authority with mandatory membership, statutory authority with voluntary membership, or under customary land laws which recognize a tradition of cooperation among communal landowners.

Agricultural cooperatives are quite common in most countries; forestry cooperatives are less so. But as various settlement and land reform programmes result in fragmented forest ownership, forestry production cooperatives will gain in importance. And as appropriate forestry enterprises begin to come into being, the cooperatives will take on even more importance as a processing and marketing instrument.

Forestry cooperatives may be organized under a variety of legislative forms, including business and corporate legislation, agricultural legislation and specific forestry legislation. The question as to which type of legislative framework is the most appropriate has to be decided within the general legal system of each country. Although some forestry

cooperatives have been organized under agricultural cooperative legislation, the most common approach is to provide a separate juridical base within the forestry legislation. Agricultural cooperative legislation can often be looked upon as a model in drafting similar forestry laws.

Most of the modern cooperative arrangements in forestry are based on voluntary membership. Various categories of cooperatives require a varying degree of formal and juridical organization.

The rules for establishing a utilization cooperative may be fairly simple, while a production cooperative engaged in processing or marketing may need to be much more elaborate.

Among the points to be considered when reviewing formal arrangements for forestry cooperatives are the following:

- name, status (non-profit, corporate, semi-public), place of registration;
- purpose and objectives may be given in considerable detail or in more general terms;
- membership: voluntary or obligatory; eligibility; registration; limits in size, conditions for leaving;
- rights and obligations of members;
- statutory bodies of the cooperatives: general assembly, executive committee, supervisory committee;
- adoption and modification of statutes;
- dissolution and liquidation.

Forestry cooperatives that engage in actual business operations require a more formal structure which is usually determined by the general business and fiscal legislation of the country. Issues to be considered are financial participation of members, formation of capital, access to external financing, capacity of owning land, appointment of managers, employment of personnel, financial liability of members and officers, etc.

Many countries have specialized agencies and specific legislation dealing with the subject of cooperatives. Although most are concerned primarily with agricultural production and marketing, the opportunity to adapt the service and legislation to cooperatives for rural forestry enterprises should not be overlooked.

## 2.7 Fees and Taxes

Local enterprises will be subject to a number of fees and taxes which relate directly to the harvesting and processing of timber or other forest products. Usually these will be found within the forestry laws and regulations.

In most countries, the exercise of customary rights to forest produce for domestic use by rural people usually carries no fee, for the simple reason that enforcing such a regulation would cost far more than it would bring into the treasury, and because revenue agents have enough to do keeping track of commercial concessions and activities.

When the exercise of usage rights expands into commercial production, regulations, including fees of various kinds, are likely to be applied, especially when the forest land in question is government land.

## 2.8 Forest Administration

The manner in which the public forestry administration is organized and functions can have a significant impact on rural forestry enterprises, particularly in those countries where all forest land is government-owned and where activities such as transport of forest products and regulation of forest industries are vested in the forestry agency.

The closer government decision-making can be delegated to the local scene, the better it will generally be for the local forestry enterprise. For an operator to be forced to make frequent long and expensive trips to a central administrative headquarters can be a heavy burden.

For this reason, if rural development forestry is to succeed, government services need to be strengthened at the field level, both to provide necessary regulatory controls and to provide those technical services that might be desirable.

Almost without exception, the countries of the developing world suffer from a lack of strong forestry field services. This fact has a historical background. Until only recently, most national forest services were concerned primarily with administering the government forest reserves and dealing either with log-exporting operations or with large companies that had their own management and technical expertise. The need to regulate and assist rural-based forestry enterprises simply was not called for.

Most countries that are pursuing a policy of rural development are in the process of reviewing their administrative organization in order to provide stronger services at field level. This is true for forestry as well.

Many countries are decentralizing their government services in order to move authority, and decision-making authority, closer to the rural areas. This should be useful in the process of promoting rural forest industries.

## 3. SUGGESTIONS FOR IMPROVED LEGISLATION

As has been pointed out, rural forestry enterprises are subject to a variety of legislation, beyond that of the forestry sector. This interdependence between forestry law and other economic development and natural resource legislation is growing both in scope and complexity. It is therefore important that any effort to develop appropriate forestry enterprises be accompanied by a review of this interrelationship of the laws and coordination of the development, agricultural, forestry and land-use laws.

Successful evolution of rural forestry enterprises also means that an increasing number of people will be required to know and understand the laws with which they must comply. For this reason it is important to develop legislation that is comprehensive, well structured, easy to understand and available to the public in a consolidated and understandable form, and is also translated into local dialects if necessary.

Legislation must also be practical and capable of being complied with and administered. A few enforceable laws will accomplish more than a flood of regulations and rules that may be ignored either because they cannot be complied with or because they cannot be enforced.

The laws themselves should in general be limited to major policy provisions and constraints, and details be left to implementing regulations. Regulations can be changed to meet new conditions, whereas laws are usually much more difficult to amend. Keeping the law to the basics provides the necessary flexibility.

Finally, the laws must be continually under review in order to ensure that they are working as intended, and continuous efforts must be made to strengthen their administration through continuing programmes of training, education and enforcement.

TECHNOLOGY AND PEOPLE AT  
PAPER INDUSTRIES CORPORATION OF THE PHILIPPINES

by

P.M. Picornell\*

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## 1. INTRODUCTION

In the early fifties when PICOP first came into the picture, the supply of tropical hardwoods in the Philippines was believed to be inexhaustible. Logging was being carried out with little thought of conservation, and the conversion from extracted logs into wood products was very low.

Only high quality logs were brought out of the forest and of these, the tops, branches and the buttresses were left behind to rot. After selective logging, such forests were left unguarded, an easy prey for the land hungry settlers who cleared thousands upon thousands of hectares of these for agriculture.

Almost 50 percent of the wood that was used for the manufacture of semi-finished and finished products ended up as wood residues. In fact, some of this created a disposal problem. Only high quality plywood and lumber were exported, and there was a very limited local market for the lower quality products which naturally develop from such operations. Most sawmills were semi-permanent structures to be dismantled and moved when the areas operated in ran short of adequate logs. Plywood mills were more permanent structures, usually located in the larger cities or towns, and supplied with logs purchased from various sources.

At that time, the idea of producing pulp and paper from tropical wood was just that, an idea in the minds of a few visionaries. In fact, many people actually believed that it could not be done on a commercial scale. This, however, did not worry the large pulp and paper companies; after all, they had enough softwoods in temperate countries to supply the needs of the world for many years to come.

This was the picture when Paper Industries Corporation of the Philippines (PICOP) came into the picture. Initial research done in the Philippines and abroad by San Miguel Brewery, Inc. (now San Miguel Corporation) indicated that paper could be produced on a large scale from tropical hardwoods, and San Miguel needed paper to complement its operation; paper to make corrugated cartons for packing beer and soft drink bottles and for the production of other containers. Two companies were created for this purpose, Bislig Bay Lumber Co., Inc., and Bislig Industries, Inc. Tropical hardwood forests were the only source of wood in the Philippines available in sufficient volumes to sustain a large scale pulp and paper industry. These two companies were later to merge into what is now Paper Industries Corporation of the Philippines. More on this later. The site chosen for the project was at Bislig in the province of Surigao del Sur, on the eastern coast of the island of Mindanao in the Philippines.

The entry of PICOP into the picture presented two new factors to the Philippine forest industry.

1. It represented a very large investment in forest industry that would require a permanent supply of wood.
2. It would call for a much more efficient use of forest resources as the plan was to use forest residues and the waste from lumber and plywood manufacturing operations for the manufacture of pulp and paper.

If successful, it could bring about a new era in the utilization of tropical forest resources.

The first problem to be solved was to make sure of a permanent supply of wood for such a project. At about that time, Filipino foresters were making their first studies on the natural regeneration of tropical forests in the Philippines. Bislig became a laboratory for the use of selective logging to perpetuate tropical forestry, and very valuable information was obtained from observations made over thirty-four years.

However, it became apparent that, while natural regeneration through selective logging did very well in some areas, it did not do well in others, and something else would have to be done to ensure an adequate wood supply for the project. The solution was to strike an adequate balance between natural regeneration by selective logging in areas where this was suitable and to supplement the wood supply by clear-cutting areas where natural regeneration was not doing well and converting these into industrial tree plantations. This, of course, was easier said than done. There were some successful plantations and some very costly failures. There were insect infestations and natural calamities. However, the overall analysis showed that the idea was sound and workable.

An offshoot of the idea of tree plantations was the idea of getting supplemental timber from industrial tree plantations to be established by farmers in private lands surrounding the PICOP operations. While this plan had its difficulties, it did come out to be very successful, and it did establish a very important area of cooperation and partnership between the local population and the industrial complex. This is a very good example of the interaction of people and technology.

Where does PICOP stand today? It is an industrial complex based on a perpetual supply of wood from natural tropical forest and plantations, and surrounded by individually-owned tree plantations that make the tree farmers partners in the enterprise, a very good example of joint efforts of people and technology. PICOP has had and still has serious problems, financial and technical. However, solutions to these problems are being worked out to make this enterprise a prime example of the cooperation of people and technology in the forest industry.

## 2. THE HISTORY OF THE PAPER INDUSTRIES CORPORATION OF THE PHILIPPINES

The establishment of Paper Industries Corporation of the Philippines started with beer and the vision of one man, Andres Soriano, a far-sighted industrialist and president of San Miguel Brewery (now San Miguel Corporation). Beer needed bottles, which were already being manufactured in the Philippines, bottles needed corrugated cartons, and cartons needed paper. Don Adres, as he was affectionately called by his associates, had been looking into the possibility of making paper from raw materials native to the Philippines since 1934. This work was interrupted by the second world war. In the late forties it became evident that any large scale pulp and paper industry, to be established in the Philippines with the object of manufacturing a low-priced product such as container board, would only be able to obtain sufficient raw material if it was to use tropical hardwood found in abundance in the country. The first two problems to be solved were:

1. To prove that adequate paper products could be made on a commercial scale from the tropical hardwoods in the Philippines.

2. To find a forested area large enough to support a commercial size pulp and paper mill producing low-priced papers.

A technical team was organized to study the feasibility of making paper out of these raw materials and extensive studies were made in well-known laboratories abroad, this being supplemented by work done in the Philippines in a laboratory established for this purpose. A search was also initiated for a suitable forested area for this project. After an extensive search, the Bislig area on the eastern coast of the island of Mindanao was chosen. This was the first interaction between people and technology in PICOP.

Thus, Bislig Bay Lumber Company, Inc. was established in 1950 to engage in the development of the forest in this area where a forest concession was applied for. A camp was built and the first road leading to the logging areas was constructed; logging operations started shortly after. A portable sawmill was installed at the same time, and a more permanent one was built in 1953.

In the meantime, as the experimental work on the use of the wood at Bislig showed promise, the decision to establish a pulp and paper mill was made. In line with Don Andres' policy to get the best available know-how, International Paper Company, the largest pulp and paper company in the world, was invited to participate in this venture, and Bislig Industries, Inc. was organized in 1952 to implement the pulp and paper project. Bislig Industries, Inc. changed its name to Paper Industries Corporation of the Philippines in 1963.

Bislig Industries applied for a timber concession just north of the Bislig Bay Lumber Company concession, the first timber and pulpwood concession granted in the Philippines. In view of the encouraging results obtained in laboratory and pilot plant work, arrangements were made to send 1 000 t of the wood available at Bislig Bay to the United States where it was processed into newsprint and container board in two mills of the International Paper Company in 1957. The paper so produced was sent to end users in the United States and the Philippines who used it under actual commercial conditions to prove once and for all that Philippine tropical hardwoods could be used for this purpose.

Unfortunately, there were delays in implementing the project due to prevailing economic conditions, and it was only in 1962 that the go-ahead signal was given for the establishment of the pulp and paper mill. In the meantime, in line with the idea of establishing a fully integrated forest industry, Bislig Bay Lumber Company, Inc., in the late fifties built a veneer plant and dry kilns and a lumber finishing mill. This was followed by a plywood mill which was established in 1966.

It took another six years to work out the financing for the project, to negotiate its special requirements with the Government and to design the mill. Construction work on the mill proper started in 1969 and the mill was started up in late 1971.

In 1969, PICOP acquired Bislig Bay Lumber Co., Inc. as its wholly-owned subsidiary. In 1970 it became a public corporation, offering its shares to the general public and in 1972 PICOP and Bislig Bay Lumber Company were merged with the former as the surviving corporation.

A second plywood mill was started up in 1976 and in 1977 PICOP acquired Rustan Pulp and Paper Mills, Inc., with a mill at Iligan, Lanao del Sur, on the northern coast of the island of Mindanao.

The first decade of operations has not been an easy one. Quality problems had to be worked out, and the energy crises of the seventies affected costs severely. Measures had to be taken to make the mill less dependent on imported oil by constructing a new high-pressure wood burning boiler. The recession and the financial crises in the Philippines in the eighties also affected the company with high interest costs and decreased markets, forcing the closure of the container board line at the Iligan mill.

However, these problems are being worked out. The mill now produces newsprint and container board which meet international standards and its plywood and lumber products are known for their quality throughout the world. Thus, PICOP faces the future with confidence, a confidence built on its people and its technology.

Appendix 1 indicates the capacities of PICOP's manufacturing units at the end of 1984.

### 3. THE BISLIG FORESTS

PICOP obtains most of its raw materials from the forests around Bislig Bay on the eastern coast of the island of Mindanao. These consist of 182 692 ha of national forests operated by the company held as concessions from the Philippine Government which include some 46 000 ha converted into tree plantations. This is supplemented by wood from about 20 000 ha of privately owned land converted into industrial tree plantations around the concession. Appendix 2 shows the location of these forests and their major subdivisions.

The forests operated by the company are managed on a sustained, expanding yield basis, combining for the first time in the Philippines two different silvicultural systems, selective logging and plantation forestry.

Selective logging is aimed at perpetuating the original rain forest in the areas best suited for this, and consists of only harvesting mature trees (60 cm breast height and above) leaving the healthy young trees to mature and act as seed trees for the next cycle, usually in from 25 to 35 years. Forest protection becomes of prime importance under this system as maturing forests have to be protected during the long years while regenerating.

As not all areas are adequate for natural regeneration, those which are not are converted into industrial tree plantations. The original forest cover is clear-cut and the land planted with fast growing species which grow to pulpwood size in six to eight years, and to sawn timber size in twelve to fifteen years. Plantation forestry is a prime example of the combination of people and technology. People are needed in clear-cutting while technology is used in matching species to soil conditions and planning the plantation. People are essential in maintaining the young plantations until these can take care of themselves, as proper maintenance is essential to the successful growth of the trees. Technology is also very important in protecting the plantations against pests and diseases while people are used in monitoring growth till time of harvest.

Technology and people also come in when planning the harvesting of the timber in selective logging. The selection and deployment of machinery and equipment to do this, the planning of the actual settings, the logistic support required to sustain such operations are prime examples of modern technology.

Road building and maintenance are essential activities in the Bislig forests. As of 1984, PICOP had a road network of 2 100 km of roads designed to carry 50 t loads under all weather conditions to bring the wood from the forests to the mills. The planning of the road system is done by modern computerized methods while the building of the roads to exacting specifications requires highly skilled manpower operating the most modern road building machinery.

In addition to logs supplied from forests operated by the company, PICOP obtains an important portion of its wood supply through its cooperative agro-forestry programme with landowners in the vicinity of its forests. Under this programme, the company helps small farmers and private landowners to improve their living by supplementing their crops with the growing of trees in the marginal parts of their farms. The company provides free technical advice, sells seedlings at cost, payable at harvest time and guarantees a market for the wood produced in proper sizes. There are 5 300 farmers operating a total of 20 000 ha under this programme.

All these activities are supported by a very strong Forestry Division engaged in surveying, cruising and planning the harvesting operations. It also includes a complete Forest Research Department engaged in all phases of silvicultural work.

As we look at the Bislig forests today, we have to remember that what we now see is the product of years of development work in all phases of forestry. We have had our share of costly failures as well as resounding successes. It is only through the proper combination of people and technology that we have arrived at where we are today. Important problems still remain to be solved, but we are confident that these will be worked out in due course.

#### 4. WOOD PROCESSING

The idea of wood processing at PICOP is to obtain the maximum utilization of the Bislig forests in the most economical way. As the wood arrives at the mill site, it is taken to a central area where it is sorted and sent to the appropriate processing unit. Experienced graders inspect the logs and decide where these are to be used. There are, of course, certain logs which, because of their characteristics, are sent directly to the unit which is to process them. This is particularly true of pulpwood logs coming from tree plantations which are used as pulpwood.

Very high quality logs are still exported as such because the net value obtained for these in the export market is better than the net value of processed materials that may be obtained from these. While the Philippine Government discourages log exports, it recognizes this reality and allows a limited export of logs by companies who have extensive processing operations.

Veneer blocks developing from the wood being brought in are sent to the two plywood mills - with a combined capacity of 150 000 m<sup>3</sup> of plywood per year - where they are manufactured into plywood which is exported all over the world. PICOP PLY, PICOP's trade name, is well known for quality and reliability.

Logs which cannot be processed<sub>3</sub> into plywood are sent to the sawmill which has a capacity of 50 000 m<sup>3</sup>/a. Some of the lumber is air dried and sold rough while some of it is dried in dry kilns, after which it is sold rough or finished.<sub>3</sub> Kiln-dried lumber is also converted into blockboard (capacity 10 000 m<sup>3</sup>/a) which in turn is sold as such or used as cores in the plywood mills.

Waste from the plywood mills and sawmill is either used as pulpwood or as fuelwood to generate steam and electricity required to run the processing facilities. PICOP has two large and three small wood-fired boilers (2x114 t/h boilers and 3 small boilers with a capacity totalling 30 t/h) and an electric power plant with a total capacity of 61 MW. Very recently, it has also been connected to the Mindanao grid of the National Power Corporation which obtains its energy from hydro-electric sources.

Pulpwood is sent to the pulp and paper mill where it is converted into either chemical or mechanical pulp. The chemical pulp is used in the manufacture of container board (capacity 68 000 t/a at Bislig) while chemical pulp is also mixed with mechanical pulp in the manufacture of newsprint (86 000 t/a at Bislig). The container board mill at Iligan is presently shut down due to an insufficient market and plans are made to transfer its machinery to Bislig and thus have all the manufacturing facilities at one site.

All of these processing facilities use the latest technology and are operated by highly trained Filipino technicians and workers.

PICOP is now in the process of increasing its container board capacity at Bislig to 78 000 t/a and its newsprint capacity to 118 000 t/a by improving its present facilities. A major expansion is planned for the early nineties.

Appendix 3 shows the distribution of wood from its various sources to the different processing centres.

Because of its isolated location, PICOP operates extensive maintenance and machine shops to make sure that its machinery and equipment are maintained in top operating condition. It also operates its own port facilities capable of handling ocean-going ships which take the company's products directly to overseas and domestic markets.

## 5. PEOPLE AT PICOP

At the end of 1984, PICOP had 8 500 persons directly employed. Another 1 500 were employed by contractors working on tree plantations, 1 000 working for other contractors in other wood operations, and some 300 working for hauling contractors. At an average of four dependents per worker, it can be conservatively estimated that there are at least 67 000 people directly dependent on the PICOP operations. This does not include people involved in the shipping and distribution of finished products nor people engaged in the further processing of these.

As an organization deeply involved in technology, PICOP is committed to the improvement of the skills of its employees to be able to achieve the proper balance between people and technology. While aware of the important function of creating employment in a developing country, the company does not believe in employing large quantities of very low grade labour, but rather in upgrading its labour force and paying it better wages. Fortunately, the company's operations are located in an area where there is no surplus of labour and it does not create a social problem by being choosy in picking out the people it employs.

Prospective employees are carefully selected using a series of tests, and there are self-improvement programmes at all levels of the operation. These include on-the-job and class-room programmes. All personnel are periodically evaluated. Promotions are effected from within whenever possible.

Being in an isolated location, PICOP has to provide quite a number of services which would not usually be provided in more populated areas.

PICOP maintains a very well-equipped hospital which can handle most medical, surgical and dental cases encountered at Bislig. Medical and dental services are rendered free to employees. Employees' families get free consultation services and pay nominal charges for hospitalization and medicines. While the Company's medical facilities are not usually available to outsiders, these are always there for emergency cases.

While the Company does not operate any schools directly, it heavily subsidizes two schools which provide quality education through high school levels. It is important to keep families with growing children together and thus provide a healthy family life for the personnel of the Company.

The Company only provides housing for executives and key operating personnel. It has subsidized two projects where supervisory personnel have been able to own their own houses, and it helps its labourers in building their own houses by a programme of selling them lumber and plywood at subsidized prices.

Within the limits of its capability, the Company assists the community in developing programmes for the benefit of all. These include civic and agricultural cooperative programmes, the most important of which, the agro-forestry programme, has already been mentioned.

When PICOP (then called Bislig Bay Lumber Company, Inc.) moved into Bislig in 1950, the town was a small fishing village with a population of less than one thousand persons. Today, Bislig is a thriving community of some 75 000 persons with its own banks, hotels, market and shopping centres. This is the best example of what can be done by combining people and technology in a developing country.

## 6. CONCLUSION

In looking at PICOP today, it must be stressed that it has evolved into what it is now over a period of thirty years. And even today, the Company is still in financial difficulty due to the recession of the early eighties and the economic problems the Philippines are going through. However, the PICOP story shows what can be done with the proper application of people and technology.

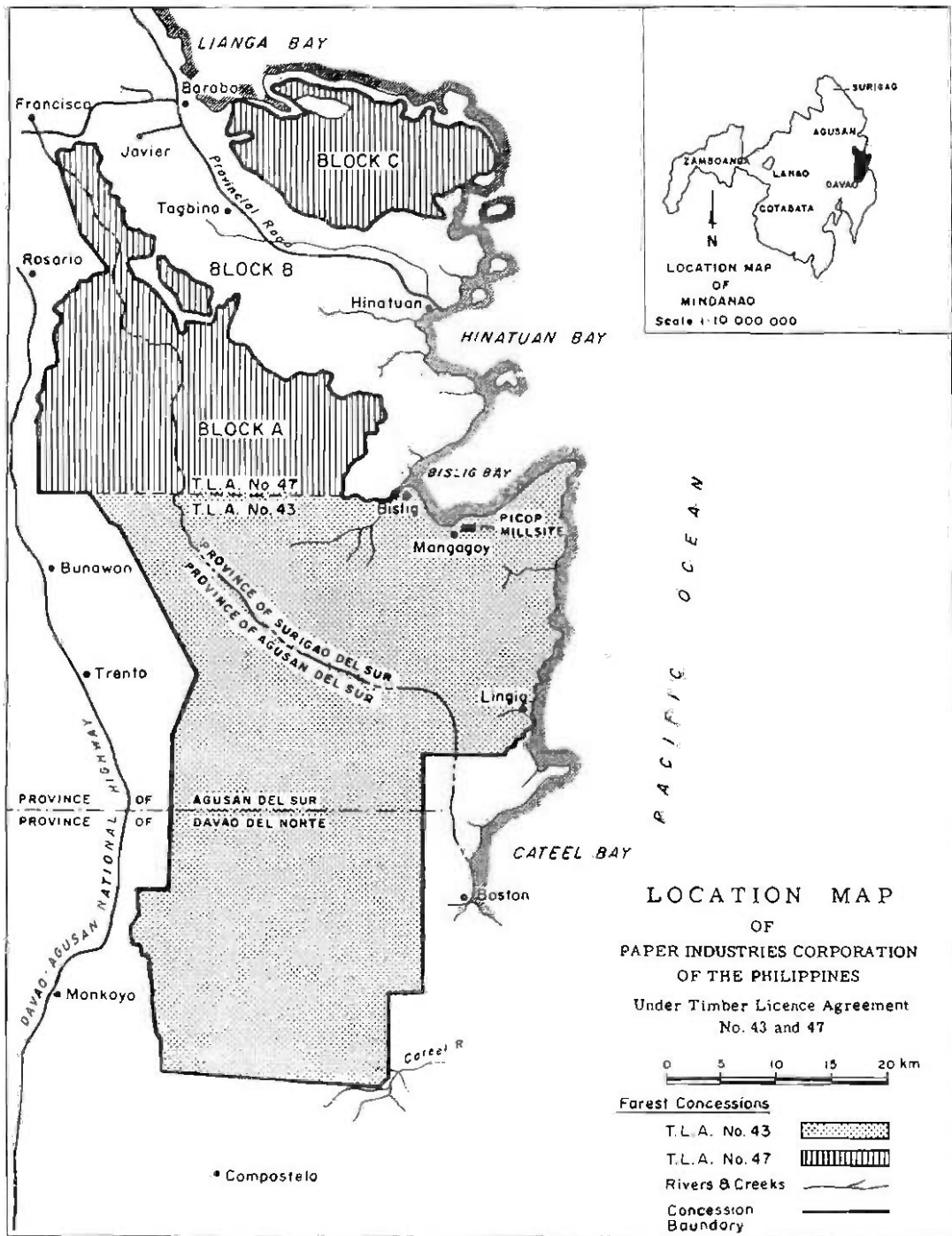
APPENDIX 1

ANNUAL CAPACITIES OF THE PRODUCTION UNITS AT PICOP  
1984

Newsprint line, Bislig	86 000 metric tons
Container board, Bislig	68 000 metric tons
Container board, Iligan	30 000 metric tons
Abaca pulp, Iligan	3 000 metric tons
Plywood plant No. 1, Bislig	50 000 cubic metres
Plywood plant No. 2, Bislig	100 000 cubic metres
Lumber, Bislig	50 000 cubic metres
Blockboard, Bislig	10 000 cubic metres

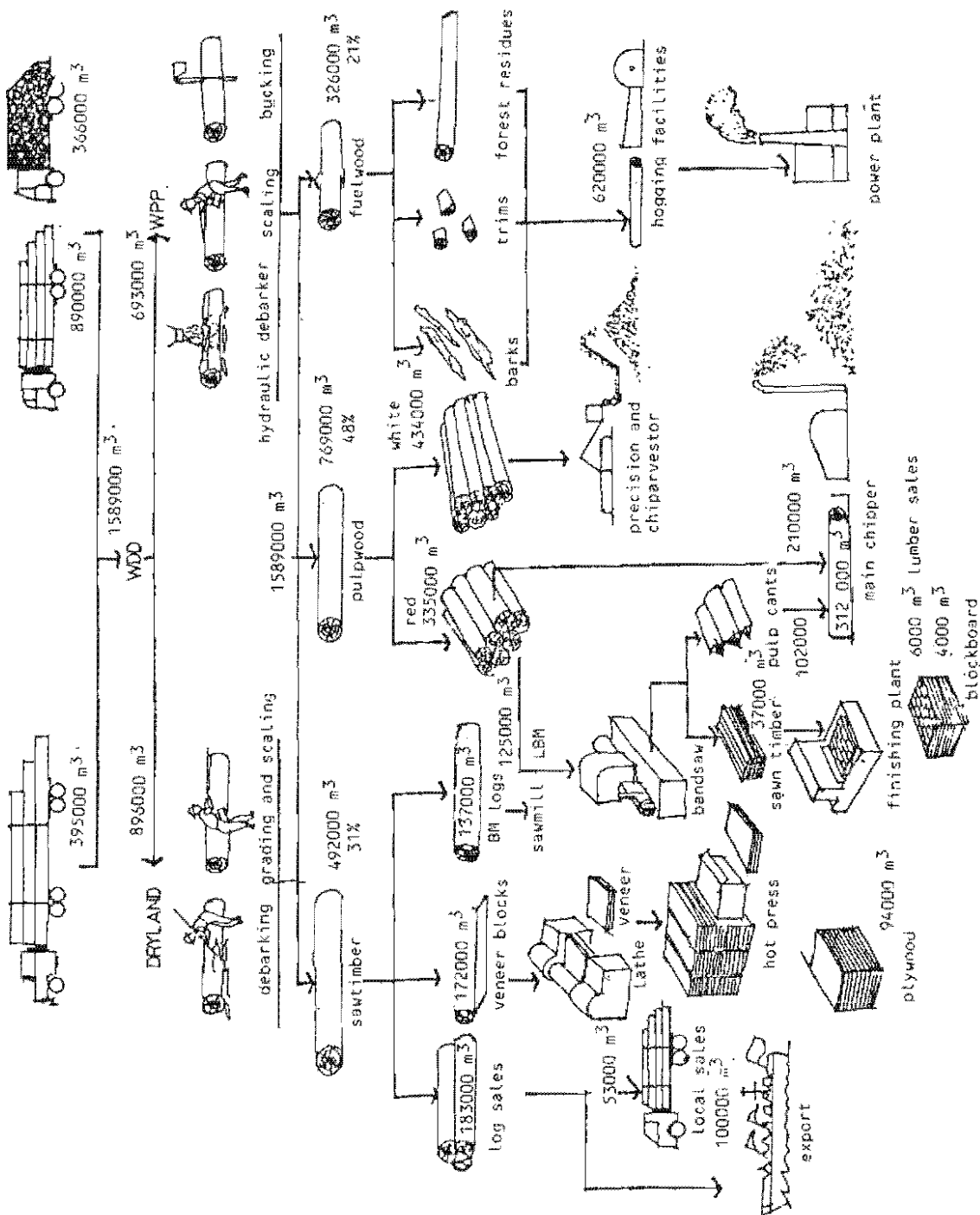


THE BISLIG FORESTS



APPENDIX 3

FLOW OF WOOD AT PICOP



THE KESEDAR PROJECT IN KELANTAN, MALAYSIA:  
A STUDY OF THE SOCIO-ECONOMIC DYNAMICS  
IN A NEW LAND DEVELOPMENT SCHEME

by

Alexa Webster

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## 1. INTRODUCTION

Since 1956 the Malaysian Government has been involved in land development schemes as a component of a national plan to develop the resource base of the country while simultaneously stimulating regional development. Such schemes and their adjunct development of institutions and infrastructure to service them became even more integral to national development activities with the introduction of the New Economic Policy (NEP) in the Second Malaysia Plan (SMP, 1971-1975). In addition to spurring resource and regional development, land development schemes were anticipated to contribute to the eradication of poverty and restructuring of society in its social and economic functions as stipulated in the NEP strategy. Implicit in such a strategy was income distribution and alleviation of regional disparities.

In response to such strategies, the Kesedar project (Pembangunan Kawasan Kelantan Selatan) was designed with implementation starting in 1978. The project denoted a commitment and determination on the part of the Government to directly address many of the problems of the rural poor in Kelantan. In essence, the mandate of the Kesedar project was:

- (i) to fully develop the southern region of the state into an economically viable productive area and to ensure a more equitable distribution of the benefits of economic development to the Kelantanese people in accordance with the goals of the NEP;
- (ii) to provide employment opportunities especially to the Bumiputras (literally "sons of the soil" and used by the Government to identify the Malay ethnic group of the Malaysian population);
- (iii) to encourage Bumiputra participation in the development process by creating an environment conducive to their entry into the commercial sector of the economy (for example, in order to encourage Bumiputra logging concerns, the Government would award logging concession licences to Bumiputra companies); and
- (iv) concomitant to (iii), training programmes and financial institutions would be developed to encourage and enable Bumiputra participation in such ventures.

It is not the intent of the author to either question or evaluate the underlying decision-making processes nor the objectives of the Kesedar project. However, problems have surfaced in the Kesedar project which have resulted in it falling somewhat short of its objectives and hence the goals of the NEP. These shortcomings seem to be attributable, in part, to incomplete problem analysis by underestimating the impact of prevailing socio-economic conditions on the implementation of the activities of the project. The paper aims at examining those conditions and at analyzing their impact on the project in achieving its goals.

## 2. CONDITIONS AT THE DESIGN OF THE KESEDAR PROJECT

### 2.1 General

Examination of any facet of the economic system in Malaysia in the past reveals an inequitable distribution of financial and political power. Therefore, the Second Malaysia Plan called for an increase to 32

percent by 1975 for Bumiputra participation in the modern economic sector, indicating how small Malay participation was in the economy given that they constitute the largest ethnic group in the country.

The New Economic Policy is a strategy designed to restructure economic and social imbalances in the Malaysian society. Its objectives are:

- (i) to reduce and eventually eradicate poverty by raising income levels and increasing employment opportunities for all Malaysians, irrespective of race; and
- (ii) to accelerate the process of restructuring society to correct racial economic imbalances in the context of an expanding economy, leading toward the creation of a dynamic and just society. (SMP, 1971-1975, p. 1.)

The Federal Government, in conjunction with the state governments, has sought ways to implement NEP objectives by encouraging Bumiputra participation in economic development through integrated regional development strategies. Rural Malays, identified as the group experiencing the most regional and ethnic imbalances, became a priority target group for such strategies. Land development schemes as a component of regional development plans became a panacea for the manifold problems of the rural poor in Malaysia. Landlessness, underemployment, unemployment, unproductive farm holdings and subsistence agriculture were to be eradicated by projects such as Kesedar.

The NEP demonstrated an understanding of the underlying problems of development in Malaysia - a disequitable development process marked by social, economic and ethnic imbalances. The economic and social goals expressed were aimed at attaining sound and stable growth to correct the imbalances. Moreover, it was designed within the context of an expanding economy whereby the underprivileged would be allocated a larger slice of the "economic pie". Not all Malaysians, however, perceived that "pie" to be expanding and became anxious that their share would diminish. The restructuring policies promulgated by NEP inadvertently contributed to a polarization of ethnic identities determined to protect their shares of that "economic pie". In such an atmosphere, serious reactions and behavioural responses developed which could be expected to affect the implementation of projects like Kesedar. These will be discussed in the analysis of the project.

## 2.2 Ecological Milieu

The state of Kelantan, located in the north-eastern region of the country, covers an area of 14 750 km<sup>2</sup> (1.5 million ha) of which 75 percent is occupied by forests. The topography is dominated by mountains in the southern and western areas, which has contributed in the past to a geographical isolation from the rest of the peninsula. In the northern part of the state is the only flat area constituting 20 percent of the total land area - it is intensely cultivated. Rubber accounts for approximately 45 percent of the total cultivated area; padi (rice), 33 percent; mixed horticulture, 18 percent; and palm oil, 4 percent (Economic Survey, Kelantan, 1979, p. 1).

Kelantan has one of the largest concentrations of Bumiputras in the country - 93 percent (or 673 012) - of the total state population of 686 286 (ibid, p. 1). The vast majority of the population (over 500 000) resides as padi farmers on the 1 550 km<sup>2</sup> alluvial plain created by the

Kelantan River. At least half of the households in Kelantan earned less than M\$ 150/month<sup>1</sup>/ in 1976; indications are that 76 percent of households in Kelantan live in poverty compared to a national average of 49 percent (*ibid*, p. 2).

The Kesedar region, located in southern Kelantan, had a population of 61 780 in 1970, of which 89.6 percent or 54 141 were Bumiputras. The man-land ratio was 9:1 per km<sup>2</sup> as compared to a 58.8:1 per km<sup>2</sup> in the northern part of the state. As of 1978, the population had increased a mere one percent to 67 489. The area was still heavily forested with only 53 916 ha under cultivation - primarily rubber (81%) (Lembaga Kemajuan Kelantan Selatan, 1984, p. 20). Development has been hindered in the past by geographical constraints - a mountainous and heavily forested terrain. As a result, the area has had little infra-structural development. This absence of readily accessible infrastructure impeded opportunities and access to market and service areas for the population of the region and reinforced the sense of a remote and isolated hinterland. Additionally, this sense of isolation deterred spontaneous settlement. The majority of Kelantanese preferred to remain either in proximity to service and market areas and familial ties in the north-east of the state or to travel out of state to where employment opportunities were greater and more lucrative and ancillary services available.

Given such constraints to development in southern Kelantan and the poverty in the state, Kelantan was an ideal environment in which to operationalize the NEP strategies.

### 2.3 The Socio-Economic Milieu

It has been understood that the Kelantanese Malays personify all that is associated with being Malay in Malaysia. They are seen as a closely knit and proud people who continue to pursue their traditional culture in a rural milieu. They embody, however, a dilemma, caught between the need to retain traditional value systems and the need to participate in the growth and development of their country. They are cognizant of their socio-cultural beliefs having remained intact because of their marginality to the modern Malaysian economy. However, the increasing disequitable distribution of incomes and standards of living between themselves and Malaysians, as a whole, has not gone unnoticed. The Kelantanese, like other Malaysians, want to participate and share in the growth and prosperity occurring in their country. To balance participation in the development process while simultaneously preserving their cultural heritage has become their dilemma - the Kelantanese dilemma. Kelantan's settlements are primarily rural with the agricultural sector providing the largest source of employment. Practically all farming is on a smallholder basis at the subsistence level, marked by low yields and low levels of technology. It should be noted that most farming is done in conjunction with other activities such as tobacco, *dusun* (fruit and vegetable gardens), coconut or non-farm occupations. Such diversity is indicative of subsistence economics where the rationale of "hedging one's bets" prevails (i.e., little latitude for income failure within their power).

The extended family is the nucleus of the Kelantanese household - extended in the sense of the nuclear family and sundry relatives freely moving in and out as the occasion dictates. After the family, the

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<sup>1</sup>/ 1976 rate of exchange: US\$ 1 = M\$ 2.20

kampong (village) structure is central to the individual. The kampong social structure provides a milieu for mutual support, security, guidance, social interaction and identification. It is common that a person, upon introduction, identifies him/herself in terms of their kampong.

The Kelantanese (used here as synonymous with Malay) society is noted for having an inordinate number of female headed households. This is due, in part, to social practices associated as being distinctly Kelantanese. Polygamous marriages and an excessively high divorce rate (between 1948 and 1957, 71 percent of marriages in the state ended in divorce) force many females to take sole responsibility for the financial well-being of their families. The result is that the female has become an active participant in economic activities (albeit activities in the informal sector). It is generally accepted that female headed households constitute a large component of any target group identified as being poor. Since in Kelantan they comprise an unusually large component of the rural poor, it would be assumed they would be recipients in any programme aiding the poor. Moreover, given that the land development schemes are anticipated to alleviate a great many of the problems associated with the rural poor, it would follow that female headed households would participate in them. This may be unlikely to occur, however, as a result of a stringent adherence to a division of labour code in Kelantan.

In Kelantan, farm activities are distinctly demarcated by sex. In padi farming women have the tasks of caring for nurseries, transplanting, weeding, winnowing and threshing while men prepare the land and harvest the crop. Delineation of tasks is equally prevalent in rubber and palm oil cultivation. To perform tasks of the opposite sex results in a severe loss of face in the kampong.

Such division of labour codes have important implications for land development schemes. Female headed households would find it exceedingly difficult to perform the tasks associated with land development and the subsequent farm activities. Moreover, it should be noted that in the initial stages of the Kesedar project only the males of a household were permitted on the project to prepare the individual landholdings. This decision was necessitated due to inadequate housing and infrastructural facilities in the early stage of the project. Given such considerations, few, if any, female headed households would be willing to risk participation in the land development scheme. Without access to the opportunities of the schemes, female heads of households would maintain their status quo in the traditional activities of the informal sector where divisions of labour would not preclude their participation. Furthermore, their activities would continue in established "no risk" areas of the densely populated north-east region.

In view of the above, a considerable component of the rural poor of the state (i.e., the target group of the project) would be eliminated from participation in the project and the Government would have to develop alternative programmes to aid this group (unless a way to accommodate them was to be found in the project as it developed).

The division of labour practices also creates problematical situations for the males who participate in the scheme. As has been stated previously, Kesedar was set up on a model whereby in the initial stage of land development only the males of a household (excluding school aged boys) would be permitted to work the land. Although the male inputs are greater than those of the females for rubber and palm oil production in Kelantan, the secondary activity - the home garden - is cultivated by

the women and their children. The income from the produce of home gardens is important for supplementing the family income. For the adult males of the household to perform such tasks, however, would constitute a loss of face in their villages. Given the time involved in operationalizing a home garden, if the males were not to develop them, it would mean prolonging the time before the family would benefit from its yields once the entire family was settled on the new landholding. Here is the dilemma - they cannot do it - yet, they cannot, not do it! Such dilemmas may seem somewhat exaggerated in importance to the outsider. However, it should be remembered that incomes in the early years of such projects are negligible except for Government supports - increased financial burdens only add to an already stressful environment for the new settler.

For the Kelantanese, as for the majority of Malaysians, land is security. The security, however, is in owning the land, not in the working of it. In Kelantan land ownership is an extremely sensitive issue. Seventy-five percent of the land in the state is still forested and protected under the Malay Reservations Enactment. This means that the land is under the authority of the state government and cannot be released to non-Malays. Even though these lands are held in trust and their release controlled in their favour, the majority of Kelantanese cannot afford to buy them. Those Malays who have the financial resources quite naturally purchase agricultural land already developed. The premium prices demanded for the land in the developed fertile north-eastern plain is financially prohibitive to the majority of farmers. Hence a small, well connected Malay elite own the "prime" agricultural land which they, in all likelihood, do not work themselves.

Some 96 percent of the farmers in Kelantan lease land on a crop-sharing basis and experience the full range of difficulties associated with such conditions (i.e. insecurity of tenure, fragmented or small farm size, lack of capital and/or collateral, lack of access to financial institutions, low technology inputs, low productivity, poor quality yields and debts to non-institutional bodies). It would appear that crop-sharing stems from two economic realities in Kelantan: (i) absentee landlords who own the land but do not want to work it, but are willing to lease to the landless on a crop-sharing basis; and (ii) small scale farmers who have for various reasons mortgaged their land, defaulted on payments and were forced to sell. It is common in (ii) that the new owner leases over the land to the former owner on a crop-sharing arrangement. There is no need to discuss the ensuing sentiments associated with such events. It is sufficient to say that it is not only the family who suffers a personal loss but the kampong as a whole. Although such actions are perfectly legal on the part of the new owner, many of the villagers regard the new owners (although themselves Kelantanese) with contempt and distrust as usurpers of the rights of the true "Bumiputras".

Land was in the past and still continues to be a valued commodity among the Malays. Until very recently there were few occupational alternatives to farming for all but the small elite centred around the Sultancy. With universal education a reality, new alternatives emerged for the rural youth. Alternatives which amplified aspirations and expectations far in excess of what the Government would seem to be able to deliver. With a close correlation between education qualifications and the type of work young people were/are willing to accept, farming became unacceptable. Their education prepared them to anticipate growth and development in their country and it was their right to have access and to share in it commensurate with their qualifications.



One of the basic assumptions of land development schemes has been that subsistence farmers and rural poor want to remain farmers and that, by improving conditions and production, rural poverty would be placed in check. For certain components of the rural poor, that assumption has been and continues to be valid and has been borne out in various land development schemes in Malaysia. However, for the educated rural youth such a solution is not so easily accepted. Granted that, ultimately, financial circumstances will force changes in attitude, their aspirations and expectations will not disappear ... they do not want to be farmers ... they want something with more status and greater returns. Resistance to farming has been so intense in some young Kelantanese that they have implied that land development schemes are a ploy to keep the Bumiputras in the rural areas and marginal to the real growth of the country. Whether such sentiments are valid or not is irrelevant if they are sincerely felt and expressed as a certain kind of reality.

Historically many rural youth have migrated out of Kelantan to the industrial areas of the south where wages and facilities were more in line with their aspirations. However, with the closure of Singaporean factories to Malaysians and a labour surplus for the factories of Malaysia, such options are not so readily available for the vast majority of Kelantanese rural youth of today. Undeniably, alternatives are needed but, more importantly, they must be alternatives acceptable to the rural youth as being in line with their aspirations and expectations.

The aspirations, expectations and attitudes of today's youth in Kelantan have serious implications for land development schemes. First and foremost is concern that fewer youths would be interested in participating in the schemes. Given that the youth constitute one of the state's most valuable resources, if a substantial number choose not to participate, how would that affect the longer term strategies of the schemes? Moreover, what alternatives would be available to them and how would the Government integrate them into the overall strategies of the NEP? Secondly, if they were to participate and given the hardships confronting them as settlers, how would their attitude (a sense of disenfranchisement) affect the successful implementation and ultimate objectives of the project? Thirdly, resistance and/or refusal to participate in such schemes may affect the family's decision to participate in them. In land development schemes manpower is a resource heavily dependent upon operationalizing of individual landholdings. If the young are unwilling to work with the family, the family would suffer a substantial reduction in their output capabilities at a crucial period. Under such circumstances, would the family be willing to take the risk of resettlement? An issue such as resettlement would be a consensus decision. Even if economic considerations and realities determine participation, compromises would be made to accommodate the harmony of the family. That is the Kelantanese way. How would such compromises affect the family's ability to cope with and perform the tasks on their new land?

Kelantan is noted for having a large proportion of its population migrating out of state for employment. Be it to Kedah to help with seasonal activities or to Kuala Lumpur, Penang or Johore Baru, Kelantanese (primarily males in their productive years) seek employment to supplement their family incomes. Between 1957 and 1979, some 55 700 Kelantanese sought employment on a permanent basis elsewhere in the country. Optimally, economic development would curb this flow and attract those who have left, back. (To attract Kelantanese back to the state has been a personal objective of the Mentri Besar (state minister) of Kelantan who wishes to maintain the distinctly Kelantanese way of life.)

Emigration has been a particularly problematic issue for Kelantanese. The incomes derived from such employment have often provided the needed cash for the basic needs of the family. At the same time, however, migration deprives family of one of their most highly productive resources. The remainder of the family - wife, children and, perhaps, older parents - do the farming tasks. It is possible that these families would be hesitant to participate in land development schemes. Firstly, they may be reluctant to take the risk in foregoing the supplementary income they depend on with the head of household having to work the new land. Secondly, if there is a reluctance to forego the supplementary income, the family would be in a situation similar to the female headed households in that they would not have an adult male to prepare their holding. (It is assumed that the rigours of land clearing and preparation at this stage would be exceedingly difficult for males over 50 years of age and thereby exclude the woman's father or father-in-law from doing these tasks.) Given such considerations, it may be possible that these families would retain their status quo in a perceived no-risk situation rather than take the opportunities offered by a new landholding.

An attitude of dismissal could easily be taken toward those who do not want to or cannot participate in the programmes such as Kesedar. There are always others willing to participate. However, reasons why certain components of a slated target group refuse to participate in a project have considerable bearing upon measuring the ultimate success of that project. Considering the extent of rural poverty in Kelantan, the fact that certain groups do not participate may point to intrinsic weaknesses in the project design or to problems in the society which the project has not taken into consideration when analyzing the problems of the very group they are targetted to help. The preceding discussion has attempted to illustrate the measures the Kelantanese have taken themselves to maintain their social structure and cope with the problems of their poverty. They have taken actions in response to conditions and circumstances over which they have little control but must, nonetheless, exist in. Recognition and analysis of the measures taken by the target group to cope with their daily needs should be central to the project designers problem analysis. Far too many programmes anywhere in the world presuppose an understanding of the socio-economic environment without proper analysis. As a consequence, analysis is often done in terms of the project (i.e. analysis is preconceived to fit the project).

Given the success of land development schemes in Malaysia, attracting participants per se has not been a problem. However, attracting the right participants (i.e. the group targetted to benefit from the project) is another matter. For example, if the rural poor at subsistence level are the target group of a project and it is apparent that the family and kampong (which are central to their way of life) was perceived to be threatened or altered by the project, how would those sentiments affect the degree and success of their participation in that project? If the risks when weighed are too great and they forego participation, who, then, would actually benefit from the project? Would the project achieve what was originally intended? If risks and impacts are identified in the pre-design stage, then perhaps the project would be able to circumvent such problems and reach the stated beneficiaries.

#### 2.4 Economic Dualism

Analysis of any problem in developing regions illustrates the interdependence between the social and economic milieux. Certain economic situations determine aspects of the social milieu and vice versa. In Kelantan responses to events in the social and economic

milieux appear accentuated by overriding concerns between "have and have not" issues translated into ethnic concerns and emerging as a form of economic dualism.

As has been stated earlier, 93 percent of the state population is Malay while Chinese and Indians constitute 7 percent. Due to historical factors, the majority of Malay Kelantanese participate in traditional agriculture. For the same historical reasons, the Chinese are involved almost monopolistically in all facets of the trade and industrial sectors. Their children receive on-the-job training from their families and relatives in acquiring the skills to operate within those sectors. Under such conditions and given the absence of ethnic interaction, the trade and industrial sectors become closed spheres, open only to those with ties to them. Such a circular system allows little opportunity or latitude for the Kelantanese to have access to these sectors. Moreover, they simply lack the required skills to compete and operate in them. An important point to consider here is that, although universal education exists, it is of a classical rather than vocational nature and does not prepare its students for the real skills required for the growth and development of the economy within the state.

It is precisely this sort of economic and social polarization that the NEP wants to rectify by "elimination of the association of race with economic activity." To redress the economic imbalances, the Government has created programmes (such as Kesedar) which will eventually turn the balance scales toward an equilibrium. Not all Malaysians view the programmes as an attempt to balance economic disparities. The Chinese, who as a group feel that they are not favoured by the policies and programmes, interpret the actions as a deliberate attempt to weaken or destroy what they have achieved. It must be emphasized that the validity and/or veracity of such opinions is not the concern here, but rather the reality which results from such beliefs and the subsequent responses to them. Concern is with the methods and extent of the measures the group initiate in response to those programmes.

The phenomenon of the "Ali Baba" illustrates such methods and responses. The Malaysian Government has set legislation whereby any new enterprise in Malaysia must have 51 percent Bumiputra ownership. Adherence to the legislation has resulted in entrepreneurial Chinese seeking out equally entrepreneurial Malays who will, on paper, maintain control of the magic 51 percent. For their signature, the Bumiputras are paid a "directors' fee" and are expected to stay out of the way. They do not learn nor are they aware of the mechanisms of "their" business; nor can they have access to such information.

Ostensibly the legislation was designed for all the right reasons. It was designed to stem the flow of economic control from Malays while providing on-the-job training, enabling them to eventually operate the businesses themselves. However, overlooking certain social realities - that the Chinese would not readily welcome Malays into their business world and that the Malays in turn would prefer not to work with the Chinese - plus the lack of economic reality in the assumption that a group would willingly relinquish control of their domain, the legislators severely limited the scope and impact of a sound policy.

The "Ali Baba" phenomenon points out another weakness endemic in economic dualism particular to this region ... a shortage of Bumiputras with expertise or training to function successfully in the realms of business. Ultimately the Malays will acquire the skills. However, in the interim, self-fulfilling prophecies of failure and/or "Ali Baba's" might possibly undermine their participation in economic development and thus the goals of the NEP.

### 3. THE KESEDAR PROJECT

#### 3.1 Project Design and Implementation

The Kesedar project evolved as a part of an overall integrated regional development plan for the state of Kelantan in line with the goals and strategies of the NEP. In opening up new land in the southern region of Kelantan, the project was to:

- (i) provide employment opportunities particularly for Bumiputras;
- (ii) improve the social and economic status of the kampong people;
- (iii) ensure a more equitable division of the benefits from economic development;
- (iv) help improve the man:land ratio in the north by resettling underemployed farmers and provide agricultural land to Bumiputra landless and casual farm labourers;
- (v) promote the region as a growth centre;
- (vi) encourage Bumiputra participation in all facets of the project by providing the necessary training programmes and appropriate financial institutions; and
- (vii) encourage Bumiputra participation in the development process by creating an environment conducive to their entry into the trade and industrial sectors.

The executing agency - Lembaga Kemajuan Kelantan Selatan (Development Board of Southern Kelantan) - was to be funded by the Federal Government. The release of land for the project was to be determined by the state Department of Forestry in conjunction with the state development planners. In the initial phase, 6 000 ha of land were to be allocated under a budget of MR\$ 23 000 000. During this phase (which coincided with the latter part of the Third Malaysia Plan) it was estimated that 1350 people would be settled within the project area.

To integrate Kesedar with the regional development plan of the state, five activities (in addition to the organizational framework) were designed:

- (i) development of new agricultural lands;
- (ii) town development;
- (iii) traditional kampong development;
- (iv) infrastructural development;
- (v) development of an investment programme; and
- (vi) introduced in 1983, rehabilitation of land contiguous to or in the Kesedar region.

The nature of the activities was to be determined by Kesedar's executing agency coordinating with the state's planning units.

During the design of the project, it was determined that rubber and palm oil estates and forestry would constitute the principal economic base of the region. Forestry had been identified as not having realized its income potential despite the availability of natural resources. The planning design specified that the processing of forestry produce would be increased substantially while the exports of logs would be reduced. In addition, the first forestry complex at Gua Musang, reinforcing the town as a growth centre, was to help promote the establishment of integrated timber-based industries in the region.

The project began in 1978 with the focus on structuring the organizational framework of the project and recruiting staff. Concomitantly, a land settlement model, whereby people would be settled on the land immediately with provision for their subsistence requirements was set in motion. Activities centred around land clearing, land procurement and the selection of the first wave of settlers. Simultaneously, the state government began infrastructural development of the area.

By the early eighties, with minimal regional infrastructural requirements completed, all activities of the project were in various stages of implementation. In 1983 the project became an "umbrella" for all projects developing the southern Kelantan region including land and crop rehabilitation.

### 3.2 Evaluation of the Project

As a component of longer term objectives for the development of the state, Kesedar's achievements have yet to be realized. Progress toward those achievements, however, has been slower than anticipated in the planning strategy. The problems identified by the author as impeding Kesedar's progress have been:

- (i) Recruitment problems as evidenced in the difficulties in recruiting staff for the wide range of expertise required and in obtaining administrative personnel;
- (ii) Difficulties in coordinating project activities and allocating them to the respective agencies involved;
- (iii) Institutional problems whereby activities were dependent upon other agencies performing tasks prior to Kesedar's involvement; which resulted in lengthy delays of the project (e.g. infrastructure, water and electricity);
- (iv) Due to restrictions in awarding logging concessions (i.e. to Bumiputra firms only), the selection process became unduly lengthy thereby slowing down project activities which would follow; moreover, once concessions were awarded, difficulties in land clearing occurred as a result of delays in infrastructural construction and an absence of skilled labour;
- (v) Due to the remoteness of the area, there were difficulties in attracting and maintaining labourers to work in the infrastructure and construction sectors;
- (vi) Owing to a number of factors, there were difficulties with having settlers remain in the region (see "Analysis of Kesedar Project"); and

- (vii) Delays in the procurement of materials and a poor performance, on the whole, of the construction sector impeded the physical progress of a variety of project activities.

A number of these problems are, in part, inevitable given the long-term nature and scope of the development plan in an undeveloped region. Due to the region's isolation, for example, attracting labourers becomes intrinsically problematic. Furthermore, until certain minimal levels of infrastructure are realized, delays in land clearing and delivery of materials are unavoidable. The majority of problems identified will not, however, be ameliorated with the region's initial development. It is likely that the problems will continue and be exacerbated as the project progresses unless certain socio-economic factors are recognized and attempts to rectify them are built in to the project.

In the following discussion, analysis of the above problems in a socio-economic context will be presented.

### 3.3 Analysis of the Kesedar Project

The Kesedar project has had two main objectives:

- (i) to develop the southern region of the state in terms of its natural resources and potentials; and
- (ii) to redistribute incomes and increase opportunities for the rural poor.

Both goals are intrinsically part of the NEP and the activities designed reflect the strategies established in the NEP. There is no questioning of either the strategies or the activities of Kesedar or the NEP. In fact, the Government should be commended for having taken an action-oriented approach to its development goals. The problems which have been identified in the Kesedar project have arisen because of an intricately woven socio-economic milieu in Kelantan which affects all facets of development in its southern region.

A shortage of staff in terms of administrative needs, expertise for extension services and for operationalizing development strategies has created problems since the beginning of the project and continues to be a bottleneck. This situation is indicative of all projects in Malaysia where expertise is required. Facilities to train the experts are too few and reflect an overall problem in the strategies of the educational system (i.e. policies have not always realistically followed the needs and requirements of the labour market and economy as a whole).

Delays in implementation, poor implementation and non-achievement of goals are synonymous with shortages of staff. In Kesedar the shortages in extension staff to retrain settlers (usually former padi farmers) in the cultivation of rubber and palm oil has impaired productivity and, hence, income generation. A shortage of experts in training construction workers, road builders, land clearance labourers, for example, has contributed to the slow start of the project and continues to plague it as activities multiply. To exacerbate the situation, other agencies such as FELDA, FELCRA, RISDA<sup>1/</sup> and all other

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<sup>1/</sup> FELDA = Federal Land Development Authority  
FELCRA = Federal Land Rehabilitation Authority  
RISDA = Rubber Industrial Development Authority

federal and state agencies are equally seeking experts so that competition for the human resources available is acute. In such a demand scenario, few experts are willing to be recruited to an area so isolated and underdeveloped as Kesedar.

Given the financial resources available in Malaysia and given the potential of human resources, due consideration should be given to training experts as quickly as possible. With the existence of a well-educated rural youth in Kelantan, the developing of programmes to train them in the skills required for integrated land development schemes should be a priority. Under such programmes, the skills required to meet the demands of development would be achieved while concomitantly providing alternative non-farm employment for the youth who do not want to be farmers.

In terms of problem analysis, it is evident that the acute shortage of technical expertise has been and will continue to be a major bottleneck to the success of Kesedar. Given the scale of land clearing, infrastructural development, agricultural extension and construction required, the scope of the project is far in excess of the capabilities and capacities of human resources available. And yet, in 1982, the scope of Kesedar was increased to include rehabilitation of land and expansion into primary resource industries thereby creating an ever-increasing demand for skilled experts and labourers.

The overall staff shortage is exacerbated by giving preference to Bumiputras for staffing and provision of services for development. This policy is in line with increasing opportunities for Malays to participate in the development process. Per se there is no problem with such a policy. However, realistically there are not enough Bumiputras who, as yet, can deliver such services. In the private sector, for example, contracts were often awarded to inexperienced contractors resulting in untold delays and difficulties in delivering the agreed-upon service/product. There are manifold socio-economic ramifications in such a situation which affect the outcome of activities in the project:

- (i) Often expert personnel are placed in an area for which they have inappropriate expertise, e.g. a tobacco extension expert supervising rubber plantations;
- (ii) In an area where there are already too few experts, the possibilities of recruitment are diminished further by constraining hiring to Bumiputras only;
- (iii) Inexperienced contractors fail because of their very inexperience as a consequence of which they end up being viewed as incompetent;
- (iv) The favouring of certain ethnic groups at the expense of others in obtaining contracts has resulted in a polarization of ethnic identities;
- (v) Failures in businesses may result in the non-realization of expectations and aspirations for many Malays and reinforce their sense of frustration arising from not being able to positively participate in economic development; and
- (vi) Difficulties in delivering services/products has resulted in inordinate and often unnecessary delays which affect the progress of numerous components of the project.

Kesedar and other land development schemes in Kelantan must coordinate with the Government agencies, JKR (roads) and LLN (electricity and water)<sup>1/</sup> for the necessary infrastructure. Kesedar has had to prioritize its development areas with five other land development and rehabilitation schemes in order that JKR and LLN schedule their work programme. There is no need to elaborate on the gamut of problems which arise under such circumstances. They are common to all projects where massive coordination and delineation of specific tasks occur. Their impact, however, in terms of delays in land clearing and the permanent settling of families will be discussed.

Due to delays in road construction and electrification in the initial phase, it was decided that only males of a household would work the landholdings. This would simplify housing requirements which were primitive barracks. Without adequate roads for clearing and electrification, the work on housing could not proceed as originally planned.

With the delays in physical infrastructure, the construction of the social infrastructure (i.e. marketing facilities, servicing centres, schools, etc.) was impeded and consequently did not develop concurrently with the land development component. Construction of such ancillary systems would determine when families could move into the area in terms of schooling and services and when commercial enterprises could start up, thereby providing needed services and extra employment opportunities for the settlers. The absence of such facilities in the first phase of the project strongly influenced many settlers' decision not to remain in the programme.

It should be noted that, given the scope and scale of the project and the number of agencies responsible for various components of it, the executing agency has performed well in achieving the level of development it has to date. Since the beginning of 1983, Kesedar's executing agency has taken over the coordination of the development projects of the entire region and it is anticipated that many of the administrative problems mentioned above will be abated.

Awarding of logging concessions and land clearing has created a plethora of problems for Kesedar. Logging concessions were to be awarded to Bumiputras as a way of integrating them into an extremely profitable sector of the economy in Kelantan. At the time of Kesedar, however, nearly all logging companies, not only in Kelantan but in Malaysia, were owned and operated by Chinese. The Chinese also dominated all ancillary systems for the logging industry (sawmills, truck leasing and heavy equipment companies, timber companies). The awarding of logging concessions to inexperienced Bumiputra companies resulted in an atrophying of ethnic relations in Kelantan. The established logging companies and sawmills proceeded to take two different courses of action in response to the concession awards. The first was to freeze or make access difficult to all facilities and equipment the Bumiputra companies would require to complete their contracts. Such actions resulted in a self-fulfilling prophecy - the new companies failing to execute their tasks competently and/or on time. Compound such formidable constraints with delays in road construction and it is not surprising that many of the new companies did not rate highly in fulfilling the terms of their contracts. An alternative and far more common response to the concessions issue was the emergence of the "Ali Baba" practice of a Malay fronting an essentially Chinese operation. How the "Ali Baba" functions

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<sup>1/</sup> JKR = Jabatan Kerja Raya  
LLN = Lembaga Elektrik Negara



has been described earlier. The end result of an "Ali Baba" is the total circumvention of a Government policy - on-the-job training for Malays to enable them to operate effectively and with skill in the country's economy.

Both actions reflect an underestimation of the extent and degree of opposition the Chinese had to NEP strategies and an even far more serious underestimation of how polarized the ethnic communities had become in terms of interaction, cooperation and sharing the "economic pie" discussed previously.

In an environment of limited skills and technical expertise, cooperation and interaction between the "have and have nots" should have been encouraged and developed. Moreover, given human nature, it was unrealistic to have expected the Chinese, who perceived their share of benefits as being diminished to acquiesce without a confrontation of some sort. Such problems should have been anticipated when Kesedar was being designed and ways and means of diminishing these negative impacts should have been a part of the project package. The full impact of non-cooperation and of "Ali Baba's" has yet to be measured. There is no doubt that both actions have severely impeded Kesedar's mandate to encourage Bumiputra participation in its development process and the goal in the NEP of "accelerating the process of restructuring Malaysian society to correct racial economic imbalances." Perhaps of paramount importance is the further retrenching of ethnic polarities which may become even more exaggerated in future endeavours.

Since forestry was identified as one of three main economic bases of Kesedar, care should have been taken to assure its successful implementation. Given the expertise, skills and equipment already available in the Chinese community, it might have been prudent to have integrated them into the activity of forestry development for the project. The logging and sawmill companies could have been awarded logging concessions and their employees utilized as extension workers on the understanding that actual training of the Bumiputras was to take place. Not only would the Malays have received the training and skills to competitively participate in developing the forestry base of the region, but land clearing would have been done faster and more efficiently for the overall interests of the project. Equally important, such a formula might have deflected the ethnic polarities from surfacing so strongly ... with an air of cooperation and unity surfacing instead.

The land development model used in the Kesedar project called for the settlers to be placed on the land as soon as possible with their subsistence needs being met by the Government. What happened, however, was that only the males were allowed on the holdings. Although this decision, as discussed previously was made due to land preparation limitations, the consequences had far-reaching effects on the settlers and their families:

- (i) The men, accustomed to extended family support systems and the support of their kampong, did not like being isolated from those systems; in many instances the men left the project because they missed those supportive systems.
- (ii) The men, accustomed to a division of labour system shared by the extended family, found it difficult to perform all the tasks necessary to operationalize the landholding.
- (iii) Having the head of household on the project created immediate financial burdens on the family who, in a sense, was having to support two households.

- (iv) Often male members on the project had sought seasonal employment elsewhere in Malaysia thereby supplementing the family income substantially; financial burdens for the family resulted due to loss of that income.
- (v) The rather primitive conditions under which the men lived contributed to making an already difficult psychological situation more difficult.
- (vi) Delays in infrastructure and construction delayed even further the time before the family could be reunited on the new landholding; and
- (vii) Delays in infrastructure and construction meant that few opportunities to augment incomes through casual employment in other sectors of development (e.g. commercial establishments, markets, etc.) would be available to the various members of the family once settled.

As a result of the above or a combination of them, many settlers left the project during the initial phase. Land development schemes, in general, have been very successful in Malaysia and there have rarely been problems in attracting settlers to participate or remain on them. However, a highly organized social structure characterized by strong family and kampong alliances and migrating labour patterns, an absence of economic infrastructures (i.e. transportation, communication, financial and marketing institutions, public services, water supplies and electricity) and an isolation reinforced by topography are distinctive in their totality to the Kesedar region. Under such conditions and given the land development model used, it should not have been unexpected that an appreciable drop-out rate would occur. Essentially, the first wave of settlers perceived themselves as having been placed in a high-risk situation where the economic and social costs were higher than they were willing or could afford to pay.

Loosing participants will, necessarily, slow down the project's overall progress. More importantly, it points to an inherent weakness in the project design whereby certain socio-economic conditions in Kelantanese society have either been underestimated or not taken into consideration. It is very possible that many of the problems arising for the settlers could have been avoided or their impact diminished had the socio-economic factors contributing to them been more thoroughly analyzed in the pre-design phase of the project.

Underestimating the influence of certain socio-economic conditions is evident also in the selection process for settlers. Reports about or concerning the selectivity process have been vague and somewhat open-ended in terms of the criteria to define who is the target group and who should be selected within it. The Malay rural poor consisting of the landless, the underemployed and casually employed were identified as the target group. The particulars of who, how and why the settlers were selected are not clearly stipulated. Consequently concern arises as to whom the actual benefits of the project went/go to; if, in fact, there was/is an income distribution taking place; and if an actual restructuring of the society was/has been set in motion as a result of settler selection. As has been discussed earlier, there were/are groups within the non-homogeneous rural poor of Kelantan who, for specific reasons, could not participate in the project. These people were most at risk in terms of social and/or economic costs if they were to

participate. It is generally accepted in development planning that those at risk constitute the group to whose aid a major part of project planning should be directed. A question then arises as to whom the more equitable division of benefits from the land development schemes go. Moreover, a concept such as "equitable distribution of benefits" has emotive connotations which, in practice, are actually difficult to measure. Given that, can one assume that the NEP objectives of equitable distribution of benefits from economic development will be accrued to those actually experiencing the greatest economic imbalances? In Kelantan, for example, the poorest agriculturalists are the padi farmers on fragmented landholdings whose family members are involved in an economic system which attempts to optimize all avenues of diverse activities available to meet the family's needs. It is an extremely delicately balanced system which has little latitude for either variance or disruption. Participation in a land development scheme means a disruption in that system. Essentially eliminated from participation because their risks are too high, settler selection would then fall to those who can afford the risks. As has been proven in Malaysia, benefits from participation in land development schemes are impressive once production begins. Given the income potentials and that participants are those who can afford participation, it follows that income distribution would likely be on a horizontal axis and would not represent either a redistribution of income or an eventual restructuring of society. In view of this, it is perhaps desirable that the project had been designed to encourage those in greatest need of receiving aid toward increasing their productive capabilities and capacities and, hence, their incomes, to be able to participate in Kesedar.

Attracting labourers to work in the physical infrastructure and construction sectors indicates both the magnitude and circularity of the problems facing Kesedar. Any activity in Kesedar has been dependent upon a road network which would have to be built from the ground up. Road construction could not begin, however, until logging concessions were awarded and land clearing could not begin until the roads were constructed. Abetting this circularity has been the shortage of staff to administer and coordinate the activities and a shortage of skilled and technical staff to execute them. Additionally, because labourers did not like working under primitive conditions in such remote areas, they would work in the region for only short periods of time to supplement their family incomes. The areas were remote and facilities poor because materials and services could not be provided until the roads were built. Exacerbating this situation, the migratory employment patterns evolving from the above resulted in increased costs and demands on the staff who had to be constantly training new labourers to replace those who had left the region. To add yet another dimension to the problem - other land development schemes offered comparable wages for labourers under better conditions and closer in proximity to their families and villages.

It is assumed that many of the problems with retaining labourers will be somewhat ameliorated as the project progresses and will thus be characteristic of the initial phase only.

Analysis of the problems of poor performance in the construction sector and difficulties in obtaining materials for both the infrastructure and construction sectors can succinctly be stated as an embodiment of the problems heretofore discussed. In one way or another shortages of staff and labourers, problems in awarding contracts to Bumiputras only and administrative bottlenecks have influenced the performance capabilities and capacities of the construction sector and influenced the ability of companies to deliver materials to that sector.

A number of these problems will be solved or their impact lessened as the region slowly progresses toward being developed. Shortages of labour, technical and administrative staff and ethnic problems will, however, not be so easily abated without major changes in policies.

In the present analyses of the problems encountered during the early years of the Kesedar project, it is apparent there are linkages between many factors which have contributed to the problems evolving. In one form or fashion, these linkages are associated with aspects of the socio-economic conditions prevailing in Kelantan. It is these very linkages which make analyses of socio-economic conditions one of the key factors for the successful implementation and achievements of a project such as Kesedar.

### 3.4 Major Accomplishments of the Kesedar Project to Date

In terms of progress toward its objectives, the Kesedar project is well on its way to attaining regional development. The difficulties in operationalizing the project (given the scope and long-term nature) are naturally reflected in the slow progress achieved during the initial phase (1978-1980). With the completion of main roads (as of June 1984, 604 km of roads had been completed), water supplies (increased by 220%) and electricity (24% of population in southern Kelantan now have access to electricity), activities for construction of public services, facilities for marketing and commercial services, housing, etc., should increase considerably. Since 1978, land allocated for agriculture has increased some 98 percent from 53 916 ha to 106 910 ha as of June 1984. The population of the region has increased from 67 489 in 1978 to 171 287 in June of 1984. In terms of the Kesedar land development scheme, 3174 families have been settled on landholdings of 4 ha each.

To create opportunities for Bumiputras in non-farm activities as part of its overall investment activities, Kesedar established three companies:

- (i) Kesedar Sawmill Sdn. Bhd. (1980);
- (ii) Kesedar Inn Sdn. Bhd. (1981);
- (iii) Kesedar Galian Sdn. Bhd. (1982).

Kesedar Sawmill was set up in Gua Musang with a capacity to produce approximately 650 m<sup>3</sup> of sawnwood per month. The sawn timber was to be used for the construction of settler housing with the residual timber being utilized by the settlers for their personal needs. In 1981 a second sawmill with a capacity for producing approximately 500 m<sup>3</sup> of sawnwood per month was built in RKT Paloh III. Kesedar Inn, also located in Gua Musang (which had been designated as the major growth centre), was established to meet the housing needs of the settlers (i.e. to build hostels for the first wave of settlers). Of an originally projected 21 hostels to be ready by 1981, only 5, in fact, were built. Reasons for these delays have been discussed previously. Kesedar Galian (a brick factory) was set up to provide bricks for the construction requirements in the Kesedar region. Its capacity was set to produce 80 000 bricks eight times per year, employing twenty people from the settler community; it has achieved this goal.

By 1981, 86 percent of all the contracts for development of the Kesedar region were awarded to Bumiputras; this increased to 90.5 percent in 1983 and, in the first half of 1984, it increased further to 98 percent thereby fulfilling one of the major objectives of the project - opportunities for development of Bumiputra enterprises.

Land rehabilitation, which became a Kesedar activity in June of 1983, has rehabilitated some 1 118 ha of rubber trees out of an objective of 1 564 ha. In a joint programme with RISDA, 3 272 ha of land was rehabilitated in 1983 with an additional 2 424 ha converted to rubber estates with the provision of young plants.

In addition to rubber estate rehabilitation, activities in 1983 have also encouraged the development of home gardens (383 ha), coconut groves (28 ha), fresh water aquaculture (20.2 ha) and animal husbandry with the provision of 353 heads of cattle.

Kesedar has also been involved in developing the economic infrastructure of Gua Musang, Jeli, Manik, Urai, Kuala Krai, Kemubu and Dabong to meet the demands for public services and commercial activities generated by the project. Since the region's overall development is slated for completion between 1990 and 2000, it is too early to assess achievements in general. It is possible, however, to state that major development inputs have already taken place and that the region is progressing toward the objectives stated in Kesedar's integrated strategy.

### 3.5 Implications for Future Projects in Kelantan

Prior to the early seventies, development and growth prospects for Kelantan were less than satisfactory. The Malaysian Government, however, recognized many of the bottlenecks to regional development and growth in the region and responded with an integrated rural development plan which would, ostensibly, improve the economic and social conditions in the state. The Government's determination and commitment to address and rectify these bottlenecks has been reflected in the New Economic Policy.

Over the last ten years, land development schemes have changed appreciably in response to the social and economic needs of the participants as identified through evaluations of the schemes. For example, land development schemes in the past have been criticized for not creating an environment conducive to self-reliance on the part of the settlers in terms of development and maintenance of the land settlements. Clearly, the Kesedar project, through its activities such as Kesedar Sawmill, Kesedar Inn and Kesedar Galian reflects a recognition of that criticism and an effort to correct it. To revise activities in response to monitoring and evaluations is vital not only for the ongoing project, but for the design of future endeavours.

Since major development and growth efforts are under way in Kelantan, experiences from the Kesedar project can prove to be an especially useful resource for the design of future activities such as a pulp and paper mill (to be located at Kuala Krai), proposed by the Heavy Industries Corporation of Malaysia (HICOM). The site proposed is contiguous to the Kesedar project; the social and cultural conditions discussed heretofore are also evidenced in this area. It is hoped that information and experiences derived from Kesedar will prove useful to the designers of this new project. More importantly, the lessons learned from past experiences, if built into the new project, could be beneficial to the projected target group who, after all, can bear enormous social, cultural and economic costs from planning decisions.

The Malaysian Government's recognition of the importance of monitoring programmes to gauge their impacts on targetted populations and responses to problems once identified would tend to indicate that any new project designed for Kelantan would utilize such experiences. It will thus be interesting to note how future projects in the state (such as a new pulp and paper mill) will be designed and implemented given the experiences from the Kesedar project.

# REFERENCES

- Cheng, Keek Cheok, Khoo Siew Mun, & R. Thillainathan eds. Malaysia:  
1979 Some contemporary issues in socio-economic development.  
Persatuan Ekonomi Malaysia.
- Government of Malaysia. Kota Baru urban development study: Singapore.  
1981
- Jackson, J.C. & Rudner, M. Issues in Malaysian development. ASAA  
1979 Southeast Asia Publications. Kuala Lumpur: Heineman Education  
Books (Asia).
- Lembaga Kemajuan Kelantan Selatan. Pembanyunan Kawasan Kelantan  
1984 Selatan 1978-1984. Kota Baru.
- Mahathir bin Mohamed. The Malay Dilemma. Singapore Federal  
1970 Publication.
- Mazumdar, Dipak. The urban labour market and income distribution: A  
1981 study of Malaysia. London, Oxford University Press.
- Ministry of Finance. Kelantan: An economic survey and implementation  
1979 programme.
- Roff, W.R., ed. Kelantan: Religion, society and politics in a Malay  
1974 state. Kuala Lumpur. Oxford University Press.
- Siang, Lim Kit. Time bombs in Malaysia. Petaling Jaya, Malaysia.  
1970 Federal Publications.
- Young, K., Bussink, W.C.F., & P. Hasan eds. Malaysia: Growth and  
1980 equity in a multiracial society. Baltimore and London. John  
Hopkins University Press.

GENERAL PLAN FOR TIMBER ESTATES DEVELOPMENT  
IN INDONESIA

by

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## 1. INTRODUCTION

Indonesia is an archipelagic country located between the continents of Asia and Australia and between the Indian Ocean and the Pacific Ocean. Its land surface is 200 million ha with a 70 percent forest cover.

The general nature of its tropical climate is wet; the maximum temperature is 33°C and the minimum temperature is 21°C. The rainfall varies greatly, from 700 mm to 3600 mm, averaging 2190 mm. There are two pronounced weather seasons which are the dry season from June to September and the rainy season from December to March.

Based on the preliminary Forest Land Use (1982), 113.5 million ha of the total 143.5 million ha of forests are to be maintained as permanent forests and the rest will be reserved for non-forestry purposes. The production forests, for which the Forest Land Use Plan has allocated 64 million ha, are for over 90 percent of the natural rain forest type.

Forest planting has been carried out since early this century. It is centred on Java and consists mainly of teak, mahogany and pine species. However, during the last eight years, forest plantations have been expanded to the other islands as well with a steadily increasing acreage.

Forestry plays an important role in the national development as a source of employment, income and foreign exchange earnings. Timber occupies second place after oil in national exports. In this framework forest resource development has become extremely important and is a development programme which has been given a priority status by the Government.

## 2. SITUATION OF PRODUCTION FORESTS

### 2.1 Tropical Rain Forests

The rain forests of Indonesia belong to the world's tropical forests rich in high-quality wood species. The most significant species association is Dipterocarpaceae. The island of Kalimantan is the most abundant habitat of the genus. There are 450 species of them, especially of the genera of Shorea, Hopea, Dipterocarpus, Vatica, Dryobalanops, Cotylelobium and Upuna.

The natural rain forests, amounting to + 60 million ha, are the main source of timber production in Indonesia. Despite the generally good condition of the natural forests, concern has been voiced over degradation of quality and potential of the forests as a result of interfering factors among which the most serious are:

- (a) Shifting cultivation as practised by 1 million families who every year cut and burn down hundreds of thousands of hectares of forests.
- (b) Forest fires, which annually destroy 40 000-50 000 ha of forests. In the severe dry season of 1982/83, conflagration razed a total forest area of 3.5 million ha in East Kalimantan.



These occurrences have contributed to the degradation of over 15 million ha of forests to less productive forests or to "alang alang" (grass), other unproductive scrub areas or to barren land, and they have caused serious environmental disturbances such as floods and erosion.

Of the 60 million ha of natural forests, 45 million ha are considered to be still productive with a production potential of approximately 40 million m<sup>3</sup> of roundwood per year. Limited survey and research results indicate a forest increment of 1 m<sup>3</sup>/ha/a.

Large scale exploitation by forest concession holders started only in 1967. The average production during the last decade was 22.6 million m<sup>3</sup> of roundwood per year, mostly for export.

## 2.2 Forest Plantations

In 1981, the total area of forest plantations covered 2.7 million ha, of which 1.8 million ha can be developed as Timber Estate units. On Java 1.99 million ha were under the direct management of Perum Perhutani, the state enterprise in charge of forest management.

The species planted on Java are Tectona grandis (1 053 200 ha), Pinus merkusii (527 200 ha), Aghathis spp (81 800 ha), Swietenia spp. (77 400 ha), Altingia excelsa (58 000 ha), other species (193 300 ha).

So far, the average yield of the 1.99 million ha production forest plantations has been only 758 900 m<sup>3</sup> timber per year. The yield will be increasing rapidly in the coming years as most forests on the other islands will become mature enough to be cut.

The greatest danger of destruction threatening the plantations is forest fires. People living in forest environments are in the bad habit of burning the fields preparatory to farming. In the dry season this may well be a source of fire, which can easily spread to forest plantations.

Since 1977, large scale reforestation averaging some 160 000 ha/a has been carried out under the Forest, Land and Water Preservation Programme. However, the reforestation is mostly aimed at protecting watersheds and is carried out on eroded land areas.

## 2.3 Demand for Timber

In 1983 the population of Indonesia was 157 million. With a 2.2 percent mean growth rate a year, it is estimated to reach 228 million in 2000. Despite a soaring domestic demand for wood-based products, which is caused among other things by an improved national income, forest produce harvesting in Indonesia will continue to be oriented toward export markets.

Employing population, Gross Domestic Product growth, consumption structure and industrial timber growth as indicators for his demand projections, Nasendi (1984) drew the conclusion that the timber demand, exclusive of fuelwood, in 1990, 2000 and 2020 will be 27.7 million m<sup>3</sup>, 59.5 million m<sup>3</sup> and 113.1 million m<sup>3</sup> respectively. Should timber be supplied only from the natural forests with their annual production capacity of 40 million m<sup>3</sup>, the demand-and-supply balance will be as reflected in Table 1.

Table 1  
Timber Demand and Supply Balance  
(in million m<sup>3</sup>)

<u>Year</u>	<u>Demand</u>	<u>Supply</u>	<u>Balance</u>
1990	27.7	40	(+) 12.3
2000	59.6	40	(-) 19.6
2020	113.1	40	(-) 73.1

In order to offset these negative balances, some 19.6 million m<sup>3</sup> of timber will have to be produced from forest plantations by the year 2000 and 73.1 million m<sup>3</sup> by 2020. Immediate steps must, therefore, be taken to establish forest plantations which should be able to counterbalance the estimated shortages.

Table 2 indicates the estimated total requirements for industrial roundwood and fuelwood for the years 1990, 2000 and 2020. Requirements of roundwood for the various forest industries are also shown.

Table 2  
Estimated Industrial and Fuelwood Demand  
in 1990, 2000 and 2020  
(thousand m<sup>3</sup> of roundwood)

<u>Product</u>	<u>1990</u>	<u>2000</u>	<u>2020</u>
1. Plywood	4 520	10 850	21 800
2. Sawwood	17 350	28 350	54 250
3. Wood panels	1 700	10 500	18 375
4. Pulpwood	4 169	9 869	18 725
Subtotal	27 739	59 569	113 150
5. Fuelwood	89 500	125 400	218 700
Total	117 239	184 969	331 850

### 3. TIMBER ESTATE DEVELOPMENT POLICY

#### 3.1 Forest Resource Development

In an effort to achieve a steady increase in the potential of the production forest, the Government adopted and carried out the following policies and actions relating to forest resource development:

- (a) Productive tropical natural forests shall be maintained.
- (b) Unproductive forest areas shall be rehabilitated by establishing Timber Estate Units of industrial forest plantations.
- (c) The Government encourages capital investment by private companies in the Timber Estates through extending various facilities within the range of its possibility.
- (d) To ensure proper implementation of regeneration in areas logged-over by concession holders, the Government imposed in 1980 a US\$ 4 performance bond on every m<sup>3</sup> of wood which the concession holders produce. These fees are deposited in the Reforestation Fund.

### 3.2 Objectives of Timber Estate Development

Timber Estate development is a priority activity of forestry development with the following objectives:

- (a) The rehabilitation of unproductive forest areas for the prevention of environmental disruption.
- (b) Increasing the yield of forest products to satisfy the demand for timber of the domestic and export markets.
- (c) Supporting timber industrial growth by supplying wood material in appropriate quantities and quality.
- (d) The expansion of employment and business opportunities.

The large scale establishment of forest plantations is expected to curb the exploitation of the highly valuable tropical natural forests in 20-30 years from now on so that the latter's sustained survival is safeguarded.

### 3.3 Linkage with Regional Development

Each Timber Estate will require an infrastructure, including hauling roads, means of communication and other facilities. It will also need a large work-force, which is difficult to acquire in certain areas.

Meanwhile, the Government has projected development centres in remote areas as part of regional development plans, which include population transmigration, opening of new, irrigated agricultural areas, horticultural estates, etc. Under the transmigration programme, for instance, 150 000 families will be moved from Java every year. The Government will provide these development centres with the necessary infrastructure and various other facilities. The selection of relocation areas will conform to existing Government development programmes. This conformity will give mutually beneficial results.

Likewise, the establishment of Timber Estates will be in the proximity of existing forest industries as far as possible.

### 3.4 Incentives

All forests in Indonesia are owned by the State. Based on Government Regulation No. 21 of 1970, exploitation is, however, carried out by private or Government companies. The regulation also applies to the projected Timber Estates.

The Government will subsidize 60 percent of the total expenditure of every concession holder who establishes a Timber Estate in his work area. The subsidy will come from the accumulated Reforestation Fund, mentioned earlier.

#### 4. TIMBER ESTATE ESTABLISHMENT

##### 4.1 Reforestation Plan

There are at present 2.7 million ha of forest plantations, of which 1.8 million ha can be developed into Timber Estate Units. Up to the year 2000 reforestation is projected to cover an additional 4.4 million ha of Timber Estates, which will make a total of 6.2 million ha.

Table 3  
Reforestation plan 1985-2000  
(in 1000 ha)

Period	Concession area	State forest	Total
Existing	-	1 800	1 800
1985 - 1990	610	400	1 010
1991 - 1995	1 075	500	1 575
1996 - 2000	1 215	600	1 815
Total	2 900 (46.8%)	3 300 (53.2%)	6 200

Table 3 indicates that in the first, second and third 5-year period reforestation will average 202 000 ha, 315 000 ha and 363 000 ha per year respectively. After 2000 the yearly reforestation is expected to continue at the same rate, taking into account the vastness of unproductive forest areas which will still be in excess of 10 million ha by then.

Over 80 percent of the forest plantations will be established in Kalimantan, Sumatra and Java, nearly half of them by private companies in their respective concession areas. Table 4 shows the distribution and the areas of the planned Timber Estate plantations.

Table 4  
Distribution of Timber Estates  
(planned areas in ha and percentages)

Island group	Area (000 ha)	Percentage
1. Kalimantan	1 965	31.7
2. Sumatra	1 570	25.3
3. Java	1 560	25.1
4. Sulawesi	450	7.2
5. Maluku	215	3.6
6. Other island groups	440	7.1
Total	6 200	100.0

#### 4.2 Species Recommended for Planting in Timber Estates

In selecting the wood species, fast-growing, indigenous ones are preferred. Species considered to have good prospects are listed in Table 5.

Table 5  
Species Recommended for Planting in Timber Estates

Species	Mean annual increment (m <sup>3</sup> /ha)	Rotation (years)
<u>Construction wood</u>		
1. <u>Tectona grandis*</u>	5.1	80
2. <u>Swietenia macrophylla</u>	14	30
3. <u>Eucalyptus spp</u>	20	25
4. <u>Albizzia falcataria</u>	45	15
5. <u>Dalbergia latifolia</u>	20.3	25
6. <u>Shorea stenoptera</u>	26	30
<u>Pulpwood</u>		
1. <u>Pinus merkusii</u>	18	10-15
2. <u>Araucaria klinkii</u>	20	30
3. <u>Eucalyptus spp.</u>	17	10
4. <u>Acacia mangium</u>	43.9	10
5. <u>Albizzia falcataria</u>	38	10
<u>Fuelwood</u>		
1. <u>Acacia auriculiformis</u>	23	10
2. <u>Leucaena leucocephala</u>	25	5
3. <u>Albizzia falcataria</u>	45	15

\* Planted only on Java.

Research is now being made into the possibility of monocultural planting of a number of tree species of the tropical natural forest. Well-known species of good quality such as meranti (*Shorea* spp.), *Agathis borneensis*, ramin (*Gonystylus bancanus*), matoa (*Pometia* spp.), etc., are generally slow growing and require a close environment when still young.

An extensively planted softwood species is *Pinus merkusii*, whereas *Araucaria* is still at trial stage.

No intensive development of special fuelwood-producing Timber Estates will be carried out until at least five years from now. The use of fuelwood as a source of energy or to generate electricity is still very limited and, for the time being, residues from forest industries or agricultural residues will continue to be utilized for this purpose.

#### 4.3 Tree Improvement Programme

As mentioned earlier, only fast growing species with an expected growth rate of 15 m<sup>3</sup>/ha and suitable qualities are selected for Timber Estates. Furthermore, there should be sources of seed that are capable of supplying quality seed in sufficient quantities.

For this purpose, tree improvement programmes have been carried out in a more systematic way since 1976. Up to the end of 1983, 4 283 ha of seed sources had been established, as shown in Table 6.

Table 6

#### Established Seed Sources as at the End of 1983

<u>Type of seed source</u>	<u>Area (ha)</u>	<u>Number of species</u>	<u>Number of locations</u>
1. Seed orchards			
a. Seedling seed orchards	548	3	7
b. Clonal seed orchards	40	1	2
c. Seed stands	3 695	10	6
	<hr/>		
Total	4 283		
2. Others			
a. Mass selection	721	5	6
b. Provenance trials	14	5	4

Source: Ministry of Forestry, Indonesia (1984)

The 1984-2000 work plan envisages the continuous expansion of the above activities and new activities such as species trials, establishment of clonal banks, progeny tests, etc., will be taken up.

The programme is backed up, among others, by:

- (a) The Seed Research Laboratory of the Forest Research Institute.
- (b) The Seed Technology Centre, Bogor.
- (c) The Tree Improvement Centre, Yogyakarta.

#### 4.4 Designation of Industrial Forest Plantations

Based on the demand projections mentioned in Chapter 2.3, it is reasonable to infer at this stage that, of the planned 6.2 million ha of industrial forest plantations, 85 percent will be designated for construction timber, 10 percent for pulpwood and 5 percent for fuelwood, as indicated in Table 7.

Table 7

#### Designation of Industrial Forest Plantations by Areas and in Percentages

Designation	Area (000 ha)	Percentage
1. Construction wood*	5 270	85
2. Pulpwood	620	10
3. Fuelwood	310	5
Total	6 200	100

\* Comprising plywood, sawnwood and wood panels.

#### 4.5 Prospects for Production

The 1985-2000 reforestation plan envisages that the fifth year will produce the first fuelwood, the eighth year wood pulp and the fifteenth year construction wood resulting from thinnings. Peak production will be reached in the thirtieth year, that is 2015, when logging of the timber construction forests begins.

A rough production estimate is based on the following assumptions:

	<u>Average growth</u>	<u>Average rotation</u>
- Construction wood	15 m <sup>3</sup> /ha	30 years
- Pulpwood	25 m <sup>3</sup> /ha	10 years
- Fuelwood	30 m <sup>3</sup> /ha	5 years

The estimated production (exclusive of fuelwood) in 2000 will, therefore, amount to 17.5 million m<sup>3</sup> and in 2015 it will reach its highest point, i.e. 94.55 million m<sup>3</sup>, as shown in Table 8.

Table 8  
Estimated Wood Production by  
Timber Estates in 2000 and 2015

Product	Forest Plantation (000 ha)	Wood production (000 m <sup>3</sup> )	
		2000	2015
1. Construction wood	5 270	2 000*	79 050
2. Pulpwood	620	15 500	15 500
Subtotal	5 890	17 500	94 550
3. Fuelwood	310	9 300	9 300
Total	6 200	26 800	103 850

\* Thinnings.

#### 4.6 Timber Estate Development Costs

Calculations on the basis of the areal extent of the forest plantations have revealed that the average cost of a Timber Estate amounts to US\$ 600-650 per ha. The present average wages for manual workers are US\$ 2-3 per day. Details of the development cost are as follows:

	Average cost per ha	Percentage
- Planning and preparation	US\$ 26.0	4
- Seedlings	63.5	10
- Planting	430.5	69
- Infrastructure	103.5	17
Total	US\$ 623.5	100

Accordingly, a Timber Estate Unit of 50 000 ha will need an investment of US\$ 30 million. This maximum expenditure is based on the assumption that the area lacks transportation roads, housing and other facilities.

As explained in Chapter 3.4, the Government will reimburse the concession holders with 60 percent of the total cost for the establishment of a Timber Estate and this repayment comes from the Reforestation Fund.



## 5. GENERAL DESIGN OF TIMBER ESTATE UNITS

### 5.1 Requirements

A Timber Estate is a forest plantation management unit which is designed in such a way that it constitutes an economically viable, roundwood producing unit. For progress' sake, some form of cooperation, horizontal as well as vertical, is needed in the timber business.

Timber Estate development requires relatively large, long-term investments. Reasonable profits can be obtained through careful planning with due attention to certain conditions, such as:

- (a) optimal area of the forest;
- (b) proper forest organization and infrastructure;
- (c) efficient organization and management.

Indonesia has gained much experience in the management of teak forests, conducted with a high degree of intensity. With certain adaptations, the managerial principles are most likely to work equally well in the best interests of the Timber Estates.

### 5.2 Areal Extent of Timber Estates

The determination of the areal extent of a Timber Estate must be based on economic considerations, especially on the productivity per unit of area, wood value and interest rate. Prijasukmana (1984) made an extensive analysis using the NPV (Net Present Value) as the main criterion resulting in minimal area figures where the NPV = 0, and optimal area figures where the NPV is maximum.

For the present, the guiding size is between a minimum of 10 000 ha and a maximum of 60 000 ha, as indicated in Table 9.

Table 9  
Minimum and Maximum Areas  
Suggested for Timber Estates

Timber Estate Unit	Minimum (ha)	Maximum (ha)	Average rotation (years)
1. Construction wood	30 000	60 000	30
2. Pulpwood	25 000	50 000	10
3. Fuelwood	10 000	-	5

As a matter of fact, forest plantation products are not for a single purpose, but they are utilized for a variety of end uses. This matter should be taken into account in determining the areal size on the basis of the results of feasibility studies of the site concerned.

### 5.3 Forest Organization

The organization of the forest is closely related to the hierarchy of the different levels of management. The total area of a Timber Estate is divided into the smallest areal units, i.e. compartments, which are operational units for reforestation, logging and other related activities. The size of these compartments is based on the foreman's capacity for supervisory work, relating particularly to reforestation. Compartments vary from 50 ha to 100 ha according to the implementation system used.

For administrative purposes, these compartments are further grouped into resorts, resorts into ranges, and ranges into forest units, as shown in Table 10.

Table 10  
Administrative Division and Organization  
of a Timber Estate

Division	Areas (ha)	Supervisor
Total area	30 - 50 000	Senior graduate forester
Forest unit	15 - 20 000	Graduate forester
Range	4 - 5 000	Senior technician
Resort	1 - 1 500	Technician

Forest units are areal units for planning production continuity under Forest Management Plans. The boundaries of the forest units follow, as far as possible, the natural boundaries of watersheds or parts of them. Aerial photos on a scale of 1:20 000 are required for this purpose.

### 5.4 Road Network

The intensity of the road network is designed in the interest of reforestation activities, but the road network will also be used for general supervision and in case of forest fires. Roads for forest exploitation will not be constructed until the forest is mature for logging.

The road intensity is planned to be at least 10 m/ha, consisting of 2 m/ha main road and 8 m/ha branch road.

Branch roads simultaneously function as fire-belts with both sides clear so that the total width is  $\pm$  20 m.

### 5.5 Timber Estate Management

Timber Estates, for which Forest Management Plans have been prepared based on forest inventory results, the physical conditions of the terrain and the socio-economic aspects of the areas concerned, will be placed under intensive management, similar to the teak forests on Java.

The plantations will be given treatment according to intensive silvicultural methods in order to accelerate tree growth without damaging the soil and the environment. Research and development will support the forest development programme.

As middle management units, Timber Estates will be engaged in many activities. For example, in a 50 000 ha work area, the following activities will occur every year:

Yearly activities

a. Reforestation	2 000 ha
b. Forest tending	10 000 ha
c. Logging, transportation	750 000 m <sup>3</sup> /a
d. Marketing	750 000 m <sup>3</sup> /a

The management organization is founded on the areal system as follows:

- General manager	1
- Unit managers	2 - 3
- Forest rangers	6 - 15
- Supervisors	18 - 75

Requirements for permanent personnel, from managers down to foremen, are estimated at 300 persons per Timber Estate. Recruitment is arranged in stages in pace with the progress of the establishment of the forest plantation.

## 6. SOCIAL ASPECTS OF FOREST PLANTATIONS

### 6.1 The Forest-for-People Concept

There is a firm, general awareness that forests should benefit the community as much as possible in a direct way, especially the inhabitants of the surrounding area. An interrelationship exists between the sustained growth of the forests and public welfare. A forest can prosper well only in a prosperous social environment. The reverse will happen if the people live in poverty. This condition will become evident if we trace it back to the causes of forest degradation in many developing countries.

Besides producing wood as chief objective, the forest also provides a wide opportunity for cultivation of corn, rice, grass, edible mushrooms, honey-bees, etc., and other activities which benefit the forest dwellers. This basic idea has led to the development of the concept of Forests for the People, which has become the platform for the development of the agro-forestry system. This system combines farming with forest planting without disrupting the main function of the forest.

Indonesia has a long and extensive experience in the field of agro-forestry in the forests of Java. The following two chapters report on the situation and techniques of agro-forestry and the results obtained on Java.

#### 6.1.1 Raising the social function of the forest

Jaya with its 132 187 km<sup>2</sup> land surface has a density of 691 persons/km<sup>2</sup> and is the most populous region of Indonesia. About 80 percent of the population are farmers with an average land ownership of

0.63 ha per family. This condition has brought about a state of "land hunger" and a low level of income. It exercises a great pressure on the forests which cover only 2.9 million ha or 22.7 percent of the land surface. The deteriorating forest condition is the result of over-grazing, haphazard collection of fuelwood and wood for construction, and land grabbing.

Besides taking appropriate security measures to overcome the problem, the Government has also adopted a policy relating to the welfare aspect under a programme known as the "prosperity approach".

Perum Perhutani, the state enterprise in charge of the management of the forests of Java, has since long been carrying out this policy, among other things, in the following ways:

- (a) Maintaining the labour intensive nature of forest management in areas of reforestation, forest tending and exploitation. The entire 2.9 million ha forest area employs 350 000 people (1982), of which 15 000 are permanent employees and 335 000 seasonal workers.
- (b) Spreading the practice of the agro-forestry system.
- (c) Other activities aimed at promoting the prosperity of the inhabitants in the forest neighbourhood including fuelwood production, construction of simple houses, school buildings, water catchments, etc.

#### 6.1.2 Agro-forestry practices

Agro-forestry methods which have been put into practice are:

- (a) Agro-silviculture (the tumpangsari system), which is the planting of food crops between rows of young trees during the reforestation period. This is widely applied, where 2-4 families take part in one hectare plantation.
- (b) Silvopasture, which is the growing of "elephant-grass" for cattle feed among forest trees.
- (c) Silvofishery or fish-pond forestry, which is fish or shrimp breeding in coastal mangrove forests.
- (d) Farm-forestry, i.e. the planting of trees on farms for fuelwood or cattle feed.
- (e) Apiculture to breed bees for honey production.
- (f) Sericulture, i.e. breeding of silkworms that feed on leaves of mulberry trees cultivated in forest areas for the purpose of raw silk production.

The extent of these activities and the average output during a period of five years (1978-1982) are set out in Table 11.

Table 11

Average annual coverage of agro-forestry and output on Java  
(average figures for the period 1978-1982)

Type of agro-forestry	Area (ha)	Number of farmers	Yield	
			Kind	Quantity
1. Agro-silviculture	50 000	150 000	corn, rice, etc.	*
2. Intensified agro-silviculture	3 567	11 031	corn, rice, etc.	2 088 t
3. Obat-obatan	82	*	ginger, etc.	13 t
4. Silvopasture	591	*	grass	863 t
5. Silvofishery	40	*	fish, etc.	*
6. Farm forestry	49 531	*	fuelwood	362 029 m <sup>3</sup> s
7. Bee-keeping	3 004	1 594	honey	2 980 kg
8. Sericulture	729	*	cocoon	84 724 kg

Source: Perum Perhutani, 1983

\* Unrecorded.

REFERENCES

- Alrasjid, Harun. Aspek-Aspek pembanguna hutan tanaman industri. Paper  
1984 for Seminar on Timber Estate Development. Bogor Agriculture  
Institute, Indonesia.
- Mangundikoro, Apandi. Pola dan strategi pengembangan hutan tanaman  
1983 Pinus merkusii. Paper for Symposium on Utilization of Pinus  
merkusii forests. Forest Products Research Institute, Bogor,  
Indonesia.
- Mangundikoro, Apandi. Policy and programme for forest resource develop-  
1983 ment in Indonesia. Paper for poster session of International  
Symposium on Strategies and Designs for Afforestation,  
Reforestation and Tree Planting. Agricultural University,  
Wageningen, The Netherlands.
- Mangundikoro, Apandi. Rencana umum pembangunan Timber Estate. Paper  
1984 for Seminar on Timber Estate Development. Bogor Agriculture  
Institute, Indonesia.
- Martawijaya, A. et al. Alas kayu Indonesia. Forest Products Research  
1981 Institute, Bogor, Indonesia.
- Ministry of Forest. Rencana Pembangunan Kehutanan PELITA IV. Ministry  
1983 of Forest, Jakarta, Indonesia.
- Nasendi, B.D. Proyeksi demand dan supply kayu menjelang tahun 2000  
1984 dan 2020. Paper for Seminar on Timber Estates Development.  
Bogor Agriculture Institute. Bogor, Indonesia.
- Perum Perhutani. Buku saku statistik tahun 1978-1982. Perum Perhutani,  
1983 Jakarta.
- Perum Perhutani. The role of forestry in rural community development in  
1982 Java. Perum Perhutani, Jakarta.
- Priasukmana, S. Bahasan ekonomik pembangunan Timber Estate. Paper for  
1984 Seminar on Timber Estates Development. Bogor Agriculture  
Institute. Bogor, Indonesia.
- Ginting, A.N. et al. Proceedings seminar agro-forestry dan  
1981 Perladangan. Forest Research Institute. Bogor, Indonesia.

TRAINING OF LABOUR IN A NEW CELLULOSE PULP MILL  
ALTO PARANA S.A. AT PUERTO ESPERANZA,  
MISIONES - ARGENTINA

Based on the work of

J. E. Balcker\*

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## 1. INTRODUCTION

New industries which are going to be installed in isolated areas will be subjected to circumstances that interfere with their erection, start-up and subsequent full-scale operation. The various problems which present themselves are a consequence of distortion - real and imaginary - imposed on the region where the industry will be established. These distortions affect the local population on account of changes in the sociologic and economic environment and in the infrastructure. This will harden the local inhabitants in clinging to local uses and habits and may lead to resentment against the "intruder" and to political reactions.

To avoid these problems it is, therefore, extremely helpful to study beforehand the impact which the planned industrial venture will have on the region and on its local population. This should minimize friction between the local inhabitants and employees attracted from other areas and reduce resentment against the new industrial complex. Such a study was carried out by Alto Paraná S.A. and, based on its findings, actions were taken before start-up, which proved to be the correct approach.

## 2. DESCRIPTION OF THE AREA IN WHICH ALTO PARANA S.A. OPERATES

Alto Paraná S.A. established its pulp mill in the province of Misiones, named after the missions founded by the Jesuits in 1631. It is situated in the north-eastern part of Argentina, covers 29 801 km<sup>2</sup>, has 455 000 inhabitants, which translates into 15.3 inhabitants per km<sup>2</sup>. Misiones produces corn, rice, sugar, tea, mate (Paraguayan tea), manioc and tung oil (from seeds of the tung trees; used in varnishes, paints and as a waterproofing agent).

The province of Misiones has a forested area of some 200 000 ha, of which approximately 80 percent are covered by pine plantations. This forestry extension resulted from the favourable conditions for plantations of softwood. Misiones has hills which range from 100 to 300 m above sea level, has a subtropical climate, with a yearly average rainfall of 1 640 mm and an average temperature of 19.3°C (minimum -3°C, maximum 40°C).

Taking advantage of this exceptional gift of nature, Celulosa Argentina S.A. commenced from 1940 onwards with trials involving over a hundred species of pine collected from all over the world. Results of these trials showed amazing yields and felling cycles for some species. For instance Pinus elliottii (slash pine), which in the south of the U.S.A., its place of origin, requires 40 years to mature and has a yield which does not exceed 16 to 17 m<sup>3</sup>/ha/a, produced much better results in Misiones with a productive cycle that oscillates between 18 and 25 years and a yield of 30 m<sup>3</sup>/ha/a.

Forestry related research and development were followed by systematically establishing new plantations. Assistance was given to local farmers and loggers, by making the results of research known to them, by giving technical advice, by teaching them forest practices, by supplying seeds to them at subsidized prices and by creating nurseries, which created a strong bond between Celulosa Argentina S.A. and the local population. All these activities made Misiones the cradle of plants such as those of Alto Paraná S.A., Papel Misionero, Celulosa Argentina S.A. and the future one of Celulosa Puerto Piray S.A. It also led to the distinction that Misiones today is the most important forestry area of Argentina.

### 3. DESCRIPTION OF THE PROJECT OF ALTO PARANA S.A.

The pulp mill that Alto Paraná S.A. installed at Puerto Esperanza in Misiones province is scheduled to produce 172 500 t of bleached, semi-bleached and unbleached kraft pulp per year. The mill consumes a total of 1.1 million t of softwood per year, which includes firewood to generate steam and power. In forestry operations it employs 600 professionals, technicians and labourers; the mill employs 291 professionals, technicians and administrative personnel and 104 labourers. Start-up of the plant took place in November 1982. Raw material is supplied from softwood plantations located in a subtropical area, semi-isolated with regard to roads and population.

The personnel employed by the company consisted of two completely different groups; one providing the raw material, the other operating the industrial complex.

The first group was composed mainly of settlers of the area, with different concepts of social life, strongly bonded to primitive habits and customs, with limited cultural background and, in some cases, even speaking a different language. Some had acquired skills as carpenters, electricians and motor mechanics and a limited number of them were trained for certain jobs in the industrial complex.

The second group consisted of higher skilled technicians and professionals required for the various stages in the erection, start-up and full-scale operation of the project. Since these were not available locally, they had to be attracted from other parts of the country.

It must be pointed out that both groups had to live in the already existing towns and in those that would eventually have to be developed. These two groups of employees converged into the Puerto Esperanza area and created serious problems for the municipalities of the three affected towns which found their servicing capacity overburdened by the influx of these new arrivals. This was noticeable particularly relating to drinking water and schooling facilities.

### 4. TRAINING

The above information has been included so as to create a better understanding of the problems which had to be solved in training for the three distinct phases of development:

- project and erection;
- start-up;
- full-scale operation.

#### 4.1 Training - Project and Erection

For basic engineering the company was assisted by technicians and specialists with experience in the production of pulp from one of the shareholding companies. Some of these technicians became part of the permanent staff of the company.

For detailed engineering a contract was signed with a local firm, which worked hand in glove with an international consulting firm specialized in cellulose and paper.

Already at this initial stage, young professionals without any previous experience in the pulp and paper sector were hired, which allowed these engineers and technicians to gather experience and to train themselves from the beginning of the project. In the later stages of development they became supervisors of the area which had been their responsibility during erection (under the control of the consultants).

The training specialists of the consulting firm and of certain suppliers contributed to the training plan for the technical personnel, which was hired in stages during the erection period, constituted work groups for each area and were destined to become the operating staff of the same area.

At this point the importance should be stressed of the valid contribution made by the external training specialists in each of the areas where they were responsible for training activities.

#### 4.1.1 Comments related to training in the project and erection phase

The prediction that the good professionals, which Argentina has, would be prepared to adapt themselves to a new job under the guidance of consultants and equipment manufacturers, proved to be correct. The professionals were trained to transfer their knowledge; they subsequently trained new work groups successfully in their respective areas. Language differences between the Argentinians and their foreign mentors never became a serious problem due to the professionalism of both groups. Mutual understanding is made easy through technical language.

Only 10 percent of the required labour force of technical level came from the area where the project would operate. Ninety percent came from different parts of the country; of this 90 percent, only one-third had previous experience in industry.

Initially turnover of personnel was very high, which complicated hiring and resulted in duplication of training for many jobs.

#### 4.2 Training - Start-up

The groups created during the project and erection phase were responsible for the start-up phase under the competent management of the foreign supervisors.

The consultant firm and the equipment manufacturer each supplied one supervisor until suitable local personnel with previous experience in similar equipment could substitute these supervisors. To ease this transfer, personnel from Alto Paraná S.A. had been trained abroad to gain technical and operational experience with the equipment that would be put under their supervision after this training period. In addition to these measures, help was requested from Scandinavian and Brazilian pulp manufacturers which sent groups of technicians and operators for training during periods ranging from three to six months.

#### 4.2.1 Comments related to training in the start-up phase

Training during the start-up period was efficient and effective, which may be concluded from the fact that nominal production was reached ten months after start-up.

#### 4.3 Full-Scale Operation

In order to provide adequate training in accordance with the requirements of the plant, Alto Paraná S.A. carries out the following training programmes:

- 4.3.1 General technical training for existing company personnel
- 4.3.2 Special technical training for personnel joining the company
- 4.3.3 General training (management, human relations, supervisory relations, etc.)

Special attention is given to management training. Although technical training of all personnel is important, it can be achieved relatively easily. Management training is, however, even more important because it takes much time and effort to develop real managers with the necessary special blend of competence and vision necessary to manage a large group of men and their families with such different backgrounds settled in isolated areas, and to avoid friction between their personnel, the local population and the authorities.

#### 4.3.4 Cultural training of company personnel

The general training mentioned above and the cultural training is for the company's personnel, aimed at a better understanding of, and integration with the community.

#### 4.3.5 Extension of technical and cultural training to communities in the area

This training is intended to improve communication between the inhabitants of the area and the company's personnel which came from other areas of the country.

The company has the following sources on which it can draw to carry out the above training programmes:

- (a) company technicians and engineers who give courses after working hours;
- (b) teachers and professors, specially hired by the company;
- (c) technicians and skilled workers hired by the company for training purposes;
- (d) national and international organizations, located in the country, which give training courses in the area or in their respective locations;
- (e) national and provincial cultural organizations and well-known personalities which give lectures.

#### 4.4 Training in the Forestry Sector

While the project and erection phases of the plant were in progress, the forestry sector started with the training of its own personnel and, indirectly, with that of the personnel of the contractors for the logging operations. Training these people, of which the peculiarities have been described above, was carried out by technical personnel which had previously been trained in overseas techniques by a foreign consultant. These techniques of felling, skidding, loading, etc., were absorbed quickly and the training results were excellent.

Independent of training courses for company personnel, tuition courses will be extended to different regional organizations, so as to create employment sources and availability of labour. This will not only meet the requirements of the company, but also those of the province of Misiones which bases a large part of its employment on the forestry sector.

#### 4.5 Training of Outsiders

Alto Paraná has not only taken care of the training of its existing personnel but it has also considered the possibility of their replacement or rotation, training those professionals, technicians and workers outside the company who might be potential candidates for the organization or, possibly, elsewhere in the country to satisfy the country's requirements.

The latter is achieved through:

##### 4.5.1 Scholarships

These are granted to those professionals or advanced students considered capable of fulfilling the company's needs. Subsequently they may join the company or not.

##### 4.5.2 Programmes for summer students

These programmes are meant for forestry students, to whom particular attention is paid during their stay with the company in order to enlarge their knowledge. As in the previous case, future employment is not an automatic result.

##### 4.5.3 Temporary training jobs

During their last year of engineering, students are allowed to extend their theoretical knowledge by complementing it with practical experience in the company. They are trained for specific jobs by company personnel appointed as instructors; this allows the company to choose possible candidates for future employment after graduation.

##### 4.5.4 Agreements with training institutions

Another training method for possible future personnel of the company consists of agreements with universities, tuition institutes, artisan schools, etc. The purpose of these agreements is to share scholarship expenses for a certain number of students, some of whom will be employed by the company when graduated, while the rest will find jobs within the province.

##### 4.5.5 Cultural training

Finally, within the framework of integral training, Alto Paraná S.A. offers to the communities cultural training through lectures, painting and sculpture courses (given by specialists from the Federal Capital), physical training and elementary hygiene courses, etc. In other words it provides access to some of the amenities of modern life such as those found in developed centres of the country.

#### 5. POSITIVE POINTS OF THE TRAINING

The positive points relating to the training of personnel for erection, start-up and full-scale operation of the plant and for forest operations are the following.

### 5.1 Training for the Plant

From the beginning of the project young engineers with drive and energy were incorporated in the project and erection phase which proved to be very successful. It also allowed these engineers to obtain knowledge and gather experience which would help them effectively during the subsequent development stages.

Considering the lack of local professional services and labour, the only possible solution was to hire firms and engage labour from other areas of the country. Taking into account that only 20 percent of the hired personnel had previous experience and that production came on stream more or less at the planned time shows the positive result of the training and versatility of the Argentinian professionals.

The firms which contributed to the planning and erection of the plant did not only show their capability to adapt to difficult situations but also a depth of technical and human know-how which proved their eligibility for contributing to similar projects.

Relations between the foreign consultants, representatives of equipment manufacturers and Argentinian management remained friendly, which may be the result of reciprocal understanding on technical matters relating to the erection of the plant.

### 5.2 Training for Forest Operations

Training proved to be successful. Personnel quickly learned the new techniques, introduced to them by a team of instructors who had a good sociological grasp of the mentality of the people under their supervision. The acceptance by the local people of the instructors contributed to improve the personnel relations between these two groups. It also increased the efficiency of the workers.

Cooperation by the local communities was, doubtlessly, an important element in the achievement of these results. When, because of outside reasons, a slackening of this cooperation was felt, an immediate reduction in general efficiency was noticed.

The capability of company management to understand the various different kinds of personal problems of the working force was one of the most important factors in achieving the targets which had been set.

## 6. NEGATIVE POINTS OF THE TRAINING

The negative points relating to the training for the various phases of the project are the following.

### 6.1 Training for the Plant

The area in which the pulp mill project was developed did not offer adequate facilities for schooling, housing, health care and amusement, which are normally provided in developed areas of the country. This was the main reason for the high rotation rate of personnel during all development phases. Efforts were made by the company to alleviate these shortcomings, particularly of those amenities which were not, or insufficiently, supplied by the Government. This involved unforeseen additional investment for the company.

The impact of the project on the infrastructure and services of the villages was very negative. With a lot of effort these services had been created by the villages to satisfy their needs. The influx of all the new people involved with the development of the project overburdened

these services, and instead of considering the pulp mill as a basis for progress of the area, it, and the people involved with it, were seen by the local population as invaders. Actions, taken by the company to improve these services, compensated at least in part for the damage done to this relationship which, however, never reached the expected level. Different habits, customs, needs and philosophies were responsible for this.

## 6.2 Training for Forest Operations

The problems surrounding the training for forest operations were basically the same as those described above, but to a lesser degree. This may be due to the fact that forestry operations have always been associated with a certain amount of "roughing it", and it certainly helped that the instructors in forestry techniques had a thorough knowledge of the life style and pattern of the native inhabitants.

Extraneous factors of ideological and even political origin caused slight difficulties but no serious problems.

## 7. SUGGESTIONS FOR MINIMIZING PROBLEMS DURING FUTURE INSTALLATIONS OF THIS TYPE

Considering that these industrial establishments generally will be installed close to the origin of the raw material, it is logical to think that everything that happened to Alto Paraná S.A. could be repeated, with a few changes, during the installation of similar plants.

In addition to training, attention will, therefore, also have to be paid to resolving or avoiding a series of human problems that will normally arise as a result of the relationship between people from developed countries and those from developing ones, but also between people from developed and developing areas within the same country. Before the physical installation of a project is initiated, answers should be found for some basic questions on the people involved:

- What is the structure of the established society in the area where the mill will be installed? Which are their habits, customs and needs? Which is their native language? How is their behaviour with regard to themselves and toward "intruders"?
- The same questions should also be asked about the arriving group, in other words the "intruders", even though some are of the same nationality. It is even more important to obtain information on the foreign personnel, whose social and economical circumstances differ basically from those of the local personnel. Their native tongue usually is also different from that of the local population.

## 8. CONCLUSIONS

Well-planned, executed and maintained human participation is one of the most important factors contributing toward a positive return on the investment.

The role played by local personnel during the development of the project is fundamental; as such it must be recognized and analyzed.

The role of personnel hired abroad for training should be limited only to instructing and advising during each of the erection stages, without any operating responsibilities.

Foreign instructors should be able to judge the personnel they are training, not from the point of view of methods of their own countries of origin, but with a vision and understanding of the technical and social capabilities of the personnel to be trained. To achieve this, preliminary courses must be given to all instructors and equipment erection supervisors.

Different cultural levels and languages should not be impediments to mutual understanding and efficient personnel integration, provided both parties know beforehand the level they will face.

Foreign instructors must have an excellent practical training and be qualified as teachers; of these two conditions, the latter is the most important.

Whichever language is chosen for the full-scale production phase, it must allow integral and reciprocal understanding.

The length of stay of each instructor should be the maximum possible. Time lost in fomenting new approaches and eventual friendship between local and foreign personnel is thus avoided, enabling the latter a better understanding of the former.

In the optimizing stage of the full-scale operation of the plant, personnel exchanges in certain areas (maintenance, quality control, etc.) with foreign companies is advantageous.

It is felt that the most effective way to train new personnel for an operation such as the one described in this report is for periods of not more than four months in similar operations abroad, and an equal period in the project of the home country.



EDUCATION AND TRAINING IN FORESTRY

by

the Secretariat

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## 1. INTRODUCTION

The importance of education and training in any field of human knowledge is sufficiently recognized by all sectors of society, and it might therefore seem repetitive and even superfluous to refer to this aspect in a meeting organized by FAO.

However, the Secretariat of this meeting has desired to discuss this topic once more because of the special relevance it acquires when not only technicians and professionals responsible for a given social or economic sector are to participate in development efforts but also the communities connected with this sector.

This implies adequate preparation and training of technicians and professionals to ensure that in their professional activities they adopt an attitude conducive to such participation. It also implies action to prepare the communities or groups concerned to play an increasingly more active part in development efforts.

These efforts must, of course, be guided by the policies and strategies that each country has set as short, medium or long-term objectives. The types and methodologies of the education and training programmes must be related to the economic, social, political, cultural and ethnic aspects of each country.

## 2. FAO AND FORESTRY EDUCATION AND TRAINING

From its inception, FAO has been aware that progress in the forestry sector of a country, just as in any other economic sector, depends on its ability to plan, organize, direct, control and evaluate its own development. For this it needs not only adequate financial and material resources, but above all a solid core of well-prepared staff. This problem in the field of forestry development, for which the FAO Forestry Department is responsible, led the Organization to study these aspects in depth. Between 1956 and 1964 four meetings of a Technical Panel on Education in Forestry were organized, which resulted in the establishment of an advisory committee to assist the Director-General in this field.

The FAO Advisory Committee on Forestry Education is composed of 29 experts nominated by the FAO Member Nations designated by the Director-General. Since 1964 the Committee has met 12 times in various countries to analyze the various aspects and levels of forestry education.

With the guidance of this Committee the programme of the forestry sector in this field has developed along the following main lines of action:

- (a) assessment of the needs for trained personnel;
- (b) improvement of existing institutions and study plans;
- (c) establishment of new educational institutions of different levels;
- (d) distribution of information on forestry schools and education centres to facilitate the exchange of experience and communications between institutions.

Following these lines, estimates have been made of the needs for trained personnel at various levels and in certain specific areas of action in the forestry sector (e.g. wood technology, primary mechanical wood industries, forestry planning, etc.) and the situation, as regards forestry education and training in practically all regions of the world and in many individual countries, has been reviewed.

In recent years, as a result of the addition of the social aspect of forestry to the traditional objectives of conservation and production, the educational programme of the forestry sector has been devoting particular attention to updating and strengthening courses, improving the methodology and efficiency of teaching and reorienting curricula. The demands made on forestry are constantly increasing and changing, so that it is essential for the curricula of schools at all levels to be somewhat progressive. If to this is added the growing part that communities are taking or are called on to take in forestry development, the challenge facing those responsible for the sector is enormous. They, therefore, need training that will provide them with appropriate instruments for analysis and action.

### 3. LEVELS OF FORESTRY EDUCATION AND TRAINING

It is obvious that there can be little forestry development at either national or regional level unless both the necessary specialized staff and the local population concerned are educated and trained. This condition is not always fulfilled, particularly as regards training.

Many countries do not have the educational and training facilities required to provide the necessary flow of trained personnel or, where these facilities do exist, no provision is made for the material and financial assistance necessary to make the best possible use of them. The situation is particularly serious as regards the training of forestry and forest industry workers.

#### 3.1 University Education

With regard to university education, Latin America and South-East Asia as a whole are well off compared with other developing regions, since they have a good chance of being able to meet their personnel needs. In some countries there may even be a surplus of trained professionals. The situation is different in Africa, where in many countries the need for well-trained personnel has been underestimated for too long.

However, many countries still need to make enormous efforts to improve this level of training by: devoting more attention to the training and refresher training of the teaching staff; improving and increasing equipment and laboratories for practical education, in which many forestry schools are deficient; adapting curricula to the forestry situation in the country and national development programmes; broadening the areas of attention within the sector of professional interest and the scientific disciplines connected with university education (ecology, environment, economics, sociology, anthropology, administration, technologies, etc.); and establishing appropriate links between theoretical training, practical aspects of the profession and research programmes, so that practical solutions may be found to solve the problems of the sector.

#### 3.2 Technical Education

A very great deal still remains to be done in all the developing regions in the field of technical education. The present and future needs for forestry technicians grow and become more acute as a country

commences to organize its forestry sector and initiate field actions, resulting in a need for staff skilled in many different aspects (plantations, harvesting, agro-forestry, logging, management of wildlife and reserves, conservation, control and inspection, extension work, training, etc.)

There is a certain tendency, particularly in Latin America, to have small regard for technical-level training. This is partly due to cultural, social and economic factors. The general trend is to transform schools into university centres, after they have been operating for a few years, so that the technical personnel so necessary in the forestry sector is in even shorter supply.

### 3.3 Vocational Training

In many countries the vocational training of workers and field staff engaged in forest management operations in natural forests and plantations, in logging, road construction, industrial operations, etc., is still at a very elementary level and in many cases is practically non-existent, although it has long been recognized that vocational training is essential if forestry operations are to be carried out more efficiently and the socio-economic condition of the workers and rural communities is to be improved.

Unlike professional training, which is the responsibility of university institutions, and technical training, which is usually the responsibility of the public education sector or, in some cases, of the bodies responsible for administration of the forest resources, vocational or worker training in the forestry sector is mostly left to the private sector, i.e. to the enterprises themselves, which obviously limit themselves to providing basic instruction in each enterprise's own operations, through very short training courses.

## 4. NEED FOR CHANGES IN FORESTRY EDUCATION AND TRAINING

The new objectives of forestry development to which reference has been made above present a further challenge to forestry education and training at the various levels. The educational profiles of the professional and technical schools must be changed to embrace new concepts and to incorporate into the traditional subjects items from other sciences that will enable the new foresters to carry out their new tasks and to cope with the new financial, organizational, social, economic and technical requirements. The teaching institutions must also encourage their professionals and technicians to update their knowledge and to run permanent education courses. The participation and motivation of the rural community, which is particularly demanded by the new philosophy of action which seeks to improve the standard of living of the people through a more balanced use of agricultural and forest land, calls for more extensive and continuing vocational training. This cannot be left to the private sector alone. Direct, massive and decentralized action by the institutional and teaching structures of the sector is required.

It is precisely here that the need for linking forestry education and training with research and extension work becomes most apparent. Research makes it possible to provide concrete solutions to the technical and social problems presented by forestry development depending on the different ecological, social, political and economic circumstances of each country; forestry extension work makes it possible to disseminate, transmit and transfer the results obtained to the sectors concerned, becoming a medium for training, particularly at vocational and rural levels.

## 5. EDUCATION AND TRAINING FOR FOREST INDUSTRIES

For a long time training for forest industries has received less attention in planning and assistance than professional and technical education for management of the forest resources.

FAO, through its Regular Programme and under guidance of the Advisory Committee on Forestry Education, has dealt with education and training for forest industries on many occasions. Various regional meetings have been organized on training needs in this sector of forestry-related activity, and these have irrefutably shown the extent of the deficiencies.

In developing countries various training centres have been set up for forest industries, particularly for sawmilling, but in some cases their impact has been only temporary, because they have not shown much ability to survive either for economic reasons or because the staff responsible for training had left.

The need for education and training in forest industries is evident at all levels: managerial, supervisory and operative.

### 5.1 Managerial Functions in Forest Industries

In most of the developing countries management of forest industries, usually in the hands of various kinds of professionals (engineers, foresters, lawyers, economists, etc.) suffers from serious deficiencies. This is reflected in underutilization of the production capacity in most of the forest industries in these countries. This situation has undoubtedly played a part in hindering progress in the forest industry sector and consequently also in plans for forest-based economic and social development.

At a different level of complexity, owing to the size of the industries, the same difficulty arises in the management of small rural or community industries. So long as they have the assistance and technical and even administrative supervision from the public or financial bodies that promoted and guided them in the initial phase, they operate and develop satisfactorily; but when, in the second phase, these bodies hand over the management of the enterprises to their own members, all kinds of problems arise owing to the managerial incapacity of the new managers; this soon leads to the collapse or termination of the community experiment in the area where the forest resources are being logged or utilized.

In this respect forest industry development projects of this type, which materialized after careful analysis of the aspects relating to planning, organization, monitoring, control and evaluation, have largely ignored the important aspect of training the staff who will have to direct and administer the activities of these projects.

Whatever the degree of complexity of a forest industry, without competent management it will practically be impossible to ensure a satisfactory yield and consequently the continued existence of the industry.

It is not easy to propose or define a programme for the training of forest industry managers, and only very few institutes offer any such course. The very diversity of the professionals who perform these functions makes training difficult. However, it is obvious that the success of a manager in achieving the technical, economic and

administrative objectives set by each enterprise will depend not only on his personal characteristics and empathy, but also on his ability to adopt and use the technical tools provided in the various scientific disciplines (sociology, administration, economics, policy etc.).

## 5.2 Supervisory and Operative Functions in Forest Industries

In supervisory tasks, which normally are the responsibility of technicians, training is of vital importance. In industrialized countries, technicians are usually directly responsible for the operation of the production units. This is not always the case in developing countries, where many of the difficulties observed in industries are due more to the incompetence of the technical supervisors than to the lack of skilled workers.

Adequate training of the supervisors is all the more important when they are responsible for training instructors and/or skilled and semi-skilled workers to provide a multiplying effect in expanding knowledge and acquiring new technical skills. Personnel at this level are also an important driving force in the creation of small rural industries that can develop their own activities, helping to diversify the rural economy with consequent social and economic benefits for the community.

Lack of preparation and, in many cases, shortage of supervisory staff merely confirms what has already been stated above regarding the importance of training for intermediate-level technical staff in national and sectoral development. However, studies carried out on staff requirements in the industrial sector in different regions confirm, in turn, the shortage of technicians and skilled workers and show that in most cases their training is entrusted to the industries themselves, which do not always have the physical and economic means of providing it.

A special problem arises in the training of skilled workers. Forest industries - particularly in the wood industry, which plays an important role in the economy of many developing countries because of the large extent of their forest resources - are not always included in the national training systems drawn up to meet the personnel needs of the development plans, so that practical responsibility for this aspect is left to the industrial sector itself.

This staff is therefore trained on the job, and the quality of the training obviously depends on the quality and technical ability of the trainers and on the technical and operational level of the enterprise or industry.

The cost of these activities and the managerial and technical staff's own internal vision of the development of the industry (which depends in turn on their own abilities) obviously condition the training programmes for the operative staff.

## 6. CONCLUSION

The situation regarding education and training for forest industries can only be improved if there is coordination between the industrial sector and the public sector responsible for forestry development and for training, resulting in an education and training programme appropriate to the requirements of this sector.

In recent years new organizational and teaching methods have been developed thanks to a new awareness that has emerged in the sectors concerned. All in all it may be concluded that education and training for forest industries is at the take-off stage, although considerable efforts will have to be made in the next few years to develop specific training models at both regional and national level.

#### REFERENCES

- Albin, R.H.      Survey of education and training requirements and  
1978      personnel needs for primary mechanical wood industries in some  
         Latin American countries. Document presented at the Ninth  
         Session of the FAO Advisory Committee on Forestry Education,  
         Jakarta, Indonesia.
- Beldi, F.      Training for mechanical wood industries in Eastern Europe.  
1981      Document presented at the Eleventh Session of the FAO Advisory  
         Committee on Forestry Education, Kyoto, Japan.
- Deherve, L.      Needs and issues in education and training for mechanical  
1981      forest industries in Africa. Document presented at the Eleventh  
         Session of the FAO Advisory Committee on Forestry Education,  
         Kyoto, Japan.
- Hilmi, H.A.      Forestry education and training in Africa. Document  
1971      presented at the World Consultation on Forestry Education and  
         Training, Stockholm, Sweden.
- Hilmi, H.A.      Reappraisal of education and training needs for forestry  
1980      and forest industries in Africa. Document presented at the Tenth  
         Session of the FAO Advisory Committee on Forestry Education,  
         Rome.
- Leslie, A.J.      Education and training for mechanical forest industries.  
1981      Document presented at the Eleventh Session of the FAO Advisory  
         Committee on Forestry Education, Kyoto, Japan.
- Mahlberg, F.C.      Survey of education and training needs for the primary  
1978      mechanical wood industries in selected countries in Asia and the  
         Far East. Doc. TF-INT 286 (SWE), FAO, Rome.
- Schmithüsen, F.      Human resources formation: The missing link in  
1983      forestry development. Document presented at the FAO/SIDA  
         Consultation on Forest Administration for Development, FAO, Rome.

MEASURING TRAINING REQUIREMENTS AND  
IMPACT OF TRAINING IN FOREST INDUSTRIES

by  
the Secretariat

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## 1. INTRODUCTION

The governments of developing countries have usually endeavoured to satisfy the training requirements only for those skills which were needed for the general development of their economies. Vocational training centres turned out masons, carpenters, plumbers, electricians and other tradesmen, but no attempts were made to cover the small quantities of various specialized skills required for specific industries, such as the primary mechanical wood industries. Consequently, training for these specialized skills was - and generally still is - carried out by the industries themselves through on-the-job training. Although the industries realized the importance and value of training, many were reluctant to embark on large scale "hands on" training, because of the somewhat short-sighted outlook that this type of training involves loss of production, reduction in quality, possible accidents and damage to equipment. On-the-job training has, therefore, in many instances been limited to a minimum number of candidates, usually selected from within the industry, in view of their familiarity with the techniques and procedures of that industry. These circumstances explain the chronic shortage of skilled workers for specialized industries in developing countries.

The efficiency of industries is influenced by a balanced combination of their managerial and labour skills. Leaving management out of this analysis, training requirements in existing forest industries depend on the difference between the influence which the present labour skills have, and what they ideally should have, on the efficiency of the industries' operations. But what are the skills required for the primary forest industries? Skilled, semi-skilled and unskilled are the terms normally used when classifying the different levels of labour in industry. This general classification is, however, insufficient when appraising training requirements in existing industries, or when assessing a just wage scale. It is even more inadequate when establishing a completely new forest industry - or any type of industry for that matter - in developing countries where the selection and training of labour, particularly for specific highly skilled jobs inherent to that industry, are of primal importance for a successful operation of the venture.

This report attempts to quantify the skills in industry utilizing a general reference of skills required for all jobs in the primary forest industries.

Quantification of skills will provide a means to assess the importance of available skills and the versatility of these available skills when transferred to another type of industry or, in other words, it will be possible to ascertain more accurately to what extent the required skills for a new industry can be satisfied by the available skills of an existing industry, taking into consideration the versatility of these available skills. It will highlight the requirements for training, not just relating to one industry sector, but to the nation as a whole.

Measuring training requirements in terms of time and costs involved is problematic, because the time required to teach depends on the ability of the instructors and on the aptitude of the trainees. The latter is influenced by the level of the so-called "native intelligence", a "quick mind", or whether the candidate is a "quick learner". Some trainees will never make the grade even under the most elaborate and favourable training conditions; others just watch a job being performed and carry on from there, becoming very skilled as they gain experience and confidence in their job. Training requirements are also influenced by the level of technology and mechanization of the industry for which training is contemplated.

There is still widespread belief that only labour intensive industries with a low level of technology are appropriate for developing countries. This might be applicable to those industries which cater for local markets only, but if the major part of the production is destined for export markets, an industry with a high level of technology and a limited number of workers is recommended to safeguard an acceptable export quality product. This is particularly true for the paper industry where the choice between high technology and labour intensive low technology represents an option between the "technology" of papermaking and the "art" of papermaking.

## 2. METHODOLOGY EMPLOYED

The correct performance of any job in industry requires a certain combination of three skills, whereby skill is defined as "the ability to use one's knowledge effectively and readily in execution or performance." The three skills referred to are technical, judgemental and organizational; for the majority of jobs in industry, the importance of these skills is generally in that order.

Technical in this context means "having special, usually practical knowledge, particularly of a mechanical subject." Technical skill is the ability to carry out the mechanics of a particular job, i.e. to know how to start up a pump, how to change a saw-blade, how to adjust a peeler knife. The amount of technical skill required for the widely varying jobs in industry ranges from very little to what has been gained during years of apprenticeship, technical study, practical operation and combinations thereof.

Judgemental means "relating to the process of forming an opinion or evaluation by discerning and comparing." Judgemental skill is the critical faculty to select the best solution, i.e. to know when to start up the pump, when to change the blade, when to adjust the peeler knife. Some judgemental skill may be pre-taught. Most of this skill, however, requires a complete familiarity with both equipment and process, which can only be acquired through experience. Higher levels of technical skill will usually enable a person to make more accurate judgements.

Organizational means "relating to the act or process of organizing or of being organized." Organizational skill is the ability to plan one's own work and/or to plan and direct others in their work. Most jobs in industry have a low organizational skill requirement, needing only the ability to organize work for oneself and/or for a helper. Some jobs require organizing not only people but materials and equipment as well, e.g. for maintenance work.

Training is mainly identified with the direct transfer of technical skills, which undoubtedly is one of the key factors of training; the goals for technical skills are straightforward and the results can easily be measured. Training for organizational skills in their widest sense is a rather vague concept and it has generally been neglected, possibly because of the difficulty to prepare an adequate relevant training plan for it, or to measure its effectiveness. Particularly in isolated areas of developing countries where a large part of the workers for a new industry will have to be selected from the local labour force, training for organizational skills is almost of equal importance as the training for technical skills. Men who previously may have been working in seasonal, small scale logging operations or other activities where working hours were flexible and where the pace of work was set more by inclination than by urgency, find themselves all of a sudden subjected to rigid discipline and tight working schedules. One of the main causes for the large turnover of the work-force in this type of situation is that many of the locally engaged workers eventually find themselves unable to cope with the stress which the changes in working conditions have imposed on them. They

usually revert to their previous occupations and thus a considerable amount of technical training invested in them is lost to the industry and the nation.

In an attempt to quantify the technical, judgemental and organizational skills needed for different job positions in forest industries, a list has been prepared of levels of skills acquired or required by workers in well-defined occupations. It covers the full gamut of skill levels from those for unskilled, semi-skilled and skilled workers, to those for technicians, foremen and supervisors in the production, quality control, maintenance and service departments of the primary forest industries. Excluded are plant engineers, production managers, mill managers, etc.

Table 1 defines the levels of technical skills utilized in this study and ranks them in increments of 0.1 from 0.0 to 0.8 in which 0.0 represents the lowest level. It should be pointed out that the incremental levels of technical skills are used only to denote the different levels of skills and that they must not be utilized to assess training requirements in terms of time and extent of training. A person whose level of skill has been classified in the 0.0-0.1 range could, with limited training and within a short time span, easily be upgraded to the 0.2-0.3 level, whereas a person classified in the 0.5-0.6 range might require extensive training over a long period of time to qualify for the 0.7-0.8 level.

In the description of levels of technical skills (Table 1) a few occupations, such as radio technician, TV and computer repair-man and air traffic controller have been included only for comparison's sake.

In a similar manner Table 2 defines the levels of judgemental ability required for the type of work to be carried out, based on a scale of 0.0 to 0.6, in which 0.0 represents the lowest level. The level of 0.6 covers general trades foremen or process foremen with many years of practical experience in a large-sized mill. Levels of ability above 0.6 would be required for management staff which have been excluded from this study.

Table 1  
Levels of technical skill

<u>Level of skill</u>	<u>Description of a typical individual</u>
0.0	with no training in mechanical skill, little education (or ambition). May self-develop abilities to perform simple, usually repetitive jobs adequately by carrying out same - e.g. general labourer, cleaner, manual debarker, etc.
0.1	with little or no formal education who has learned, by observation or through simple teaching, the ability to perform technical work - e.g. tradesman's helper, machine operator's assistant.
0.2	with little formal education who has been trained to carry out more complex tasks without necessarily fully understanding the technical principles involved - e.g. fork-lift truck operator, chipper operator.
0.3	with some vocational education who has been trained at school or on the job to carry out technical tasks with understanding - e.g. auto mechanic, carpenter.
0.4	who has attended a trade school or served an apprenticeship. Has knowledge of mechanical side of the trade, including the principles involved - e.g. welder, electrician, machinist.
0.5	who may have attended college, trade school and/or served apprenticeship but in a trade requiring more exercise of mental skill than physical skill - e.g. quality controller, radio technician.
0.6	who, with further training in his original field, either practical or theoretical, raised his level of ability - e.g. h.p. welder, TV repair-man.
0.7	As in 0.5 or 0.6 with further specialized training - e.g. recovery boiler operator, computer repair-man.
0.8	with specialized training followed by years of practical experience - e.g. machine tender in paper mill, air traffic controller.

Table 2

Levels of judgemental ability required

<u>Job position</u>	<u>Level of skill</u>	<u>Extent of skill</u>
Labourer	0.0	No judgement required; works to order or routine.
Equipment operator Grade 1	0.1	Operates simple, almost self-operating equipment, judges whether knives need sharpening, feed is excessive, etc.
Equipment operator Grade 2	0.2	Operates more complex stationary machinery and mobile equipment; must judge whether working to capacity, overloading or engaging in unsafe work.
Process operator Grade 1	0.2	Operates simple, single operation processes, judges feed operating correctly or that product looks to be as it should - if not, notifies foreman.
Process operator Grade 2	0.3	As for process operator Grade 1, but for more complex processes
Tradesman	0.3	Able to assess best way to do job and requiring little in the way of original thinking; repetitive worker.
Tradesman	0.4	Able to assess best way to do job and improve if necessary.
Process and trade foreman	0.5	Able to lead small groups of workers to successful continuation or conclusion of job.
General foreman process foreman	0.6	As other foreman but on a larger scale and able to cover all trades/processes

Organizational skill, as mentioned above, is the ability to organize oneself and/or others in carrying out a specific task. Every worker will need basic organizational skill, interwoven with discipline, merely to arrive at work on time and to appreciate in what manner he must carry out his task. The majority of workers are classified in this basic level of organizational skill, which has been set as 0.0 in the analysis. Normally they are given verbal instructions: "keep the temperature at X", "close the valve", "take that pallet of face veneers to the glue spreader", "do this", "do that," etc. Only a limited number of workers below the level of foreman, such as tradesmen and some machine operators, require a certain level of organizing ability. Tradesmen will have to organize not only men but also materials and tools. Machine operators with helpers or assistants must obviously have a little more than the basic skill, since they have more than one job to organize.

Table 3 indicates the organizational abilities required and used in the analysis.

Table 3  
Organizational skills required

<u>Job position</u>	<u>Level of skill</u>
Labourer	0.0
Equipment operator            )	
Process operator                )	0.0 to 0.3
Tradesman                        )	
Process and trades foreman	0.4 to 0.5
Engineers, supervisors and managers (not included in this study)	0.6 to 1.0

In order to compare the levels of skills required for jobs in five different forest industries, every job of these industries was assessed with regard to the level of technical, judgemental and organizational skills required for that particular job. For example, a millwright would be required to have attended a trade school and to be well versed in his trade, which would qualify him for a technical skill value of "T"-0.4 assumed for that job. He will be required to decide on the best and quickest way to complete a repair, which would earn him a judgemental skill level of "J"-0.3 determined for that job. He must have the ability to organize tools, equipment, a helper and possibly others to carry out his work, which will entitle him to an organizational skill level of "O"-0.2 required for that job. This would give him a rating of T-0.4, J-0.3 and O-0.2 and an arithmetical average of 0.3.

All jobs in the following primary forest industries were rated:

<u>Type of industry</u>	<u>Installed capacity</u>	<u>Number of employees</u>
Linerboard and kraft paper mill	42 000 FTPA <sup>1/</sup>	335
Newsprint mill	30 000 FTPA <sup>1/</sup>	360
Particle board mill	20 000 m <sup>3</sup> /A	169
Plymill	4 500 m <sup>3</sup> /A	83
Sawmill	42 500 m <sup>3</sup> /A	99

The level of technology, mechanization and labour intensiveness of these industries varies. Since the skills required for logging operations in general differ only marginally, they have been disregarded in this study. The number of employees required for each industry (indicated above) excludes personnel for logging operations.

Based on the general manning tables for the above industries, job descriptions were prepared for all positions in these industries, and every position was assessed and rated in the manner described above. This provided detailed information on the required skills for all workers in the five industries selected for the analysis.

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<sup>1/</sup> FTPA = finished tons per annum.

### 3. RESULTS OF ANALYSIS

The information on the requirements for skills was summarized and is reflected in Table 4, by number and percentage of workers, and per industry.

It is interesting to point out at this juncture that, in spite of the different degrees of technology, mechanization and labour intensiveness of the industries, requirements for the individual ranges of skills for each industry follow more or less the same pattern. The largest difference in percentages of required skills occurs in the lowest level of skills, where the percentages range from 69 percent of the work-force of the particle board plant to 50 percent of the workers of the newsprint mill. In the higher echelons, these differences constitute only 2 percent (in the 0.31-0.4 range of skills) and 4 percent (in the 0.41-0.5 and 0.5-0.6 ranges of skills).

In order to assess to what extent available skills can be used in another type of industry, it will be necessary to evaluate which part of the available skills is specific to the industry in which they are employed and which part could be utilized in other industries. The results will also indicate the national importance of training. The required and acquired skills of any industry are obviously of maximum benefit to the industry concerned, because some of these skills will be peculiar to that industry.

Machine tenders of paper mills, band-saw operators and sawdoctors of sawmills and peeler operators of plymills are highly skilled operators who rank among the key personnel of their respective industry. It would, however, be extremely difficult to find suitable employment for them in different types of industry - even in other forest industries - where their acquired, very specific, technical skills would be equally valuable and appreciated. On the other hand, skilled electricians and millwrights from paper, saw and plymills can easily be transferred to any kind of industry, with only a minimum of on-the-job training in their new surroundings.

This is where the concept of versatility of skills is introduced. As indicated above, some technical skills are completely transferable; others may be of little or no value to other industries. In this study the versatility of those technical skills which are 100 percent useful to other industries has been classified as 1.0. Each technical skill has a versatility factor which, depending on the individual job, may range from 0.0 to 1.0.

It is considered that any judgemental or organizational skills which a person may have acquired in one industry is of equal value to any other industry. Judgemental and organizational skills both have an invariable versatility factor of 1.0.

Applying these versatility factors to the individual skills of each worker provides information on where additional training would be required in the various jobs, if the levels of these skills would have to be raised to the generally required skills for industry in the country. Without going into too many details, the results only confirm what already transpired earlier, i.e. that generally speaking the lower the skill which is being assessed, the higher the versatility rate; for example, a plymill general labourer, with hardly any skills to his credit, will be 100 percent versatile when he transfers to a soap factory as general labourer without skills. As indicated above, band-saw operators and peeling lathe operators are so highly skilled in their specific jobs that it will be difficult to find suitable employment for them in another industry where

Table 4  
Required skills by numbers and by percentages of  
workers for the five selected primary forest industries

Ranges of Required skill	Linerboard workers		Newsprint workers		Particleboard plant workers		Plywood workers		Sawmill workers	
	No.	%	No.	%	No.	%	No.	%	No.	%
0 to 0.1	202	60	180	50	116	69	55	66	63	64
0.11 to 0.2	33	10	88	24	19	11	14	17	16	16
0.21 to 0.3	43	13	45	13	20	12	6	7	12	12
0.31 to 0.4	25	7	24	7	10	6	5	6	5	5
0.41 to 0.5	20	6	19	5	4	2	3	4	3	3
0.51 to 0.6	12	4	4	1	-	-	-	-	-	-
Total	335	100	360	100	169	100	83	100	99	100



they would be able to utilize these skills. Their versatility is, therefore, very low. Electricians, millwrights, etc., although skilled workers, have a high versatility rate, because their skills are 90 percent general and the remaining 10 percent specific to the industry in which they are employed. In the case of specialized skills these percentages are usually the reversal.

The above assessment of versatility relates to the transfer of skills from the forest industry sector to industries outside this field. An analysis was also made to see how easy - or how difficult - it is to transfer skills from one forest industry to another. The analysis is, however, based on many assumptions which in reality would be hard to realize.

Many developing countries have - forest resources permitting - an established sawmilling industry. Supposing that in one of these countries plans are being made to establish a linerboard/kraft paper mill and assuming, in a very hypothetical case, that all required labour for this paper mill has to be supplied by the sawmilling industry, the available skills in the sawmilling industry will have to be measured against the required skills for the linerboard mill. It was also assumed that through training, but mainly through practical experience within the sawmilling industry in the developing country, the required skills for all levels of labour were acquired.

Using the details of Table 4 the following table shows the comparison between the percentages of available skills in the sawmilling industry and the required skills for the linerboard mill.

Table 5  
Percentages of available skills in  
the sawmilling industry and the required skills  
for the linerboard/kraft paper mill

<u>Level of skill</u>	<u>% of available skills in sawmilling industry</u>	<u>% of required skills for linerboard/kraft paper mill</u>
0 to 0.1	64	60
0.11 to 0.2	17	10
0.21 to 0.3	11	13
0.31 to 0.4	6	7
0.41 to 0.5	2	6
0.51 to 0.6	-	4
	<hr/>	<hr/>
	100	100

This demonstrates that the sawmilling industry operates with a larger percentage of lower skills when compared with the requirement for the linerboard mill or, in other words, the lower levels of skills of the latter industry can - with a limited amount of on-the-job training, say one to two weeks - be easily filled by workers from the sawmilling industry.

Although the percentage of adjusted skills ranging from 0.21-0.3 available in the sawmilling industry is below that of the required skills for the pulp and paper mill, it would not be difficult to fill the jobs of evaporator, causticizing and kiln operators, windermen, stock preparation men, etc., with workers from the sawmilling industry who, with effective on-the-job training of between six to twelve months should be able to handle these different jobs.

Even obtaining the skilled level range of 0.31-0.4 for the pulp and paper mill from the sawmilling industry does not present any serious training problems. This group includes some tradesmen who, as pointed out above, are readily transferable. To make these tradesmen more valuable to the new industry, it would be advisable to employ them already during construction or, to be more precise, during the installation of the machinery so that they can familiarize themselves with the equipment before start-up. Millwrights, belonging to the usually foreign start-up crew, would train the tradesmen on operational repairs and maintenance.

As may be seen from Table 5, the largest discrepancies between the skills of sawmill and linerboard mill exist in the level ranges from 0.41 to 0.5 and 0.51 to 0.6, the latter of which is not even represented in the sawmilling industry. The manning of this part of the pulp and paper mill is the most critical and crucial one. On the one hand, the sawmill has very few suitable candidates, even with some of the required skills, and on the other hand training facilities for the required, very specific, skills can usually not be found in developing countries.

Sawmilling is usually the first primary forest industry to commence operating in developing countries, followed subsequently by plywood production and particle board manufacture. Since the hypothetical study of supplying the new linerboard mill with skilled labour from the sawmilling industry demonstrated the inability to satisfy the requirements for the last two level ranges of skills, the study was enlarged to see whether the plywood industry and/or the particle board industry could possibly supply the higher skills for the linerboard mill, to which Table 6 refers.

Table 6

Percentages of available skills in  
the plywood and particle board industry  
and the required skills for the linerboard mill

Level of skill	% of available skills		% of required skills
	Plymill	Particle board plant	Linerboard mill
0 to 0.1	66	69	60
0.11 to 0.2	17	11	10
0.21 to 0.3	7	12	13
0.31 to 0.4	6	6	7
0.41 to 0.5	4	2	6
0.51 to 0.6	-	-	4
	100	100	100

Unfortunately the picture presented by this comparison is practically the same as shown in Table 4, i.e. a larger percentage of available skills in the lower levels. This highlights the necessity not only of the training for these very specific skills, but also the careful selection of candidates for the jobs which require these skills.

It would be most revealing to study which percentage of the national economy of developing countries is directly influenced by people with a high skill level and a low versatility rate, i.e. those specialized skilled workers whose training is generally left to the private industry. Training for these skills, particularly in the pulp, paper and wood-based panel industries, is problematic for countries where this type of industry has not yet been established, because the best way to train for any of these specialized jobs is through on-the-job, "hands-on" training, and to learn from mistakes which are likely going to be made. For these unfortunate developing countries the only way to train their future high skilled operators for industries yet to be established is to send them abroad, which has many angles:

- It is costly; therefore candidates must be properly selected and scrutinized before sending them abroad, not only for technical skills but also whether they seem mentally prepared to work and live in a different cultural environment.
- Selection of the plant in which they will be trained is important; will they be given the opportunity for "hands-on" training, or will they only be allowed to watch how things operate? Is anybody supervising and/or guiding their training programme?
- What do they do when they come back? (If they come back? Many trained men fail to return to their home country because of political, economic or social woes.) Do they return to the company which paid for their training, or are they spirited away for a few more cents per hour by the competitors?
- Are they enthusiastically showing their newly acquired skills, or have they all of a sudden become too important for the menial skill for which they were trained?

All these side effects of overseas training could be overcome if the governments of the developing countries, preferably on a regional basis, took on the training for these high skilled jobs. They might do so if they realized the importance of these skills for the development of their country and the multiplying effect which these skills generate.

Some advanced countries (including Brazil), in addition to having a well-established pulp, paper and wood-based panel industry - and subsequently the means and opportunity to train for high-level skills - also operate government-sponsored training centres complete with manufacturing facilities for these specialized skills.

REFERENCES

- Chalk, R. Training in World Bank-financed pulp and paper projects.  
1984 FO:PAP/84/Inf.9 - FAO Advisory Committee on Pulp and Paper. 25th session, Rome, 16-18 May 1984.
- Lawast, G. Actual experience in training labour for pulp mills of Oy  
1984 Metsä-Botnia Ab in Finland. FO:PAP/84/Inf.11 - FAO Advisory Committee on Pulp and Paper. 25th session, Rome, 16-18 May 1984.
- Mahlberg, F.-C. Survey of education and training needs for the primary  
1978 mechanical wood industries in selected countries in Asia and the Far East. TF/INT 286 (SWE). FAO, Rome.
- Picornell, P.M. Expatriates and understudies in developing countries.  
1984 FO:PAP/84/Inf.8 - FAO Advisory Committee on Pulp and Paper. 25th session, Rome, 16-18 May 1984.
- Sila-On, Amaret. Technology transfer - the role of expatriates in mill  
1984 operation and training. FO:PAP/84/Inf.10 - FAO Advisory Committee on Pulp and Paper, Rome, 16-18 May 1984.

A STRATEGY FOR THE DEVELOPMENT OF  
FOREST INDUSTRY IN DEVELOPING COUNTRIES  
(THE CASE OF MEXICO)

by

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## 1. INTRODUCTION

In most developing countries the least developed strata of the population are located in the forest lands, arid zones included. These areas are characterized by a standard of living well below the national mean, with high rates of unemployment, underemployment and social unrest. Therefore in these countries the forest is not only an important factor in the preservation of the ecological balance, but also a natural resource with a potential to produce much needed social and economic changes.

The maximum sustained harvests, as well as the type of forest products potentially available in developing countries for the next twenty to thirty years, are a variable which is more or less known. The stock is already there. But, unless it is put to use with the active participation of the inhabitants of the forest zones, these same people will destroy it systematically in search of less efficient alternatives of land use as a means of subsistence. This is a very important difference between developed and developing countries that must be taken into account when considering forest development strategies.

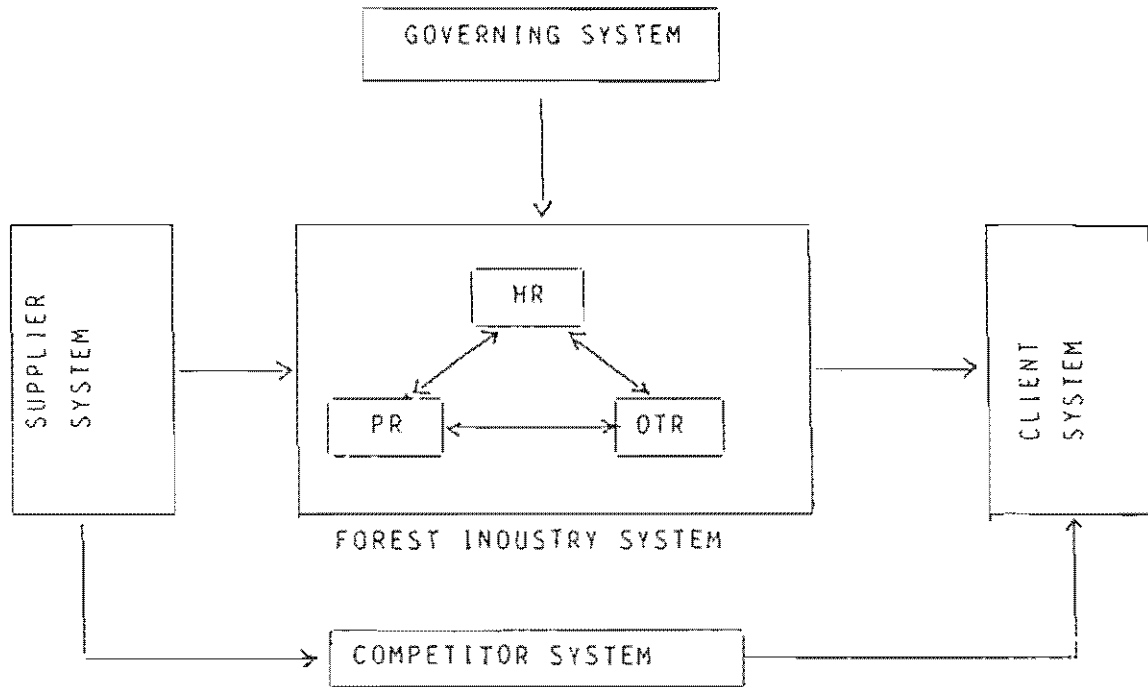
As opposed to other types of land produces where self-consumption and marketing of the products in their natural state are possible, thus enabling the peasants to obtain economic gains in a relatively simple way, forest products require an industrial infrastructure to process the harvest. Without a highly productive industrial establishment whose capacity is in balance with the available forest potential, the optimum development of this resource is not possible. The experience of developing nations shows that any unbalance between resources and industry is harmful to both. When existing plant capacity is in excess of the forest potential, industry either exerts undue pressure upon the resource, endangering it by overexploitation, or industry is forced to operate at a very low productivity level. On the other hand, a forest underutilized by lack of adequate industry tends to deteriorate both biologically and by the depredatory actions of impoverished peasants.

Depending on the way it is exploited, the forest can be increased or destroyed thus affecting the society as a whole. That is why it is considered a resource of public interest and why its use is highly regulated by governments. An efficient and rational utilization of the forest is the best and frequently the only way for many developing countries to assure a minimum of social and economic well-being for a significant part of their population which inhabits the forest lands, as well as to achieve a much needed social peace without which progress for the whole society is not possible. That is why the impact of forest industry on the national development of emerging countries transcends such traditional aspects as its direct contribution to the GNP, the trade balance and national employment. More important is its potential value as a "steering arm" to induce a full and optimum development of the forest resources of a nation.

## 2. A "SYSTEM APPROACH" TO FOREST INDUSTRIES

The forest industry of any nation is a very complex reality. In order to analyze the way it functions and to find ways to improve it, a simple model is needed which indicates the vital aspects of forest industry without the many trivial details that might cloud the analysis. The so-called "systems approach" provides such a model which is graphically described in Figure 1.

Figure 1



A system is briefly defined as a set of elements highly interacting with each other and the environment, aimed at obtaining an object which is more relevant than the individual objects of each component. Forest industry, which can be viewed as a system in itself, is part of a suprasystem: the integral forest system, whose purpose is greater and more relevant to society than industry's own. This also means that, whichever the object of industry may be, it has to contribute directly to the forest system's purpose.

As seen in Figure 1, forest industry, conceived as a system, has an operational environment with at least four related systems:

- (a) The client system composed of those who use the outputs of forest industry, such as manufacturers of housing and furniture.
- (b) The supplier system composed of those that furnish industry with the required inputs like raw materials, energy, information, etc. The most important component of this system is the set integrated by the forest vegetation, the forest productive infrastructure and the inhabitants of the forest lands, including the landowners.
- (c) The competitor system composed of those who use the same inputs for alternative uses and those who produce substitute products for the client system. Depredators,

producers of firewood, ecological groups (in a sense) as well as manufacturers of plastic, metal and other non-wood substitutes and imports of forest products, can be included in this system.

- (d) The governing system composed of those who have the power to regulate the performance of industry, such as federal and local government agencies.

From this environment the forest industry receives inputs that, through a process of transformation, return to the environment as outputs with a value added. These inputs and outputs are well known and do not need to be specified here.

As stated before, the forest industry as a system is itself composed of many "elements" or subsystems with a high degree of interaction and interdependence. When analyzing a national complex system such as this, it helps to regroup its components in subsystems:

- (a) The human resources subsystem composed of all personnel working in the industry, whether as labourers, technicians, clerical workers or as executives.
- (b) The physical resources subsystem composed of all the physical facilities, such as machinery, equipment, buildings, land and funds available to industry.
- (c) The organizational/technological resources subsystem composed of all the systems, procedures, methods and tools of technology that organize and regulate work in the industry.

The interaction between these subsystems gives rise to the processes that determine the performance of the industry. For the purpose of analysis, three main processes should be considered:

- (a) The productive process comprising all activities such as debarking, sawing, drying, etc., related to transforming raw materials and other inputs into products with value added.
- (b) The regulating process comprising all activities such as production control, quality control, cost accounting and obtaining feedback from clients in order to assure the desired output level.
- (c) The learning/adapting process comprising all activities such as market research, product development and strategic planning aimed at detecting instantly significant changes in the environment so as to adapt industry, consequently preventing deviations in its performance.

When applying this model to analyze the forest industry of a particular country with the object of designing a sound strategy for its development, careful attention should be given to the following items:

- Which is the desired purpose of forest industry as part of the integral forest system of that particular country? To what degree has the desired purpose been attained?
- Does the industry have the potential capacity - indicated by the nature of its human, physical and organizational/technological resources - to attain the desired goal?



- Are the outputs of industry fulfilling the needs of the client system, including government if such is the case? Is the competitor system affecting the marketing opportunities for the national industry, imports included?
- Are the main inputs, i.e. roundwood and transport services, supplied in the required quantity, quality, opportunity and price? Which are the main constraints of the supplier system? Is the competitor system affecting the supply of vital inputs?
- How efficient is the productive process? Are means of production and technology adequate for the type of raw materials and available labour?
- How effective is the regulating process in maintaining a high level of productivity throughout the industry? Do government and industry boards participate in carrying out this process?
- How effective is the learning/adaptive process to prevent the impact of negative changes from the environment? To what extent does government participate in this process? Is there a government agency at the appropriate level whose sole purpose is to develop forest industry?
- Are state-owned industries - if any - contributing in a direct and significant way to the accomplishment of the aim of the forest industry? Are the inputs of the governing system, such as laws, administrative procedures, policies, incentives, etc., inducing a high level of performance by the forest industry?

The use of this model in analyzing the performance and the constraints of the forest industry is an iterative rather than a linear process. The results will not be better than the information inputs; so a first-hand knowledge of the industry and its operating environment will be necessary to apply them successfully. This is particularly so in developing countries where statistics are unreliable or non-existent. Special care should be taken in obtaining all data pertaining to the socio-cultural peculiarities of the country. Local values, norms, habits and attitudes as well as the patterns of behaviour they elicit, are a vital factor to be taken into account when establishing policies and strategies for the development of forest industry. The implementation of suggestions made by experts from developed countries have frequently failed because this very important component of analysis had not been considered by them.

### 3. FACTORS RESTRICTING AN EFFECTIVE PERFORMANCE OF FOREST INDUSTRY IN A TYPICAL DEVELOPING COUNTRY: THE CASE OF MEXICO

#### 3.1 Background Data

Approximately 70 percent of Mexico's total area is forest land and includes the three main forest ecosystems as shown:

Temperate forest	273 322 km <sup>2</sup>	19 %
Tropical forest	132 006 km <sup>2</sup>	9 %
Dry land vegetation	677 414 km <sup>2</sup>	47 %
Other	346 772 km <sup>2</sup>	25 %
<hr/>		
Total forest land	1 429 514 km <sup>2</sup>	100 %

National parks and reserve areas comprise 59 million ha. The volumetric potential is considerable. The temperate and tropical forest inventory indicates approximately 3 000 million m<sup>3</sup> with an annual increment of about 27 million m<sup>3</sup>. In spite of this potential, the annual cut during the last five years has been approximately 9 million m<sup>3</sup> or 33 percent of the increment, which represents only 1.7 percent of Mexico's GNP.

The structure of Mexico's forest primary industry reveals a high percentage of plants that manufacture low value added products as shown below:

<u>Type of industry</u>	<u>Number of plants</u>	<u>%</u>
Sawmills	1 325	62.5
Wooden boxes, crates, etc.	636	30.0
Wood-based panels	50	2.4
Pulp mills	10 )	
Paper and pulp mills	14 )	3.3
Paper mills	45 )	
Others (resin, impregnation, etc.)	40	1.8
TOTAL	2 120	100.0

During 1983 timber production was as follows:

<u>Product</u>	<u>Wood intake (000 m<sup>3</sup>)</u>	<u>%</u>
Sawnwood	5 072	58.0
Railway ties (sleepers)	214	2.4
Pulp material	2 460	28.1
Poles and piles	228	2.6
Plywood and veneer	214	2.5
Firewood	560	6.4
TOTAL	8 748	100.0

The productivity level of most of the forest industries is low as the utilization percentages of installed capacity show:

<u>Type of industry</u>	<u>Utilization percentage</u>
Sawmills	80
Wood-based panel plants	52
Pulp mills	70
Impregnation plants	30
Resin plants	38
Weighted mean	65

Mexico's primary forest industry employs close to 100 000 people comprising labour, technicians and clerical staff; this figure does not include personnel engaged in logging operations. Secondary industry, including the production of furniture, building elements, houses and other high value added goods, represents some 900 plants with close to 100 000 employees.

Mexico has run a deficit in its trade balance for several years. In 1983 the statistics on foreign trade relating to the forestry and forest industries' sector, expressed in million U.S. dollars, were as follows:

	<u>Wood products</u>	<u>Non-wood products</u>
Exports	52	20
Imports	172	45
<hr/>		
Deficit	120	25

Imports of pulp and paper accounted for 79 percent of the forest products' trade balance deficit which represents about 17 percent of the total trade balance deficit of the nation.

### 3.2 Base Line Analysis

During the first months of 1983 a survey of the actual state of the forestry industry in Mexico was conducted with the object of identifying the main constraints for its development. At that time the country had reached the lowest point of the worst economic crisis in its history and many of the constraints were, therefore, of a circumstantial nature, such as the plummeting of internal markets, a very high inflation rate, lack of foreign currency and so forth. An effort was made to identify these structural constraints that would have to be corrected through medium and long-range strategies. Among the most important findings of the survey were:

- The general forest policy of the new Federal Government was in the formulation stage. Extreme attention was given to considering which should be the main objectives to be achieved in the medium and long range. The backward state of forest activities demonstrated the failure of past policies. The role of federal and state governments in forest development, the incorporation of peasants and landowners in the production process, the suitability of giving forest concessions to private industry, the role of public industry and other related issues were carefully analyzed. It also transpired that the main purpose of forest industry in the general framework of forest development had never been defined. As a result, industry throughout the country had developed without a plan and the main consequences are reflected in the figures given above.
- On the one hand there was, and still is, an unused forest potential and, on the other hand, there is the largest and richest market in the world - the United States of America - so close to Mexico. In spite of this, the established industrial plans did not have the capacity to produce at the quality and price levels required to make a systematic

entry into the American market. Its physical and organizational/technological resources were not adequate. The general level of management was poor. They had been unable to instil their labour force with a sense of quality and productivity. The country had many small inefficient industries, mainly sawmills, and very few large integrated complexes which limited the utilization of the whole tree volume with the most profitable use. Industry had neither the equipment nor the technology required for the industrialization of tropical woods and other non-conventional species like oak. On the positive side, there was a large portion of unused plant capacity that could be marginally utilized for export purposes and also a great will on the part of several segments of private industry to go ahead and try to solve the internal crisis through exports.

- One of the vital constraints was, and still is, the poor supply of raw material. This is a result of two main negative factors in forest production: lack of infrastructure and organization. There is a great need of roads. Many of the existing ones are so poor that they can be used only during a short period of the year. This condition also causes unduly high transportation costs. Logging operations are very inefficient due to a lack of appropriate equipment, coupled with a low productivity level of the labour force which consists mainly of peasants turned into crew workers without the required training and organization. One of the reasons for the poor supply of raw materials is also the lack of adequate financial schemes for all stages of forestry development. Most wood pulp mills are located outside the acknowledged economical supply radius of 150 km and the establishment of commercial plantations is almost impossible due to the high cost of money (up to 70%/a) and problems relating to land tenancy.
- Forest industry as a whole had failed to detect trends and changes in the environment and to alter its structure and functioning accordingly. It has been more of a reactive type of system oriented to try to get the best part of any opportunity which offered itself. This circumstantial approach is largely responsible for the present incapacity of industry to project strongly on the export market, to use the great reserves of tropical woods or to obtain a fair share of the expanding market for low-priced housing.
- Up to the first quarter of 1983 there was no Government agency specialized in forest industry. The pertaining functional responsibilities were scattered around different units of the Undersecretariat of Forestry. There were no incentives designed specially to promote the development of forest industry. Most public forest industries operated with losses and none of them contributed in any significant way to the achievement of the national goals. They were poor duplicates of private industries.

#### 4. MAIN CONCEPTS FOR THE FORMULATION OF A SOUND STRATEGY FOR THE DEVELOPMENT OF FOREST INDUSTRIES

When designing a strategy for the development of forest industries in a developing country, several political, socio-cultural, economic and technical issues should be carefully considered.

The peculiarities of the prevailing political system are vital because they define, among other things, which are the roles of government and other political forces regarding industrial development. Is the government's role restricted to regulation through administration of policies that may induce the private sector's efforts, or does it also include the establishment and operation of public enterprises? Is mixed investment, i.e. by public and private sectors, politically viable? Which is the accepted role of intermediate organizations such as industry associations or farmer and workers unions? Is planning formulated solely by government agencies or is there a system to promote a consensus of all sectors? Is foreign investment encouraged or forbidden? Which kind of forest land tenancy prevails? To what extent does government regulate forest activities? The answers to the above-mentioned questions will make it possible to determine the best way to share the effort of development.

Socio-cultural peculiarities are also very important in strategy formulation. Are there marked ethnic differences between groups that make regional integration difficult? Which are the prevailing attitudes toward private enterprise? Which are the main attitudes of workers toward such issues as productivity, quality, discipline and so forth?

Are managers of industries conservative or risk-oriented? Is there an export tradition among forest industrialists? Could an industrial culture be viably promoted among peasants which might result in efficient logging and processing? Is the attitude of government toward peasants one of paternalism? The answers to these questions will indicate the nature of those development processes which are more likely to succeed.

Economic conditions play a major role in strategy formulation. Which are the prevailing economic conditions in the forest areas? Is there a strong migration from forest zones to urban areas? Is qualified labour available close to forest areas? Is there an adequate infrastructure of support services such as transport, maintenance, training, etc.? Are there sufficient preferential financial resources for such items as plantations, road construction, transport and logging equipment and so forth? How strong is the local demand for forest products? Are there prospective foreign markets and export incentives? Is there a commercial type of forest still available for a sustained growth of industry? How is the balance between forest potential and plant capacity? These and many other related questions should be carefully answered before attempting to design the strategy of development.

There are also important technical issues to be considered in developing a strategy. Which are the main species available for future industrialization? Is the technology for its industrialization already known or in a stage of development? How marketable are these species? Should they be kiln-dried? What size and automation degree are appropriate in the case of mechanical wood-processing plants? Which are the possibilities of growth of existing plants? Can the value added of the present output of industry be increased?

A sound strategy for development clearly defines the course of growth of forest industry as well as the more efficient ways to achieve this growth given the peculiarities of the country. Some vital features of a sound strategy for the development of forest industry are:

- (a) Industry goals represent a direct contribution to the national forest policy, i.e. full use of all available species, low rates of waste, maintenance of balance between forest potential and plant capacity, etc.

- (b) The particular interest of each party is considered in the setting of national goals with a vision of a "total system" so as to assure national interest.
- (c) It is the product of real consensus among all interested parties to promote involvement.
- (d) The required effort is shared by all sectors - public, private, communal organization, etc. - according to the roles they play in the country, but well coordinated through mechanisms of agreement and joint action.
- (e) It is built on realities. Assumptions of changes in basic conditions are carefully tested for viability.
- (f) It specifies permanent solutions to structural constraints such as lack of roads, low labour productivity, etc.

When considering the course of action to be taken, it is important to identify the real causes of problems instead of the apparent causes.

Results are the product of actions, but actions are carried out by human, physical and organizational/technological resources. Inefficient actions or lack of proper actions seem to be the causes of poor results. This only appears to be so. The actions are not properly taken because the available resources are not adequate in quality, quantity or both. In order to achieve a change in results, it is therefore necessary to introduce a change in resources. To state that the yield is low due to inefficient sawing operations is not enough. Why are these operations inefficient? Is it lack of training of operators? Is it obsolete equipment? Is it inadequacy of method or standard?

It is also important to remember that in a complex system, such as forest industry is, the functioning of each part affects all the others. There is a strong interdependence among parts of the whole. That is why careful attention should be given to the identification of restricting factors, which should be dealt with first, so as to improve the whole system. For instance, a chronic deficit in the supply of raw material for lack of roads will make all improvements in equipment and technology ineffectual.

## 5. THE STRATEGY FOR DEVELOPMENT (THE CASE OF MEXICO)

In June 1983, nine objectives were set out as priorities for the development of forest industries in Mexico, each one with a set of strategic outlines which have been omitted from this paper because of lack of space; these nine objectives are the following:

- (a) To achieve and maintain the balance between forest potential and plant capacity in all regions.
- (b) To achieve the required levels of quality and productivity for industry in order to be competitive in foreign markets.
- (c) To supply the country's demand for forest products and to generate surpluses which can be exported.
- (d) To obtain the maximum value added of forest raw materials.

- (e) To industrialize all non conventional species (mainly tropical woods).
- (f) To raise the standard of living and generate employment for the population of the forest areas.
- (g) To make public forest industries contribute directly and significantly to the goals of forest development and to operate with an adequate ROI.
- (h) To optimize the allocation of investment resources available for the development of forest industry.
- (i) To assure an adequate and continuous flow of financial resources for all industrial activities.

All these objectives have a set of related indexes and ratios which make it possible to set specific goals and to measure progress. In an effort to achieve the above-mentioned objectives, a three-pronged course of action was decided upon:

- (a) Operation "F", directed at improving the effectiveness and productivity of private industry.
- (b) Operation "Plus", directed at strengthening the peasant-operated forest industries and making them profitable and self-sufficient.
- (c) Operation "Delta", directed at transforming public forest industries into efficient tools of forest development

As a mechanism for agreement and joint action that will assist in the strategy implementation, a national task force, the Forest Industry Committee for Productivity and Quality Assurance, was integrated with all concerned federal agencies and industry associations in the first quarter of 1984. This task force is engaged in several activities:

- (a) The design and installation of an Integrated Financial Programme for Forestry Development.
- (b) The promotion of joint export programmes at international price and quality levels, for instance board and furniture manufacturers.
- (c) The installation of productivity centres for each type of industry designed to reduce waste and to utilize raw material residues.
- (d) The development of technology for logging and industrialization of tropical woods.
- (e) The promotion of supply agreements between landowners and industries.
- (f) Studies to reduce the cost of inputs, such as transport, glue, etc.

The Undersecretariat of Forestry has been engaged in several activities related to the development of industry which include:

- the application of policies relating to foreign trade, logging permits and the establishment of industries aimed at inducing the utilization of tropical woods and other non-traditional species;
- the channelling of international low-cost funds to peasants for the development of roads, plantations and financing of mechanical production means for logging operations;
- the promulgation of a new forestry law that will stimulate development actions and reduce the bureaucratic controls which affect the logistic process;
- the integration of a "package" of incentives, fiscal, financial, etc., designed to promote the development and effectiveness of forest industry;
- the promotion of joint ventures designed to establish small scale pulp mills appropriate to conditions prevailing in Mexico, for the purpose of reducing the large deficit of the trade balance of forest products.

## 6. A FINAL WORD ON STRATEGY FORMULATION

When a complex system, like forest industry, is not performing as desired, the first thing that comes to mind is how to improve it; in other words, how to correct those parts of the system that are not functioning properly. Under this approach the design of the system itself is fixed and is, therefore, not questioned. The experience of developing nations shows, however, that, when a complex system is not performing effectively, it is almost always necessary to redesign it. This is a very challenging and highly creative task, because it forces one to break with existing thinking patterns about how forest industry should operate and what its contribution to national goals should be. It seems that individuals tend to look more for improvements within the established conditions than to search for radical and permanent solutions to the main constraints. The need to redesign the forest industry system arises mainly from the fact that many of the environmental conditions prevailing when it was originally established have changed considerably. The type and physical properties of available roundwood, the length of economical supply radius, the pressure of ecological groups, the availability of substitute products of non-wood materials, the attitudes of peasants and landowners toward industry, the cost of money and the rate of inflation are some of the many conditions that have dramatically changed in emerging countries during the past decade. A new and more appropriate forest industry is needed if these nations are to narrow the gap with developed countries.



DEVELOPMENT OF A FIBREBOARD FACTORY  
AT ELBURGON, KENYA

by

F.M. Kamau\*

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## 1. INTRODUCTION

### 1.1 Timsales Limited

In July 1932, when the world was in the grip of a great economic depression, the East African Timber Cooperative Society was formed in Kenya by a small group of sawmillers who had decided to pool their resources to market their own timber. As they were also farmers, the idea no doubt sprang from the highly developed and successful cooperatives which marketed their farm and dairy produce. The organization gradually became known as "Timsales", which was its telegraphic address, and it determined prices, discounts, terms of trade and codes of practice. In this it was so successful that its price lists, grading rules and conditions of sale were adopted by the industry as a whole and by Government departments as the basis for their tender documents for supplies of timber.

Some years after Kenya achieved independence in 1963, the original form of the cooperative became inappropriate because major changes in ownership of farming land in the highlands gave rise to a large number of agricultural cooperatives, and the Government found it necessary to pass new legislation to control their operation.

Under this legislation limited liability companies could not be members of a cooperative and, as all Timsales' members were in this category, a drastic change of structure became imperative. Accordingly, in 1967 the entire undertaking, assets and liabilities were transferred to a subsidiary company, Timsales Sawmills Limited, which was then converted into a public company and renamed Timsales Limited. By that time Timsales had acquired six sawmills from members, four in the indigenous forest and two which had been built specifically for plantation softwood thinnings. In 1969 the purchase of Amalgamated Saw Mills added three more mills.

Realizing that the future of the industry lay in the softwood plantations rather than the indigenous forest, the Group disposed of some of those mills working solely on indigenous input, and converted others entirely to plantation wood. Meanwhile, in 1964 it had acquired a small shareholding in Sokoro Saw Mill Limited, which throughout its life had sawn only plantation wood.

More than fifty years after the founding of the original cooperative, the backbone of Timsales' business is still the production and sale of sawn timber. It has also developed a wide range of goods which cater for consumers of forest products. These include panels such as plywood, blockboard, hardboard, softboard, chipboard, prefabricated buildings, components ranging from timber shell roofs to doors and windows, mouldings and floorings of all kinds, industrial pallets, cable drums, and a great diversity of custom-made joinery and packaging products.

In addition to maintaining its position as the leading timber exporter, Timsales now operates ten yards in the major towns in Kenya, five of which are equipped with resawing and manufacturing facilities. Expansion plans are in progress in all areas of operation.

Timsales has no overseas affiliations, and its shares are quoted on the Nairobi Stock Exchange. At the time of writing, there are 643 shareholders and, of these, 509 are employees or retired employees of the Group, and almost all of them are Kenyans. The largest single shareholder is the Development Finance Company of Kenya Limited, a parastatal organization holding approximately 30 percent of the equity.

## 1.2 Sokoro Group

In 1941, when the bulk of the timber industry thought only in terms of the indigenous conifers podo and cedar, a retired forest officer started a small sawmill at Elburgon to convert exotic logs from plantations. He operated the mill in the name of his farm and for the next eleven years the mill survived solely on thinnings of the comparatively unknown cypress timber, which was marketed entirely through Timsales.

As the volume of raw material increased, and cypress timber gained acceptance in the local market, so the mill needed to expand, and in 1952 it was incorporated as a limited liability company called Sokoro Saw Mill Limited, named after the forest glade in which it was built.

In 1964 further major expansion became necessary as large areas of mature plantations of cypress became available for clear-felling. In addition to new sawing machinery, there was a great need for more power, as the existing diesel generator sets were inadequate, due both to ageing and the high altitude of the mill site, 2400 m above sea level. It was decided to contribute toward the cost of construction of 10 km of 3-phase mains electricity service line, and this proved to be a milestone in the development of both the company and the small railway station town of Elburgon, which was to become the main sawmilling centre in Kenya. At the time of this second expansion of Sokoro Saw Mill Limited, Timsales became a shareholder to the extent of 15 percent.

Two years later, in 1966, another major step was taken with the formation of Sokoro Plywood Limited, in which Timsales participated to the extent of 20 percent. Machinery was ordered and the building was started. Production commenced in 1967, making plywood for the manufacture of tea chests, to be used for the export of Kenya's increasing tea crop. It was a successful venture from the start, and paid a dividend after the first full year's operations, by which time it was working on a three-shift basis. In addition to its marketing function, Timsales had now become involved in the direction of policy of these two companies, and this involvement was to lead to a much greater level of integration at a later date.

## 2. PRELIMINARY INVESTIGATIONS

### 2.1 Fibreboard Feasibility Studies

Timsales and individual members of the cooperative had been interested in establishing a fibreboard factory for a long time. In 1955 samples of podo and cedar were sent to Sweden to be made into hardboard, and the samples proved satisfactory, but the project was considered over-productive and too capital-intensive to be implemented at that time. Another study was carried out by Timsales in 1963, which revealed that consumption of fibreboard had grown rapidly in all three East African Community territories - Kenya, Uganda and Tanzania. The technology had also developed to the point where a smaller unit had become economically viable, but was still considered too productive and costly for the market to support.

In 1970 a prefeasibility study was carried out by experts of the ECA/FAO Forest Industries Advisory Group (FIAG) on behalf of the Kenyan Government, which concluded that there had again been a substantial increase in the consumption of fibreboard and that a small fibreboard mill, manufacturing both softboard and hardboard at the rate of 20 t/d, was feasible for Kenya, with export opportunities to neighbouring countries.

In the same year the Tanzanian Government decided to erect a factory to produce hardboard only, with a nominal capacity of 50 t/d, to be sited at Arusha, close to the southern border of Kenya. During this period both the East African Community and the East African Common Market were functioning so that a part of Tanzania's production would have access to both Kenya and Uganda, and this was undoubtedly a factor in the selection of the site.

Meanwhile, Timsales continued with studies based on the FIAG report and concluded that the East African market could sustain the output of two mills. In 1972 a new company to develop a fibreboard project was formed, Kenya Fibreboards Limited, in which equity capital was to be held 60/40 by Timsales and the Industrial & Commercial Development Corporation Limited, with possible minor adjustment of this ratio to accommodate other interested investors, but always with the intention that the controlling interest be held by Timsales Limited.

Overseas Industrial Consultants of Vienna, whose partners had been involved in the planning, installation and initial operation of a fibreboard plant in Madagascar, completed in 1970, were appointed technical consultants to KFL.

## 2.2 Location of the Factory

Three possible sites for the KFL factory were considered:

- Rongai, because of reliable water supply from the Molo River, but finally rejected on the grounds of distance and a poor access road from the forest, 15 km away.
- Njoro, attached to the Njoro sawmill of Amalgamated Sawmills Limited, because of proximity to the forest, 5 km, but finally rejected because of the unreliable water supply from the Njoro River and poor record of boreholes in the area.
- Elburgon, attached to the Sokoro companies, because of proximity to the forest, 5 km, and good record of water supplies from boreholes. In addition to these, the site also offered good communications by both road and rail, good telephone and postal services, proximity to the township of Elburgon, with social amenities such as shops, schools, churches, police station, medical services, and a Government administrative centre, including the Divisional Forest Office.

The overriding attraction offered by integration with the two Sokoro companies, comprising the sawmill and the plywood factory, was the deciding factor. Between them they offered common services such as logging, managerial expertise in the establishment of the plywood factory, availability of workshop facilities and staff, a good pool of housed workers experienced in forest industries, and existing accounting and secretarial services. In addition there was available on nearby farms housing suitable for those expatriates needed for the establishment and management of the project and boarding-school facilities for expatriate children only 8 km away at Turi.

## 2.3 Raw Materials

Studies carried out had shown that eucalyptus made an excellent board, much stronger than the standard hardboard traditionally imported into East Africa from Europe. It was learned that eucalyptus was being

used successfully in Madagascar and that it was also used to make Masonite, a brand of hardboard that was extremely popular in East Africa. It was assumed that Kenya plantation softwood could be mixed with eucalyptus to produce a satisfactory board, so that waste material from both the sawmill and the plywood factory could be used in the manufacturing process.

At the turn of the century, the Forest Department had become concerned with the need to safeguard wood fuel supplies for the Uganda Railways locomotives, which had then reached Nairobi. The planting of eucalyptus for this purpose soon followed and, after various trials, E. saligna and E. globulus were selected, with the former taking up the greater area planted.

In the early fifties wood fuel was abandoned by the railways in favour of the cheaper and more conveniently stored oil fuel, and for this purpose all the locomotives were converted to oil burning. Thereafter, the only outlets for eucalyptus plantations were telephone and power poles, minor industrial fuel and charcoal for domestic purposes.

Attempts to use eucalyptus for sawnwood and veneer for plywood proved unsuccessful due to difficulties in conversion and the excessive splitting which took place. Nevertheless, Eucalyptus became popular with farmers, in the first instance for wind-breaks and later because of its excellence for fuel for pyrethrum dryers.

It was estimated that the annual round-log needs for the fibreboard factory would be:

Fuelwood	4 000 m <sup>3</sup>
Fibre production	2 800 m <sup>3</sup>
	<hr/>
	6 800 m <sup>3</sup>

It was known that Elburgon forest district contained about 1 000 ha of mature eucalyptus plantations, the majority of this being E. saligna and E. globulus.

It was calculated that these plantations would yield sufficient raw materials for the factory to operate for the first sixteen years, thereafter utilizing material from the natural regeneration which, together with its fast rate of growth, is such an attractive feature of these species. The Forest Department welcomed the new project and guaranteed a sustained supply of the volumes needed, initially priced at the ruling fuelwood rate, with provision for review after the first seven years of operation.

### 3. SOKORO FIBREBOARDS LIMITED

Having decided upon the site for the factory, the company was renamed Sokoro Fibreboards Limited. Meanwhile other potential investors were approached and, after prolonged negotiations with the promoter, Timsales Limited, shares were taken up by:

Timsales Limited	51.5%
I.C.D.C.	34.2%
SIFIDA <sup>1/</sup>	8.6%
D.F.C.K. <sup>1/</sup>	5.7%

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<sup>1/</sup> SIFIDA = Sifida Investment Company of Luxemburg  
D.F.C.K.= Development Finance Company of Kenya

D.F.C.K. was no stranger to the Sokoro companies, having participated in the development of both the sawmill and the plywood factory by way of both loan and share capital. SIFIDA, a consortium of West European banks based in Switzerland, was to lend US\$ 560 000 with which to purchase the machinery to be imported. In addition, a loan of Kenya £ 200 000 was arranged with Barclays Bank, with whom Timsales had been banking for more than forty years.

The estimated total cost for the factory, including buildings, plant and machinery, boreholes, vehicles and logging equipment, was Kenya £ 800 000, of which 55 percent was for fibreboard machinery and steam generation plant. The estimates proved remarkably accurate and the final cost was in fact K£ 824 135.

### 3.1 Machinery and Buildings

Quotations for the provision and installation of all machinery were obtained from four sources, three of which were manufacturers, and one, Overseas Industrial Consulting (O.I.C.), consultants. Earlier, visits had been made to Madagascar and Ethiopia, in both of which small scale hardboard plants were operating, based on forming by the original deckle-box system, to which a pre-press had been added. From these visits it had been concluded that this batch-forming system is the key to small scale fibreboard production. The modern method of continuous fibre-mat production on a wet-lap or Fourdrinier type forming machine was considered unsuitable, because its high cost and productivity were far beyond the level which the East African market could sustain.

The O.I.C. process included chip digestion in a simple revolving pressure vessel, offering considerable reduction in power consumption and capital cost over the more conventional defibration equipment used in large scale factories and this, together with the batch forming presses, and the fact that no synthetic resins are used in the process were the deciding factors.

On the basis of cost and experience with small scale plants, the contract was awarded to O.I.C. Orders for machinery were placed late in 1972, and deliveries to the site began during 1973.

Building plans were drawn up by a local architect in consultation with O.I.C., and construction of the factory buildings was started in mid-1973 and completed in late 1974 by a Nairobi-based contractor.

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#### CURRENCY EQUIVALENT

Name of currency: Kenya Shilling (K.shs.)  
Kenya pound (K£) equivalent K.shs. 20.00

#### Currency Exchange Rate:

1973	US\$ 1.00	=	K.shs. 6.00
1974	US\$ 1.00	=	K.shs. 7.14
1980	US\$ 1.00	=	K.shs. 7.50
1982	US\$ 1.00	=	K.shs. 10.00
1984	US\$ 1.00	=	K.shs. 15.00
1984	US\$ 1.33	=	K£ 1.00

For the main production hall and warehouse the design included treated eucalyptus poles for columns, with timber trusses to carry the galvanized iron roof sheeting. This kept framing cost low, and had the added benefit of being corrosion resistant, this being of particular value in the area of the hot-press.

A chief engineer was engaged in time to supervise the completion of the factory building, the installation of the fibreboard machinery, the boiler and furnace, ancillary equipment, the drilling of boreholes, installation of pumps and the construction of butly-lined water-storage reservoirs. O.I.C. provided the full-time services of a partner and two fitters, one electrical and one mechanical. Machinery installation was completed in the first quarter of 1975, by which time the East African Power and Lighting Co., Limited, had completed its special transformer station in Elburgon town.

Production trials were started in April 1975 and continued for four months, during which time many variables were determined, such as cooking times for different species of wood, control of slurry consistency, and hot-press platen temperature and pressing times for various thicknesses. O.I.C.'s insistence that no resin additives were needed for hardboard production proved correct.

At the end of the trial period it became apparent that corrosion due to the acidity of the slurry was to be a major problem, and at this time the four pumps which transfer slurry from vat to vat, and from vat to preformer storage tanks, were found to be so badly corroded that they had to be replaced with new pumps made of stainless steel. The corrosion problem has never been fully overcome to this day, and there has been much replacement of corroded parts, with spare parts specially fabricated in stainless steel, incurring high costs and long delivery times. This has reached the point where parts must be ordered 18 months ahead, and stocks of parts and consumable stores held average in excess of K£ 100 000 at all times.

Experiments with alkaline salts to correct the pH of the slurry have proved that the chemicals cost more than the replacement of corroded parts. They also cause foaming of the slurry and discolouration, with the added disadvantage of weakening the board.

### 3.2 Wood Fuel

During the course of factory construction and machinery manufacture, the 1973 world oil crisis took place, and it was decided that steam generation for the factory would be based entirely on wood fuel with no stand-by oil-burning facility. E. saligna proved an excellent fuel for this purpose when dried and used in the specially designed furnace provided, and it has been possible to raise steam to 20 atmospheres throughout the life of the factory to date. Consumption of wood fuel has run at about 3000 m<sup>3</sup>/a, which is less than originally estimated.

The decision to turn away from imported fossil fuel and to rely solely on locally available wood fuel has contributed very largely to the viability of the project.

### 3.3 Wood-Fibre

Early production runs were based on 100 percent eucalyptus fibre and it was quickly discovered that E. globulus was more suitable than E. saligna for this purpose. Cautious experimental admixtures of pine and cypress sawmill waste were made, and thereafter for some years

satisfactory hardboard was made from a mixture comprising 50 percent E. globulus and 50 percent softwood waste.

However, falling availability and rising costs of transport led to greater utilization of sawmill waste, waste veneer and, lately, plywood peeler cores, to the point where the ratio is now 75 percent softwood waste and 25 percent E. globulus. This has been achieved without reducing the quality of the board and with the advantage of a lighter colour which is more acceptable to buyers than the earlier product.

The chipping of waste veneer was not successful until it was discovered that, when rolled into bundles, it is readily acceptable to the chipper. For this form of waste, cooking time had to be reduced because of the thin section of the chips produced, but it is now established as a suitable raw material.

It has been shown that acceptable board can be made entirely of softwood without the addition of synthetic resins.

#### 3.4 Machinery Maintenance

The equipment which has functioned well with normal maintenance throughout the life of the factory to date comprises:

- the bore hole pumps;
- the boiler, with separate wood furnace;
- the main chipper;
- the two digestors;
- the vat stirring equipment;
- the trim saws.

#### 3.5 Refiners

The greatest problem area has been with the original three refiners, which gave trouble from the start with the grinding segment edges crumbling, due to excessive hardness, overcome with the help of manufacturers by changing the segment design. Later, problems arose from the fact that the machines had been installed on a suspended concrete floor. This gave rise to excessive vibration, resulting in bearing damage to those machines which were standing idle. As they were not made of acid resistant metal, corrosion also took heavy toll of these machines, and extreme measures had to be taken, such as the lining of the casing internally with brazing. The usage of spare parts has been high throughout. A further problem has been that the electric motors, each 200 kW, have burnt out several times and had to be rewound locally. This is thought to have been due to the high percentage of dense heartwood in mature eucalyptus, causing overloading.

Finally, these three machines were replaced in 1983 with a raffinator made by Defibrator of Sweden, which to date has proved successful, in that it easily produces all the fibre needed, with lower consumption and much reduced maintenance cost.

#### 3.6 Preforming Presses

Another major trouble spot is that of the two preforming presses, which again have suffered excessively from corrosion. Also, the design is such that, after the mat of fibre has been formed, it is raised to the head of the machine and compressed, discharging a large volume of water onto the hydraulic lifting equipment below. On occasion, it has been necessary to change hydraulic seals every day, sometimes by use of raw leather washers made in the factory, while waiting for new seals to



arrive. The maintenance has now settled down to a major overhaul for each machine every six months, and numerous modifications have been made in the process of this work, some at the suggestion of the manufacturer, who visited the factory for that purpose.

### 3.7 Hot-Press

The hot-press has suffered similar problems to those of the preforming presses, with the added hazard that the juices expressed under great pressure and high temperature from the press platens are of much greater corrosive potency. After nine years of service on a three-shift basis, a recent examination has revealed that the press frames of 40 mm plate are corroded in places to a depth of 10 mm, so that the press is rapidly reaching the end of its economic life.

A new press is now on order, incorporating several design modifications, and it is interesting to note that the replacement cost of the hot-press after ten years in service will cost Kenya about one year's savings of foreign exchange on import substitution of hardboard.

### 3.8 Hydraulics

All three presses are linked to a common source of hydraulic pressure, so that minor seal or valve leaks result in frequent machine stoppages and loss of production.

### 3.9 Thermal Chamber

The thermal chamber was installed to produce tempered hardboard. It relied on absolute consistency of board thickness for the feed chain to function properly and, as this consistency has never been achieved, so the machine has never operated successfully and it has been dismantled and removed from the factory.

### 3.10 Production Capacity

The outcome of the machinery problems listed above is reflected in the production achieved over the life of the factory to date, which has averaged 10 t/d. The theoretical production capacity was said to be 24 t/d, with an anticipated practical production of 20 t/d. The best ever achieved was 17 t in one day, under intensive supervision when the machinery was new.

### 3.11 Effluent Disposal

As no chemical additives are employed in the process, waste water from the factory is not offensive. The original disposal system, which is still in use, comprises a very large soak-pit at a site about 600 m distant from the factory and well above it in height.

Over a period of time this became clogged with fibre, and a new series of shallow oxidization and evaporation pits was dug, so as to permit cleaning of the original system. Effluent is pumped from the factory to the original soak-pit, and then flows by gravity to the shallow pits, which in turn are extended by a maze of several hundred metres of soak-away trenches.

This system works satisfactorily, except in years of above-average rainfall. In order not to become detrimental to the surrounding ecology, in such years a way had to be found to balance the discharge from the factory, with the varying absorption and evaporation capacities of the pits.

Inevitably this has led to the adoption of a partially closed system within the factory, whereby white water is recycled many times. Although reducing overall water consumption, the closed system creates a production problem in that the "fines", formerly discharged with the effluent, build up in the recycled water to the point where they cause a reduction in average fibre length. This in turn results in the production of weak or broken boards, particularly at the corners. This is caused by the fact that the seal surrounding the deckle-box table wears most at the corners so that, when vacuum is applied, water and fines are drawn faster to the corners than to the remaining major area of the mat.

### 3.12 Engineering Capacity

In addition to normal maintenance, the extraordinary problems encountered have made it necessary to improve engineering facilities. In addition to normal repair work, the workshop is now capable of manufacturing auxiliary equipment such as hydraulic log-splitters, board trimming machines, waste extraction fans and specialized spare parts in stainless steel. This facility also benefits both the sawmill and the plywood factory, in that skilled engineering service is available to them on site.

### 3.13 Work-Force

Since completion of the factory, there have at no time been more than two expatriates in full-time employment. The post of chief engineer is at present held by an expatriate, but that of electrician, which was held for three years by an expatriate, has since been taken up by a Kenyan.

The production and maintenance managers are both Kenyans, and the total work-force for three-shift operation has remained steady at 225 for several years. These men comprise shift supervisors, machinery operators, boilermen and labourers, with a maintenance fitter and storeman for each shift. The figure includes office staff, warehouse and stores clerks, watchmen, drivers and engineering workshop staff. Apart from the top six posts, which are recruited nation-wide, all other employees are engaged locally.

The transfer of technology has been made by on-the-job training, with extensive upgrading of untrained artisans, and at all times there are not less than four indentured engineering artisan trainees on courses at polytechnics, working for practical experience at the factory in between formal training terms.

There is indirect employment of between 50 to 60 workers, engaged by log and road transport contractors.

### 3.14 Industrial Relations

The management and supervisory staff are on contract terms, but all other workers are unionizable, and their terms of service and wages are negotiated collectively with the Kenya Timber and Furniture Workers Union, which falls under the Central Organization of Trade Unions. The Timber Industries' Employers Association, affiliated to the Federation of Kenya Employers, acts for the industry via a Joint Negotiating Committee. Agreements or disputes are processed through the Ministry of Labour and final settlement is made at the Industrial Court. This whole system is well organized and has worked satisfactorily for many years.

### 3.15 The Product

The original intention was to produce hardboard, medium density board and softboard (insulation board). In fact the production of both medium density and softboard proved impracticable for two reasons: spacer bars have to be introduced into the hot-press to ensure consistent thickness, entailing unproductive down time, and moisture reduction to a satisfactory level takes four times as long as for hardboard, reducing output to an uneconomic level. Thus hardboard is the sole product. The standard size is 8 ft by 4 ft (2.44 m x 1.22 m) and the bulk of production is in 3 mm thickness. Other thicknesses up to 12 mm are also produced and two special products in regular demand are: 2.4 mm thickness for the vehicle assembly industry, used for car and truck door and roof linings; 6 mm hardboard, faced with thick white paper, as a substitute for imported softboard.

### 3.16 Marketing

Throughout the life of the factory all production has been marketed by Timsales, both through its own network of ten depots and in wholesale quantities to merchants all over the country who trade in building materials. In the early stages, when the percentage of undergrade boards was very high and the colour very dark, those merchants who had traditionally imported hardboard from overseas built up large stocks in anticipation of resistance by their customers to the local product, so that penetration was very difficult.

Arising out of a shortage of foreign currency, the Government increased the import duty so as to discourage importation of goods which could be manufactured locally, and gradually stocks of imported material were depleted.

The coffee and tea boom in 1977/78 put extra cash into the hands of many small scale growers, and this brought about greatly increased spending on home building and improvement. In general houses are of the timber frame type, with external cladding of sawn square-edged off-cuts with the bark left on them, and hardboard is used extensively inside such buildings for ceilings and internal wall linings. This market is now well established and continues to grow with the rising population, despite some degree of competition from the lower grades of plywood.

The growth of the prefabricated building industry has widened the use of hardboard, as has its acceptance for office partitioning. It has also proved popular with furniture makers for cupboard backs and drawer bottoms. Exports to neighbouring countries are slowly gaining ground.

## 4. BENEFITS

### 4.1 Socio-Economic Benefits

The most significant factor in the development of Elburgon into the largest forest industrial centre in Kenya is undoubtedly the availability of mains electricity, brought about by the expansion of Sokoro Saw Mill in 1964. The joint attractions of ample forest and electricity resulted in the establishment of another eleven sawmills in or near the town. This was followed by the building of Sokoro Plywood Limited in 1967, which offered more job opportunities, further expanded as it came to three-shift operation. Another major step was taken with the establishment of the fibreboard mill in 1975, again enhanced by three-shift operation. All this development brought job seekers into the

area, and these were followed by traders who established improved shopping facilities and service industries such as garages, petrol stations, furniture and metal workshops. Landowners built shops and houses for rent.

Churches and schools developed, and the increased population attracted medical practitioners. The existing piped water-supply was extended and the mains electricity system was expanded to meet the greatly increased demand.

The supply of eucalyptus needed by SFL created a new source of cash income for local farmers who had trees to sell, and they found that this work could be fitted into the annual programme between crops, using farm tractors and trailers to carry logs to the factory.

Both road and rail transport have benefitted greatly from the increased volumes of forest products to be carried to major towns.

Essentially Elburgon has been converted from a small agricultural produce buying centre into an industrial centre with regular cash income throughout the year, stable employment for a large number of people, with a general improvement in their standard of living.

#### 4.2 Contributions to Government Policies and Revenues

By building the factory in a rural environment, creating a large number of job opportunities and utilizing local raw material directly owned by the Central Government, the Group has complied precisely with the stated policy of prevention of drift of population to the major towns. The Sokoro Group of Companies - SSML, SFL, and SPLY, - have as a matter of policy favoured simple labour-intensive operational methods as opposed to automation. This is borne out by the fact that the Group employs about 800 workers who between them produce each month:

1 000 m<sup>3</sup> sawnwood  
300 m<sup>3</sup> plywood  
250 t hardboard

In addition, the contribution to Government revenues is very significant, including:

Corporation tax at 45 percent  
Sales tax at 17 percent  
Personal Income Tax by P.A.Y.E.  
Trading and vehicle licences  
Land rents and rates  
Training levy  
Stumpage payment to Forest Department  
Dividends to parastatal finance companies  
Foreign currency saving by complete substitution of hardboard imports, plus minor exports

In return the Sokoro Group of Companies has the benefit of the protection afforded by the increase of import duty from 30 to 40 percent, which has discouraged dumping by other producing countries. Grants of land for the factory and workers' housing have been readily made, and the original guarantee of log supply has been fulfilled. Allocations of foreign exchange for spare parts and new machinery have been made, even in times of severe stringency. Tax relief was granted by an investment allowance, and work permits for expatriates have been allowed. Generally, the Sokoro complex has been given the support of both central and local Government authorities.

## 5. CONCLUSION

The project has been successful and has paid dividends to its shareholders for the last six years. It has also repaid its initial loans, with interest, both to Barclays Bank and to SIFIDA without default. The SIFIDA loan was made in U.S. dollars, which at the time of receipt in 1974 were bought for six Kenyan shillings each. As a result of successive devaluations of the Kenyan shilling, for the final repayment at 31 December 1984, the dollar will cost fifteen Kenyan shillings, and this applies to both capital and interest. This has increased the total investment in the project by K£ 105 000 without addition to assets. As exchange losses are not allowed for tax purposes, a further cost of 45 percent of that sum must be included. The major reasons for this success are:

The acquisition of SSML and SPLY, forming an integrated unit of log utilization. In the early years of hardboard production and market penetration, heavy losses were made. These were offset by profits from timber and plywood and, had this not been so, a massive injection of fresh working capital would have been necessary to keep SFL alive.

The decision to rely solely upon local wood fuel has shielded the factory from the enormous escalation in the price of imported oil and kept production cost down.

The acceptance of O.I.C.'s basic concept of production machinery, some items of which would be considered obsolete in design in developed countries, has proved appropriate, in that production has met the country's needs at a capital cost which the company's promoters were prepared to risk.

Failure to achieve the initial production target and the maintenance problems encountered have been minimized by constant feedback both to and from the original consultants, O.I.C., who have paid visits to the factory each year.

Timsales having taken on the burden of marketing, debt collection and the procurement of spares and equipment, both locally and overseas, the factory management has been released to concentrate on the solution of production and maintenance problems.

## 6. THE FUTURE

Future plans must include expansion of hardboard production as demand increases in Kenya with the fast-rising population. Another major market is for insulation board (softboard), which is currently imported and remains a popular ceiling material in all classes of housing. Although less capital intensive in that no hot-press is required, technology of a higher standard is needed because certain additives, such as waste paper, starch and synthetic resin, are necessary, together with a higher quality of refined fibre. These factors are being investigated in order to formulate an expansion plan in this field.

THE NIGERIAN-ROMANIAN WOOD INDUSTRIES (NIROWI)  
DEGREE OF APPROPRIATENESS

Based on work of

G.O. Igugu\*

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\* Federal Department of Forestry, Lagos, Nigeria.

## 1. INTRODUCTION

The establishment of the integrated forest industry complex of Nigerian-Romanian Wood Industries (NIROWI) was based on findings outlined in feasibility studies carried out in 1973. The complex, to be located at Ondo in Ondo State, would produce sawnwood, plywood, sliced veneer, blockboard, furniture, crates, pallets and particle board. Raw material would be extracted from the company's forest concession areas in Ondo State, which is the third largest timber-producing area of Nigeria with an estimated<sup>1/</sup> resource of 26 million m<sup>3</sup> of available timber. The original intention was to utilize and process most of the abundant secondary species from the concession areas.

The company is jointly owned by:

-	The Federal Government of Nigeria	25	% share
-	The Odua Investment Co. Ltd.	30	% share
-	FOREXIM of Romania	30	% share
-	Nigerian Industrial Development Bank (NIDB)	3.7	% share
-	Nigerian Bank for Commerce and Industry (NBCI)	3.5	% share
-	17 local government councils in Ondo State	7.8	% share
		100.0	%

The Odua Investment Co. is jointly owned by Ondo, Ogun and Oyo States.

Ondo State has a population of approximately 4 million, is located at about 300 km from Lagos. It shares a common border with Bendel State, which has the largest forest industry complex and also the only two particle board mills operating in Nigeria.

The positive findings of the feasibility studies and the agreements which resulted in the establishment of NIROWI were based on the assumption that as much as 45 percent of the sawnwood and 70 percent of the plywood and veneer to be produced would be destined for export markets. In order to protect the interests of the approximately 270 sawmills operating in Ondo State, it was decided, as a matter of policy, that sawnwood produced by NIROWI would initially not be marketed in Ondo State.

The initial capital investment was ₦ 23 million, equivalent to about US\$ 30 million. The delays in completing the installation of the production lines - except the sawmill - have, however, escalated the investment costs, due to inflation, to an estimated ₦ 30 million, approximately US\$ 39 million.

The sawmill and the furniture line commenced production in 1978, the plymill in 1979. The particle board mill is expected to be commissioned in 1985.

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<sup>1/</sup> Project NIR/71/546 - High Forest Development Nigeria. FAO Technical Report. No. 1 (1979).

## 2. STRUCTURE OF THE NIGERIAN WOOD-BASED INDUSTRIES

An FAO study<sup>1/</sup> of the forest industries in Nigeria indicated the existence in 1981 of 1098 registered sawmills. It was estimated in 1984 that this number had increased to 1300. Most of these sawmills are only small to medium sized and largely unintegrated. Nigeria also has 6 plywood mills and 2 particle board mills, of which the latter commenced production in 1978 and 1980 respectively.

Ondo State, with 25 percent of the country's sawmills, had no large forest industry complexes until the establishment of NIROWI. The largest mills, African Timber and Plywood (AT & P), Piedmont and Epe Ply, are located in neighbouring Bendel and Ogun States. AT & P, the largest timber company in Nigeria, also has timber concessions in Ondo State. There is no fibreboard mill in Nigeria, although there is potential for its production. There are hundreds of furniture making establishments, most of them unintegrated operating with very little equipment, though manufacturing fairly good quality products.

A number of mills and furniture makers produce flush-doors, but the demand for flush-doors and plywood, used for the production of flush-doors, cannot be met by local production and has had to be supplemented by imports which, in many cases, were of inferior quality.

## 3. RAW MATERIALS

The Federal Ministry of Commerce and Industries is responsible for the control of industrial development in the country although the provision of wood resources is the responsibility of the individual State Forest Services who are usually assisted by the Federal Government.

Ondo State is endowed with rich forests containing about 26 million m<sup>3</sup> of utilizable timber. The forest concession in the Oluwa Forest Reserve granted to NIROWI for initial commencement in 1977 consisted, however, primarily of Brachystegia spp. (40%), Nauclea diderrichii or opepe (10%), Terminalia superba or afara (6%), Khaya ivorensis or mahogany (3-4%), Bombax spp. (6-10%), Lophira alata or ekkí (5-6%) and Cordia alliodora (2%). Chlorophora excelsa or iroko represented only 1-2 percent. Entandrophragma cylindricum or sapele and Afrormosia elata were almost non-existent, having been creamed off in the past.

Logging equipment, principally vehicles, was of Romanian origin.

## 4. INDUSTRIAL COMPLEX

The industrial complex consists of the following units:

1. Sawmill with two production lines each containing a frame saw, a wide band-saw and a resaw bench.
2. Plymill with a production line for plywood. Blockboard is also manufactured in this unit. Included in the plant are two veneer slicers for the production of decorative veneers.

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<sup>1/</sup> The Sawmilling Industry in Nigeria. FAO, 1983, Field Doc. No. 17.



3. Furniture plant, which consists of two production lines; one furniture line in which general office, school and household furniture and door-frames are produced; one line for the manufacture of flush-doors. The furniture plant is also capable of producing crates and pallets.
4. Power plant which, through utilization of wood residues from the various production units, supplies 80 percent of the power consumed by the industrial complex. The remaining 20 percent is obtained from the public supply. NIROWI does not provide electric power for domestic consumption.

## 5. MANPOWER AND MANAGEMENT

At present the company employs approximately 1000 people, who are distributed as follows:

(a) Forest operations		80	
(b) Industrial operations			
- Sawmill	100		
- Plymill	350		
- Furniture	160		
- Others	310	<u>920</u>	
Total (a) and (b)			1 000

Skilled and semi-skilled workers were recruited from local and neighbouring sources.

The company is managed by a Board of Directors consisting of ten directors, seven of which are Nigerians and three Romanians. The managing director, the technical management director and key technical management personnel are appointed by FOREXIM under a technical management agreement signed in 1976 by NIROWI and FOREXIM. There are about twenty Nigerians employed in the senior cadre of the company.

Another fifteen Romanians are employed in the establishment, responsible for installations and maintenance of equipment and machines, as well as training of indigenous staff.

All staff live in Ondo township, about one km away from the factory site.

## 6. TRAINING FACILITIES

The company operates a training school for its technicians to teach them machine operations, maintenance and sawdoctoring. Training is, however, mostly on-the-job. Five Nigerian engineers have so far been trained in Romania by the company.

## 7. OPERATING STRATEGIES: PROBLEMS AND SOLUTIONS

### 7.1 Raw Materials

The initial problem of poor species composition, mentioned earlier, has been virtually overcome by the granting in 1979 of a new

concession in the Idanre Forest Reserve where the primary species are more abundant. The predominant species is black afara.

The company's concession covers 600 km<sup>2</sup> divided into four felling blocks each of a 10-year felling cycle. The problem now is that logged-over areas are not given sufficient chance to regenerate before reallocation by the State Government. In addition, there is large scale illegal felling in the concessions.

In spite of this new concession, there is serious doubt that the available redwoods will last for more than the next five years. The best mahogany, principally Khaya ivorensis, is being retained for peeling into veneers although the limited local market for face veneers has reduced the level of veneer production to about 25 percent of installed capacity.

The preponderance of medium-high density species in the forests of Ondo requires investigation into the utilization of these species for such products as railway sleepers, beams and columns for factories and workshops which at present are mainly manufactured from steel.

Even though there is no research unit, the desire to put more species into use is yielding results: more secondary species are being peeled for core veneers, and at least fifteen species are being sawn or peeled on a regular basis. The company utilizes twenty-two out of the fifty-six tree species available in its forests. Difficulties with the use of Brachystegia spp. have not been overcome but investigations are being made to improve its peeling qualities in order to make the veneer suitable as core material for plywood production. There are bright prospects for the use of Mansonia altissima for veneer and furniture making.

Since the extent of the future log supply from the natural forests is not too clear at present, NIROWI has had to begin looking for raw materials from old Gmelina plantations. The two production lines of frame saws would be used for the conversion of small size Gmelina logs. The extent to which the company is prepared to adjust production will depend on the response of management to the changing conditions.

Because of a shortage of logs - input is only 50 percent of the originally planned quantities - the sawmill operates at 40-50 percent of its installed capacity and the plymill at 80 percent. Fifty percent of the log input goes to the sawmill and the other half to the plymill.

An even more serious constraint in plywood production is an inadequate supply of adhesives. The importation of adhesive has been adversely affected by the general import restrictions imposed early in 1984. The company produces its own plywood door-skins, for which large quantities of adhesive and peelable logs are needed.

The major imports of the company are urea-based glue (Aerolite) from the U.K. and Cascamite from the Fed. Rep. of Germany.

Bulk purchases are made to cover requirements for at least two years but there are problems with import licences and banker's guarantees for letters of credit. This situation has delayed importation of spare parts and equipment since 1979. The company has, however, benefitted from the general import restrictions because it is still cheaper for NIROWI to import raw materials than to purchase them locally. The import restrictions are chiefly responsible for the astronomical rise in costs for all raw materials, which now range between 100 and 400 percent over their 1983 levels.

Glue manufactured in Nigeria from the bark of mangrove by AT & P has not been commercialized as yet.

## 7.2 Logging Operations

Logging trucks were of Romanian origin. In Nigeria there is a long-standing tradition of timber harvesting. Logging vehicles and spare parts should ordinarily have been available without too many difficulties from the major traditional importers/dealers which, however, do not carry this Romanian line. Spares for these Romanian trucks were, therefore, difficult to procure.

The import restrictions and the difficulties surrounding import licences and banker's guarantees necessitated the retention of many Romanians to cope with the increased maintenance and the manufacture of spare parts. The company is of the view that the presence of the Romanians, mentioned under (4) above, has enhanced operations particularly of maintenance, which would have been impossible in the face of spare parts scarcity in the country.

## 7.3 Sawmill

There was obviously too much emphasis on sawnwood production for its own sake and too much reliance on expectations from sawnwood exports. The ban on the export of sawnwood in 1976 literally dealt a severe blow to the earnings of the company. In the absence of income from sawnwood, large stocks of unsold sawnwood were utilized for furniture production. About 3 750 m<sup>3</sup> of sawnwood is consumed annually in the furniture production unit. An equal amount is sold as boards in various sizes. With the recent increase in orders for school furniture, in addition to demands for framing of flush-doors, the unsold sawnwood stock has diminished significantly from 17 000 m<sup>3</sup> in 1979 to less than 2 000 m<sup>3</sup> in November 1984.

## 7.4 Plymill

The plywood production line is hampered mainly by a shortage of adhesives and of peelable materials. The steaming pits are lying idle and most of the time the huge log yard is not even half filled with logs. The short supply of mahogany species has a limiting effect on the production of furniture grade plywood. NIROWI has large stocks of unsold sliced face veneer which the company would be eager to export, even though Nigeria imports large quantities of face veneers. It, therefore, appears reasonable to suggest that NIROWI would be better off diverting some of the unused and unsold face veneers for door-skins production as there is a demand for flush-doors faced with decorative veneers. Of two installed Cremona slicers only one is producing at below 30 percent capacity, although there is a large surplus of decorative veneers. This stock pile of sliced veneers is a result of the accumulation of narrow sheets in excess of what the company requires for plywood facing and for which there is very little demand. Narrow veneer sheets require more splicing work and most other medium scale plywood producers are not equipped or are not willing to incur the additional costs of splicing.

The company uses all the door-skins, which it produces in 4 mm plywood, for the manufacture of flush-doors in its furniture plant.

There is a large demand for plywood and for door-skins in the country. Shortage of door-skins and glue has been the major limiting factor in plywood and flush-door production in Nigeria as a whole.

## 7.5 Furniture Plant

As much as 50 percent of the sawnwood produced is utilized in the production of furniture, the major part of which is consumed in the school furniture, panel door and flush-door production lines. There is evidence of over-emphasis on the use of solid wood for furniture which, therefore, limits the range of designs for household furniture. This is perhaps one way the company is attempting to reduce its stock of sawnwood.

Although the importation of wooden furniture has been prohibited, large scale importation of metal-framed furniture has replaced imports of wooden furniture. Crates are no longer in demand because of substitutes (plastic crates), and pallets are produced by the numerous small scale entrepreneurs. The main emphasis now is on flush-door and school furniture production in response to the increased demand. There is very little demand for household furniture, but the company is currently benefitting from State Government patronage in the supply of school furniture, a situation which has completely reversed the misfortunes of the company in the last year.

## 7.6 Particle Board Plant

The installation of the particle board mill is planned for 1985, and the company is satisfied that the residues generated by the other production units, supplemented by residues from the forests, will provide sufficient raw materials. The delay in the particle board mill installation has mainly been due to the poor financial position of the company. The demand for particle board has grown tremendously in the last few years as a substitute for plywood and because its application methods have improved through the use of appropriate fittings. Furniture fittings are imported.

## 7.7 Sales

The establishment of NIROWI was based on the assumption that 45 percent of the sawnwood and 70 percent of the veneer products to be manufactured would be destined for export markets. Sawnwood produced by NIROWI would initially not be marketed in Ondo State so as to protect the interests of the approximately 270 sawmills operating in the State. In the face of the total ban on sales of sawnwood by the company in Ondo State, there were difficulties in the sale of sawnwood in the early stages of the company. This was further aggravated by the ban on exports of sawnwood in 1976, when adjustments in management and financial decisions should have been made rather more quickly. The position has improved and sawnwood produced by NIROWI is now freely sold in Ondo State as well. There has also been a change in emphasis on production. The company has also been favoured by increased patronage from the Government in the supply of school furniture. Sales figures for 1984 indicate that flush-doors and school furniture each constitute 42 percent of sales and household furniture only 16 percent.

The absence of an effective sales department and aggressive sales promotion activities had led to poor turnovers. However, in the last two years there has been a remarkably increased awareness of the existence of the company but the positive effects have been drowned by the current economic recession.

Faced with an increasing number of competitors, NIROWI cannot afford to relent in its efforts to step up sales promotion, product development and production adjustment.

Blockboard is produced by a few plymills, including NIROWI, but local demand is very limited. Its potential for use in flush-door manufacture and formwork has not been fully explored.

Initially there were difficulties with the quality of finished products, especially furniture, but these have been overcome through the training of operators and their acquired experience.

It is of utmost importance that new products such as moulded panelling strips, ceiling strips, decorative door and window frames and shutters are included at an early date in the list of products utilizing solid wood.

## 8. RELEVANCE OF NIROWI AS A WOOD-BASED INDUSTRY

### 8.1 General Comments

The appropriateness of NIROWI can be viewed from two perspectives; first from the Nigerian situation and, secondly, from a point of view of the people of Ondo State with regard to the overall contribution it has made or is making to the development of the economy.

NIROWI is the first large scale integrated woodworking complex established in Ondo State. Its existence is in fulfilment of the aspirations of the people to be self-sufficient in manufactured wood products and to effect a full utilization of their forests.

Veneer production simply for meeting export demands, though desirable, does not appear justifiable in a situation where Nigeria imports some 6 000 m<sup>3</sup> of veneer annually. The reasoning is that the desire to satisfy export demands would encourage increased consumption of mahogany logs and those of other first class species. These species are already in short supply for normal plywood manufacture and sawnwood production.

### 8.2 Institutional Arrangement

Participation of Government and local government in NIROWI was seen by observers and economic analysts as the bane in the development of the company in the sense that it was regarded as yet another semi-governmental enterprise which usually requires protection in the early years and which is often over-protected. There are merits and demerits. Firstly, it was advantageous that the social and political interests of the local communities were sustained by the presence of Federal and State governments in the project. Secondly, financial constraints would have crippled the company in the early years of operation if the Government had not participated. Operating losses up to 1980 were quoted as N 3.8 million,<sup>1/</sup> or approximately US\$ 5 million.

The demerit referred to above concerns the influences of mixed participation and multiplicity of interests and objectives. In NIROWI this weakness was promptly eliminated before it could become a serious problem.

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<sup>1/</sup> Forestry subsector review by the World Bank, Federal Department of Forestry. 1983.

### 8.3 Economic and Social Benefits

The establishment of NIROWI has been an economic and social boon to the people of Ondo State in particular and to Nigerians in general. It has brought employment to the rural and urban population and it has improved their economic status as well. The state is benefitting from the sale of wood products through appointed agents or distributors. The company pays forest charges and regeneration fees to the State Government, amounting to about ₦ 70 000 per km<sup>2</sup> of concession. It also pays excise duties. There is evidence of its contribution to the development of skills in woodworking in the State, judging by the improvement in quality of furniture produced by the company's artisans. As many as 1000 workers are in regular employment and are enjoying improved standards of living as well as social security. Smaller and younger firms look up to NIROWI for leadership and technical support which it sometimes renders.

At the national level, however, NIROWI's development has not been without difficulties in the political, technological, economic and administrative areas. Although NIROWI is not a major forest industry - there are other more technically advanced forest industries in Nigeria - its decisions on which products to manufacture, which technologies to use and which marketing skills to employ, is influenced by a complex mixture of objectives of the Federal and State Governments, 17 local government councils, as well as the banks which have pooled resources for the investment. Each unit is an interested party and has its own objectives. Happily however, economic considerations now outweigh political aspirations and it is this change which has reversed the misfortunes of the company.

The economic problems will be partially solved if the original objectives such as exportation of sawnwood and veneers can be changed for improved domestic production of plywood and other panels, e.g. particle board.

### 8.4 Potential Contribution to National Income

NIROWI at the moment earns no foreign exchange as it does not yet export its products, but it saves foreign exchange through import substitution, the amount of which is offset by the value of imported glues and spare parts. Export of decorative veneer is feasible but it is not likely to meet acceptance for some time. The domestic demand for wood-based panels, principally plywood, is so enormous that an export-oriented policy is not justifiable. Export of furniture, especially at a time of economic recession, would greatly supplement the company's earnings. This cannot, however, be considered until the quality has improved and the production costs have been reduced to such a level as to make the furniture competitive on overseas markets. At the moment the cost of household furniture is so high that only the top segment of society can afford it. This is, however, the general trend in the furniture industry where the cost of raw materials, principally imported fabrics and glues, constitutes as much as 50-70 percent of the cost of production.

## 9. MECHANIZATION POLICY

One of the aspirations of Government involvement is the provision of employment for its people. NIROWI has not automated production and does not intend to do so in the near future, in view of its obligation to retain its workers until they become uneconomic to

maintain. The current level of mechanization, therefore, appears appropriate for the socio-economic needs of the people and perhaps also for the present level of development of the company.

#### 10. CONCLUSIONS AND RECOMMENDATIONS

The question whether NIROWI has been an appropriate forest industry or not cannot be answered with a simple yes or no. It has been observed that the objectives of the industrial complex, intended to put available forest resources to optimum use, are gradually being achieved. As an economic venture the establishment has had little to show in the form of economic returns until recently, resulting from changes in management and political decisions.

With respect to the transfer of technology, little new has been learnt at the national level but perhaps the local population has accomplished a great deal as far as the improvement of indigenous skills is concerned. From the point of view of the Forestry Department, the company has not completely accomplished its expectations in terms of complete forest utilization and product development. The company has also not met its objective of developing export products. But the future of NIROWI will be determined by the degree of flexibility it is showing or will show in adapting its operations to meet the changing Nigerian market and in developing substitutes for simple but imported raw materials such as splicing threads for splicing veneers, fittings and perhaps glues.

The following recommendations may enhance NIROWI's operations and create a healthier economic environment for the company:

- (a) Improved Government control of forest allocation so as to eliminate unlicensed sawmillers and licencees without resources.
- (b) Assisting the Government of Ondo State in policing NIROWI's forest concession in order to reduce large scale illegal felling.
- (c) Improvement in the forestry department of the company through an adequate staffing and motivation to achieve more effective forest operations and forest regeneration.
- (d) Intensification of research on finding uses for the thirty-four species available in its forest concession, which are not being used at the moment.
- (e) Urgent completion of the installation of the particle board mill and increased utilization of wood residues as well as the numerous secondary species for the production of particle board and the generation of power.
- (f) Changes in operational policies with respect to the intensification of production of door-skins and plywood for the domestic market and possibly for export.
- (g) Improved furniture designs and the incorporation of the manufacture of low-cost furniture for the lower income groups, in addition to the school furniture, currently being produced.

- (h) Improvements in the training school to include training in the manufacture of spare parts as well as routine courses in sawdoctoring and maintenance, in which indigenous supervisors should participate.
- (i) A more efficient sales promotion aimed at securing additional Government patronage.
- (j) A change in Government policy with regard to the export of veneers.



DEVELOPMENT IMPACT OF AN INTEGRATED  
FOREST INDUSTRY IN CHILE

by

Hernán Cortés

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## 1. INTRODUCTION

This paper describes the establishment and development of a forestry enterprise, the Cholguán conglomerate of companies in the central-south region of Chile, which started off as a family company involved in planting Pinus radiata. It grew steadily and later expanded into a number of industrial production units.

It began its industrial activities in 1959 when a fibreboard plant with a production capacity of 9 000 t/a was put into operation. The chief aim of setting up this plant was to make industrial use of 9 000 ha of Pinus radiata plantations that the company had planted in the Cholguán area between 1936 and 1959.

Through periodical expansion the production capacity of the plant was raised to its present level of 30 000 t/a. Through successive purchasing and planting of lands, the company now owns 36 500 ha, of which 29 200 ha are covered with Pinus radiata. The current industrial complex of the Cholguán conglomerate also includes a sawmill designed to produce 45 000 m<sup>3</sup> of sawnwood per year in two shifts; a packing case manufacturing plant producing 4.5 million cases in one shift and a finger-jointing line.

The paper is divided into four chapters. The first describes the economic climate that has predominated in Chile in recent years and focuses on the overall growth of the economy in general and of the forestry sector in particular. It also gives a brief outline of the major government policies affecting Chile's overall economic conditions as well as forestry development policies. The second chapter describes the company and outlines its main technical and economic characteristics. The third chapter attempts to analyze the impact the enterprise has had on development at both local and national levels. Finally, the last chapter gives the conclusions of the study.

## 2. THE CHILEAN ECONOMY AND THE FORESTRY SECTOR

### 2.1 General Economic Background

Chile is situated in the extreme south-west of South America, between 18° and 56° south latitude. It comprises a total area of 756 847 km<sup>2</sup> (excluding the Antarctic territory).

Some 50.3 million ha or 66.4 percent of the total area are unproductive lands from the agricultural and forestry standpoint, consisting of deserts, mountain peaks, glaciers, etc. A mere 1.8 million ha are suitable for intensive crop cultivation with no risk of degradation. The remainder is suitable for livestock raising and/or forest cultivation. (See Map 1, Annex 1 for a description of the agricultural zones.)

Chile is one of the more developed countries of Latin America. It has a population of 11.5 million and a per caput gross national product of US\$ 2 200. The illiteracy level is 6 percent and the infant mortality rate is less than 23 per mil. Approximately 80 percent of the labour force is employed in the industrial or services sectors. More than 80 percent of the population live in urban areas in the central-south zone and more than 40 percent live in the capital Santiago. (See Annex 2 for development indicators.)

## 2.2 Recent Economic Policy

The policy of marked Government intervention in the economy which prevailed in the fifties and sixties was abruptly abandoned with the change of government in 1973 and replaced by an economic liberalization policy based chiefly on the operation of market forces. Restrictions on capital markets were gradually lifted and practically all controls on foreign indebtedness were abolished.

Obstacles to overseas trade were also removed and in 1979 there was only one rate of taxation for all imports, equivalent to 10 percent of their value, and all export subsidies were abolished.

In the seventies the economic liberalization process produced positive results. The gross domestic production increased by an annual 7 percent and exports by 15 percent. Inflation fell to 35 percent, which was a vast improvement on previous years.

However, the economy suffered a marked depression in 1982-83. Unemployment rose to 25 percent, the gross domestic product declined by 15 percent compared to 1981, approximately 50 percent of the banks and 50 percent of companies in the productive sector faced insolvency. The foreign debt rose to approximately US\$ 1 500 per caput.

The reasons for the economic depression were many and complex but the main ones derived from a combination of external factors and poor management of the economy. Following a drop in demand for various goods, due to the world recession, the terms of trade for Chile's basic exports, copper, forestry products and fruit, declined sharply. This problem was further aggravated by the Chilean exchange control policy which persisted in fixing the exchange rate against the dollar, while leaving the capital account totally free of restrictions. This led to a foreign trade deficit which, in 1981, amounted to one-tenth of the gross domestic product. The difference was financed through a huge foreign debt which was estimated at some US\$ 17 000 million for 1983.

All this gave rise to drastic changes in economic policy. The national currency was devalued, which caused the debt to rise considerably in terms of the national currency and led to the bankruptcy of a number of firms in both the productive and financial sectors. Economic policy in recent years has tended to be dominated by a number of ad hoc measures which have led to even greater uncertainty. The financial set-back finally forced the Government to intervene in the capital market. The internal balance was finally restored in 1983, but at considerable cost, since the measures that had to be taken will certainly retard economic growth in the coming years.

## 2.3 The Forestry Sector

The forestry resources of Chile consist of approximately 9 million ha of natural forests and 1 040 000 ha of plantations, mainly Monterey pine (Pinus radiata D. Don). At present almost the entire forest industry uses the Monterey pine plantations as its source of supply. The natural forests on the other hand, because they are not easily accessible (the vast majority are situated in the extreme south of the country where means of communication are virtually inexistent), because of their composition (generally a mixture of different species) and quality (over-mature) do not justify setting up a sizeable industry in that area. Where these forests are in areas that can be reached, they supply only a few sawmills on a seasonal basis.

The forest industry of Chile combines an intensive use of both capital and labour. At one extreme there is sawmilling ranging from simple mobile sawmills to high-output mechanized facilities. At the other extreme there is the pulp and paper industry which requires considerable capital and a highly specialized work-force.

The installed annual production capacity of the forest industry for the more significant products is at present: 3.1 million m<sup>3</sup> of sawnwood; 1.25 million t of pulp and paper and 200 000 t of different types of panels and veneer. The forest industry consumes 8 million m<sup>3</sup> of logs annually.

Less than 10 percent of the natural forests are in private hands. The plantations, however, which are made up nearly exclusively of Pinus radiata, are almost entirely privately owned. These plantations are linked to the processing industry which also forms part of the private sector. More than 50 percent of all Chilean plantations belong to the large forest-based industrial enterprises and the remainder is in the hands of small and medium size investors.

The forestry sector, like the rest of the Chilean economy, has been affected by changes in the economic policy. Growth in forestry production was particularly vigorous between 1979 and 1981, when rates of real expansion equivalent to 10 percent per year were obtained. In 1980-81, production represented 2.6 percent of the gross domestic production (see Annex 3). While exports fluctuated sharply in the early seventies, between 1978 and 1980 they expanded at an annual rate of 20 percent. In 1980 exports reached their peak at US\$ 460 million, which corresponded to 10 percent of the country's total exports as compared to only 2 percent in 1973.

The expansion of the sector was strongly influenced by Government policy which used incentives on a large scale to encourage forestry development.

Incentives to forest owners are set out in Decree No. 701 on forestry development, enacted in October 1974, which will remain in force for twenty years. Among the most important incentives are:

- subsidizing 75 percent of afforestation and management costs on plantations established under this legislation;
- immunity from expropriation from the lands used to establish these plantations;
- exemption from land tax payable on those lands;
- a 50 percent deduction on taxes payable on income generated by forestry operations (for both individuals and firms).

Since private business concerns cannot obtain a plantation subsidy before establishing the plantations and having them duly certified by Government experts, the national banking system provides special terms to guarantee credits to these business concerns to enable them to finance planting. For this purpose, the Central Bank provides discount facilities to commercial banks. The debt cancellation period varies depending on the type of business concern involved; ranging from three years for large companies, to six for small companies and twelve years for individual businessmen. Finally, Supreme Decree N<sup>o</sup> 249 of July 1975 lifted restrictions on exports of forestry products, thus allowing roundwood logs, which were previously banned, to be exported.

Where imports are concerned, the liberalization policy has also served to ease restrictions. There are no preferential agreements of any sort, nor are there restrictions, such as quotas or import licences.

The factors that were taken into consideration when drawing up these special provisions for forest establishment and exploitation and which were designed to encourage an activity that is clearly advantageous to the country, included the fast growth rate of Monterey pine ( $20 \text{ m}^3/\text{ha/a}$  average), the use and protection of marginal lands, for which hardly any alternative use was possible, providing employment for unqualified workers and generating foreign currency for the country.

In the early eighties the State subsidized the plantation costs for nearly 80 percent of the total plantation area as compared to approximately 10 percent prior to 1974. It is estimated that between 1976 and 1983 the State transferred approximately US\$ 45 million to the private sector by way of plantation subsidies. This policy resulted in an average afforestation rate of more than 60 000 ha/a over the past ten years, approximately three times the country's felling rate.

Following the period of expansion (1976-80), world recession and over-evaluation of the national currency led to a loss of competitiveness of Chilean forestry products on the international market, resulting in a significant decline in exports and production. The situation was further aggravated by a drop in local demand as a consequence of the general economic depression.

In 1984, foreign exchange earnings through sales of forest products on international markets amounted to US\$ 383 million. This figure represents approximately 9 percent of the country's total exports for that year. Imports of forest products have amounted to approximately US\$ 40 million per annum in recent years and consisted mainly of paper products (see Annex 4). Employment in the forestry sector and related support services has varied between 45 000 and 53 000 over the last ten years. In 1983, with a total work-force of 52 000 persons, the sector accounted for 1.5 percent of the total labour force.

The Chilean forestry sector in general is expected to expand considerably in the coming years. It is clear that the future development of the sector will depend on a number of factors including demand, development of the international market, Government policy and availability of resources. Of all these aspects the raw material supply position is the only one for which a relatively safe forecast can be made, since wood supplies, for the next decade or two, basically depend on present stocks.

In a recent study the Chilean Forestry Institute examined the question of future roundwood supplies based on rather pessimistic assumptions. The study makes an analysis of future yields of Pinus radiata plantations projected as far as 2003. The results show a significant supply surplus for the period studied: over the next 21 years supplies would total some 490 million  $\text{m}^3$  of pine wood. On the other hand, total consumption over the last 21 years has been in the range of 115 million  $\text{m}^3$ . Supplies will be most plentiful toward the end of the century when the potential supply grows to some 40 million  $\text{m}^3/\text{a}$ . In the best felling year so far, 1980, a little more than 9 million  $\text{m}^3$  were extracted. At least, from the point of view of raw material stocks, the potential for industrial expansion is very promising and will undoubtedly enhance the economic importance of the sector.

### 3. THE CHOLGUÁN COMPANIES

#### 3.1 Description of the Area in Which Cholguán Operates

Cholguán is situated in the central valley of Nuble province in the VIII Region of Chile. When plantations were first established in the area in 1936, the town was basically a railway station on the line branching out from the central network in an easterly direction toward the Andean Cordillera. This line was originally intended to connect Chile and Argentina but this never came about. The population of Cholguán numbered approximately 40 and their economic activity was basically subsistence agriculture and livestock farming, since the poor quality of the land prevented it from being used more intensively.

The land is flat and the soil is sandy. The sand derives from materials originating from the volcano - Antuco - in the Cordilleran zone of the area. Eruptions of this volcano filled the valley with sand, first through a glaciation process and subsequently through a fluvial process. The soil is poor in organic content and not very fertile. Its natural cover is scrub, not exceeding 2 m in height, and natural pastures of low nutritional value for livestock.

It has a Mediterranean-type of climate, humid and cold in winter, hot and dry in summer. Temperatures exceed 30°C in summer and fall below 5°C in winter. Annual rainfall, mainly between May and September, is 1 300 mm.

At present, the only economic use to which the land of the area is put is the cultivation of Pinus radiata, which develops at the rate of 17 m<sup>3</sup>/ha/a in the area where the company operates. This rate of growth is considered low in comparison with the average for the species in Chile which is estimated at approximately 20 m<sup>3</sup>/ha/a.

Although the type of soil on which the Cholguán plantations grow constitutes a disadvantage with respect to the average rate of development of Pinus radiata in the country, it presents some significant advantages in terms of access and exploitation costs. Because the land is flat and the drainage of the sandy soils good, heavy vehicles can operate throughout the year, without the necessity of investing heavily in transport infrastructure. This means that exploitation can be carried out twelve months a year, which is not possible at other sites, where work of this kind can only be carried out in the summer months. All this results in lower unit costs for forest exploitation and extraction and, finally, lower transport costs for the products obtained.

#### 3.2 Description of the Cholguán Companies

##### 3.2.1 General

The Cholguán conglomerate consists of three independently managed operational units:

- (a) Maderas Prensada Cholguán, S.A., which operates an industrial fibreboard plant, whose current production capacity is 40 000 t;
- (b) Aserraderos Cholguán, S.A.,<sup>3</sup> which operates a sawmill designed to produce 45 000 m<sup>3</sup> of sawnwood per year in two eight-hour shifts; a packing case manufacturing plant producing 4.5 million cases in a single eight-hour shift and a line producing mouldings and other products;

- (c) Forestal Cholguán S.A., which is involved in forest establishment, management and exploitation. This company is responsible for supplying raw material to the other companies and, on an independent basis, exports logs to foreign markets. It owns 36 500 ha of land, 29 200 ha of which are covered with Pinus radiata plantations and the remainder is made up of industrial sites, access roads, fire-break networks and lands for future planting.

The reason for this division into operational units is threefold:

- i) to make administration more flexible, i.e., to ease the burden of bureaucratic procedures in decision-making for the enterprise which, with expansion and diversification could become extremely slow;
- ii) to improve efficiency by enabling each of the units to operate as a profit-making concern;
- iii) under Chilean law the tax system for forest cultivation and exploitation differs from that for other production activities. The system provides for a substantial tax rebate on income earned from cultivation, management and exploitation of forests.

### 3.2.2 Growth over the years

Industrial operations commenced in 1959. However, the forest resources, needed to supply the industry, had been established since 1936, when Pinus radiata planting began in the area close to the town of Cholguán, situated in the Central Valley of Nuble province, in the VIII Region of Chile (see map, Annex 5).

In 1936 the family firm "Comunidad Irarrázabal-Larrain" began planting on an 800 ha farm, which the members of the firm had inherited. The main reasons for planting were the incentives that the law at the time offered for forestry activities. These were mainly tax incentives, the most important of which were exemptions from land taxes and death duties, which at that time were very high. Another reason why these businessmen turned to man-made forests was that they had previously suffered losses with crops and fruit cultivation on the same land.

Later, the shortage of capital with which the firm was faced, compelled them to sell the plantations that they had established. To do this they divided the farm into 1 ha units which they offered for sale to the public in the major towns of the country. Stress was laid on the long-term advantages the investment offered (or as it was called "retirement insurance") i.e., by means of a low monthly payment, they would obtain a substantial return after 25 or 30 years which was also exempt from death duties. At that time, the idea of having an asset exempt from this tax as one approached retirement was very attractive to the general public.

Some 4 500 ha of these plantations were sold in this way. With the funds obtained from the sale, the firm continued to acquire lands and to plant on them. Selling "forest plots" became a rather profitable commercial activity for the "Comunidad Irarrázabal-Larrain", which was thus encouraged to continue expanding. The "forest plots" were well received by the public and this gave rise to a demand for them, which was reason enough, in economic terms, for continuing to buy lands to be planted and subsequently sold.

Later, when large areas had been planted, they were offered to the "Cajas de Previsión" (Social Security Funds) which at that time were administering these social security funds in Chile. Their reason for purchasing these lands was to capitalize their funds in an activity (forestry) which at that time seemed very profitable. Thus, in 1940 one of these organizations purchased three large properties in the area where Cholgúan was operating.

Around 1950 there were already approximately 9 000 ha of plantations, some 4 500 ha of which were sold to private investors through the plot system, 3 000 ha to the Social Security Funds and the remainder, approximately 1 500 ha, were retained by the Comunidad Irarrázabal-Larraín. At that time the initial plantations were already 14 years old and management work had to be started. It was then that concern was voiced regarding the future use to be made of these plantations, those in the hands of third parties as well as those owned by the Comunidad Irarrázabal-Larraín.

It must be pointed out that all these events occurred relatively spontaneously, without any previous planning. Industrialization of these plantations was not one of the initial aims of the "Comunidad". This question arose later when the forest resources had already been established and one way of using them was through an industrial activity.

Studies focusing on the establishment of an industrial plant were postponed for approximately four years. Finally, an industrial company (Maderas Prensadas Cholgúan, S.A.) was set up and the Comunidad Irarrázabal-Larraín incorporated its plantations. At the same time, other plantation owners in the area were given the opportunity to exchange their plantations for shares in the new industrial company and in this way approximately 350 ha were added to the 1 500 ha belonging to the "Comunidad".

Despite the lack of interest shown by the landowners to exchange their plantations for shares, the owners of the industrial plant always took the other plantations into account when planning supplies, since the location of the plant made it the natural market for wood from these plantations.

Following an analysis of the available potential, the amount of investment required and existing forest resources, it was decided to set up a fibreboard plant with an initial production capacity of 9 000 t/a. The machinery was purchased in the German Federal Republic and the investment cost was approximately US\$ 3.0 million (1959). Financing was provided entirely by private sources, contributions from partners, sales of shares and loans from a private bank. Construction of the plant commenced in 1956 and it came into operation in 1959.

It was designed by the German firm J.M. Voith G.m.b.H. and the Chilean consultancy firm Hernán Briones y Cia. The former provided credit for the purchase of machinery totalling US\$ 0.5 million over four years. Market studies were carried out by the consultancy firm of Walter Thompson y Cia. (Chile) and centred mainly on assessing the consumers' reaction to the product (fibreboard) which was then unknown in Chile. Initially, attention was focused solely on the domestic market and the plant was designed accordingly.

The success of this completely new product on the market was due to:

- (a) the company's large scale advertising efforts and the campaign designed to break into the market and replace substitute products and,



- (b) the earthquake that struck central-south Chile (in 1960) following which emergency housing had to be provided rapidly and economically and, for this, intensive use was made of fibreboard.

In 1966 it was decided to expand the plant's production capacity from 9 000 to 21 000 t/a to meet the growth in domestic demand and to try to reach international markets, particularly in Latin America. Financing for this investment, which totalled US\$ 1.3 million (1966), was provided as follows: US\$ 870 000 by a German private bank credit (guaranteed by the Chilean Government through its Development Corporation - CORFO); US\$ 125 000 in local currency directly by CORFO and US\$ 300 000 of the company's own capital.

The design and engineering for the expansion was undertaken by the Cholguán engineers themselves. External consultancies were required only for the boilers and for strength calculations, for which contracts were placed with local engineering companies.

Between the coming into operation of the plant in 1959 and the above described phase of expansion in 1966, Cholguán afforested 735 ha and purchased 457 ha of forests from other owners who did not want to exchange their plantations for Cholguán shares.

In 1978 it was decided to modernize the plant and again extend its production capacity to meet the growing demand on the international market, mainly the USA and Europe, which Cholguán had entered with some success. Production capacity was raised to 40 000 t/a and the financing of US\$ 5.5 million (1978) consisted of US\$ 2.6 million of the company's capital and an Inter-American Development Bank (IDB) credit through CORFO amounting to US\$ 2.9 million. Design and engineering were again carried out by Cholguán engineers. Some 80 percent of the equipment were updated on this occasion through imports from the German Federal Republic and Sweden.

Between 1966 and 1978 Cholguán continued to increase its forestry resources and by the end of 1978 owned some 11 000 ha of forests.

The following year, they acquired a sawmill situated at Canteras, some 35 km south of Cholguán, with a production capacity of 45 000 m<sup>3</sup> of sawnwood per year in two eight-hour shifts (see map, Annex 5).

Finally, in 1984 the company set up a packing case manufacturing plant, with a production capacity of 4.5 million cases per year in one shift, and a finger-jointing line. Total investment cost was US\$ 5.5 million. The company provided US\$ 4.4 million of their own resources and the remainder (US\$ 1.1 million) was in the form of an IDB credit through CORFO. Machinery was imported from Germany and Sweden.

The company continued to increase its forest possessions and these amount at present (1985) to 36 500 ha of land, some 29 200 ha of which are covered with Pinus radiata forests of different age classes.

### 3.2.3 Products, volume of sales and markets

When Cholguán commenced its activities the product (fibreboard) was totally unknown on the local market and an enormous advertising and marketing effort had to be made to launch it. A number of distributors experienced in the construction material market (this product is used chiefly in construction work) were chosen for this purpose. In addition,

a carpenters' club was organized and members (totalling more than 5 000) were trained in how to use and work with fibreboard. All this was accompanied by an advertising campaign emphasizing the product's advantages.

Cholguán markets two lines of fibreboard products which are widely used in building, carpentry, industry, furniture manufacture, decoration, business and the home. The "standard line" comprises smooth, waterproof, perforated and embossed sheets in widths of 1.51 m and lengths of 2.44 or 4.88 m. The "special line" comprises boards that are treated with high quality lacquers. They consist of several types and are sold under the trade name Durolac. They are produced in six varieties of mat emulsion and semi-gloss colours, imitation glazed tile, oak or slate. Because of the lacquered finish, the surface of Durolac is absolutely waterproof and more durable than any other type of finish used for wood. It resists acids, solvents and detergents commonly used in the home as well as fruit juices and steam.

Following expansion in 1966, production exceeded local demand. However, when the decision to expand had been taken, consideration had already been given to the foreign market as an outlet for surplus production. Initial efforts toward exporting fibreboard were therefore launched and directed mainly at Latin America (Peru, Ecuador) and the Caribbean countries.

The reasons for choosing these markets were to make use of Chile's relative proximity to them and to profit from tariff concessions obtained through negotiations in the Latin American Free Trade Association (ALALC) and the Andean Pact. The intention was also to gain experience in international trade in relatively undemanding markets, so as to later be able to break into other markets such as the United States and Europe, which, although much more difficult to enter and much more demanding, are attractive from the point of view of stability, volume of business and prices.

The breakthrough into these markets was very successful. In 1983, foreign markets, mainly the United States, U.K. and the Netherlands, accounted for 70 percent of Cholguán's sales. In order to break into these markets Cholguán was forced to improve, and based its operations on a system of management that takes pride in high quality and a sense of responsibility at all levels. The policy of selling directly to the user also contributed to this improvement, for it provided feedback as to the impact on the consumer and his needs.

Cholguán's absence from large Latin American markets such as Brazil and Argentina, which would be the most obvious markets because of their proximity to Chile, is mainly due to the fact that they also manufacture these products, which are closely protected through high import taxes, thus making it impossible for Cholguán to compete with them.

In 1984 Cholguán began to produce packing cases for fruit for export, so as to tap this very large and growing market (because of current demand and future prospects, in view of the significant increase in fruit-tree planting in the country). Current demand amounts to approximately 50 million cases which by far exceeds the country's present supply which is organized on an almost artisan's level. The cases are of very low quality, production is intermittent and prices are high.

Cholguán is of the opinion that by producing a high quality, low cost product at the opportune time, they can easily capture the packing case market. They are depending on the use of appropriate technology and very low production costs, to achieve their aim, since an important input, the wood, is completely utilized in the Cholguán industrial complex, as shown in Annex 6.

Due to market conditions, which have been particularly depressed in recent years, the sawmill has consistently been producing below its installed capacity. On numerous occasions it has been more convenient for Cholgúan to export roundwood directly.

Through Forestal Cholgúan S.A., the company markets Pinus radiata logs abroad, mainly to the Korean and Chinese markets. In 1983, 48 590 m<sup>3</sup> were exported giving a return of US\$ 2.0 million. Cholgúan entered this market because there was a demand for the product at reasonable prices.

#### 3.2.4 Cholgúan's planning and organization system

The company is run by the Board of Directors, headed by the Chairman. The General Manager reports to this Board of Directors and the Production, Administrative and Sales Units report to him. All three operational units are organized in this way. However, some departments, such as the Sales and Administration Departments are shared by all the firms so as to prevent duplication of effort and staff and so as not to unduly increase administrative costs.

Four trade unions exist (one in Santiago, one at the industrial plant and two dealing with forest-related activities). They have no say in managing the company and their work consists in negotiating salaries and social benefits (every two years as provided for in Chile's labour legislation), participating in work safety and social welfare commissions.

There is no official planning unit at Cholgúan. The group of executive informally plan the firm's future development. Ideas also originate in other informal planning groups within the company. Generally speaking, planning at Cholgúan is an internal process; outside consultants are taken on only when this is strictly necessary. Approval or refusal of investment projects lies with the Board of Directors.

Targets are set on the basis of an "operational activities annual budget". Every year, each production unit submits a monthly expenditure and production plan. In this way, production, sales, raw material consumption and labour targets can be known in advance. The programme is monitored on a monthly basis. Any deviation from the original plan must be explained by the persons responsible to their superiors. This is a way of obtaining advance information on the operational balance sheet, of keeping the results of the operation up to date and to make everyone aware of expenditure, how it arose and how to control it. These are also based on a single year without reference to previous years' budgets.

#### 4. CHOLGUAN'S IMPACT ON DEVELOPMENT

This chapter analyzes the conglomerate's impact on development. The development components are many and varied. Insofar as a company contributes to the expansion of the development components, it may be said that, at least in this respect, the company is "appropriate". A number of effects which are considered to be closely related to development have been examined under the above heading. These are effects on income and employment, transfer of technology, environment, availability of foreign exchange, government revenue and, finally, on social and regional development.

#### 4.1 Provision of Employment and Income

The company employs 655 persons, ranging from executives to unskilled workers, in its three firms. Thirty of these are professionals who have had a university education (mainly mechanical and electrical engineers and foresters); 30 are professionals who have had technical training; 190 are skilled workers and 400 unskilled workers.

Maderas Prensadas Cholguán S.A. - Employs 372 persons, 23 of whom are professionals with university training, 25 are professionals who have had technical training, 76 are skilled workers and 248 unskilled workers.

Aserraderos Cholguán S.A. - Employs a total of 99 workers, two of which have university training, three technical training, 44 are skilled workers and 50 unskilled workers.

Forestal Cholguán S.A. - Employs a total of 184 workers, five are professionals with a university education, 7 have had technical training, 70 are skilled workers and 102 are unskilled workers.

Out of every ten jobs directly provided by the company, seven involve industrial processing activities and three, forestry activities. This contradicts the often-expressed belief that the major impact on employment in industrial forestry companies lies in activities related to the resource and not to the processing operations. This can be explained to some extent in terms of the technology used and by the fact that for certain operations in the forest external help is required. Furthermore, it is worth noting that there is little difference between the numbers of skilled workers involved in operations in the forest and those involved in industrial operations, which, once again, contradicts popular belief on the subject.

It must be stressed that in practice Cholguán is the only source of stable work in the area, the only alternative being temporary agricultural work which can in no case absorb such a large number of workers. Furthermore, Chilean law requires workers to be protected by a social security and health insurance system benefitting the entire family. Workers with temporary jobs do not usually have these benefits.

The company is also an indirect source of employment, which amounts to 40 percent of the direct employment and includes extraction operations carried out on a contract basis, the contracting of transport for products and inputs and, finally, the multiplier effect on local trade. The multiplier effect is relatively slight as compared to other projects. One possible reason for this is that a large proportion of the product is exported, which means that further processing, which generates jobs, takes place in the importing country.

In 1983 Cholguán paid some US\$ 2.2 million in wages and salaries. The earnings of the workers in the company substantially exceed income possibilities from other jobs and, as a result, the aim of the work-force in the area is to work for the company. The chief reasons for the better wages are

- (a) the company's policy to avoid worker turnover; and
- (b) the trade unions which make it possible for the workers to negotiate collectively.

The company's growth has meant that it now operates on a capital-intensive, rather than on a labour intensive basis. While production capacity has increased more than fourfold between the launching of the company and the present day, not even twice as many jobs as those available initially have been created. The reason for this is that technology has improved considerably and there is increasing market demand for products requiring more advanced production techniques, which are more capital intensive.

If we analyze expenditure in wages and salaries, we find that in real terms this has increased substantially over the years. The reason for this is that more highly qualified staff are required as a result of the use of more advanced technology. This is the case both as regards industrial operations and planting, management and forest exploitation.

Workers with higher qualifications earn more and are also better placed to choose other jobs in other forestry companies, both in forest activities as well as in industrial production.

Chile's isolated geographical location and the relative lack of mobility of Chilean workers mean that there are no workers from other regions or neighbouring countries. There is little worker mobility within the country itself. The company, therefore, employs local workers. Moreover, natives of the area are familiar with the local way of life and have family ties there, so there is every likelihood that a locally recruited worker will stay with the company for a long time. This allows the company to invest in training, to have a stable labour force and to reap the benefits of this training over a long period.

#### 4.2 Transfer of Technology

The company's efforts have focused on improving industrial productivity and forestry operations. Production in the fibreboard plant, for example, has always exceeded its planned capacity. This is basically because the workers have been provided with adequate ongoing training, in line with the improved technology used. Because of Chile's lack of technological development, the greater part of the technology had to be imported. This situation is not peculiar to the forest industry; it exists throughout the country and is the reason why most of the equipment and machinery are imported from abroad.

At present a genetic improvement programme geared to forest activities, for which considerable funds have been spent over the last eight years, is under way. Forestry research activities are focused mainly on improving forest productivity and preventing disease. This research work is being conducted jointly with other forestry enterprises, with the National Forestry Corporation (State Forestry Services) and the universities. The same applies for the genetic improvement programme and plant health research. The company is also carrying out research studies on its own. These include fertilization trials and the adaptation of species to sandy soils.

Cholguán does not conduct a programme specifically geared to the transfer of technology. The transfer occurs indirectly through the company's workers who have been trained and who are usually in close contact with the landowners of the area and also through trained workers moving to other forest producers.

The company's training programme benefits from the advantages provided by the law through the Servicio Nacional de Capacitación Nacional y Empleo (SENCE) (National Training and Employment Service). This law allows companies to spend 1 percent of their taxable earnings on worker training. This sum is later deducted from the company's annual income tax.

The training programme is drawn up on an annual basis in accordance with the needs of each of the company's production units and depending on the economic resources available to the programme. Training services are provided on a contract basis by the national universities and the Centro Nacional de Capacitación Forestal (CENACAF). On-the-job training is also carried out and, to a lesser extent, trainees are granted fellowships and given aid to attend seminars both in the country and abroad.

#### 4.3 Impact on the Environment

Generally speaking, the company's activities do not have any significant negative effects on the environment. Since it is located in an open valley the negative effects of the gases produced are not important. Furthermore, the toxicity of these gases is relatively low. Water pollution is not very significant either, since the company uses relatively little water and the pollution that does occur is not caused by chemicals. One problem giving cause for concern with regards to the environment is the fact that the company's operations are based exclusively on pine plantations, with all the problems and risks that a monoculture involves. However, attempts are being made to overcome these difficulties through research and the introduction of new species compatible with the soil and climatic conditions of the area. On the other hand, a positive effect of the company's activities is the use of sandy soils (no other use is made of them) for establishing plantations. It must be borne in mind that when they were used for subsistence agriculture they were deteriorating. The company has, therefore, helped to upgrade one aspect of the environment in which it operates.

#### 4.4 Impact on the Foreign Exchange Supply

At the moment the foreign debt is a cause for much concern in Chile and, while this company cannot solve the country's foreign debt problem, it at least makes a net positive contribution in foreign exchange by exporting its products (70 percent of its production in 1983) and economizes on foreign exchange by producing goods which would otherwise have to be imported to meet local demand.

The company's exports in 1983 provided the country with US\$ 7.9 million in foreign exchange. Sales on the local market amounted to the equivalent of US\$ 2.6 million, which represented a saving for the country, since imports had been avoided. The company's imports, mainly inputs and spare parts which are not produced in the country, totalled approximately US\$ 800 000.

#### 4.5 Government Revenue

The company has provided considerable revenue through taxes. Throughout their 25 years of operation, these direct contributions have amounted to approximately US\$ 10.5 million (as at December 1983). In addition, Cholguán contributes indirectly through taxes paid by contractors and suppliers of inputs (such as wood, paints, etc.) and income taxes paid into the national Treasury by the company's workers.

On the other hand, Cholguán has received direct subsidies for afforestation totalling US\$ 0.25 million and it has been deducting land-tax on land given over to forest cultivation since 1974.

#### 4.6 Social and Regional Development

Cholguán has contributed in many ways to social development. One, which has been very significant for Chile, is that it has helped stem migration from the rural areas to the large towns. Cholguán has been a pole of attraction for the people of the area by offering hopes of employment and steady income.

As explained in Section 4.1, the company employs 655 persons and has created indirect employment for approximately 270 persons. If we assume that these jobs are for the most part located in or around Cholguán and that a conservative estimate of average family size is four persons, the company provides a living for approximately 3 700 persons. Had the company not existed, it is likely that a high percentage of this group would have migrated to the cities, so that, although its impact is not particularly remarkable at national level, it is clearly very significant at local level.

Cholguán has also contributed through providing schools, gymnasiums and houses for approximately 150 of its workers, which have raised the standard of living of the latter and of the community as a whole.

In 1962 the company built a school for 250 children entirely at its own expense and in 1971 donated land and equipment for the construction of a school for 500 children. In 1973, it built a gymnasium for the benefit of workers and their families as well, as for the community as a whole.

Staff education and training is another way of contributing to social development. It enables staff to improve their standing on the labour market and gives them an opportunity to improve their standard of living. Cholguán has always laid special stress on improving the level of its workers and has financed literacy programmes and provided courses dealing with various aspects of production.

Generally speaking, it has provided a number of services for the area in which it operates. The most important is the electricity network for the area of Cholguán, which was installed in 1959 when their operations commenced.

When Cholguán began operating in 1959, the local school provided only the first two years of basic schooling. Today, it provides full basic and intermediate schooling. Cholguán has contributed to this both directly and indirectly: directly, through constructing and furnishing schools; indirectly, through the arrival of professionals. The professionals themselves, or their wives, have been volunteer teachers in the schools and this has helped improve the area's cultural and educational level.

It has also financed the setting up and running of health and dental services, fire brigades, recreational centres with gymnasiums, swimming pools, tennis courts and, finally, improved the public transport service to the various towns in the area.

#### 5. CONCLUSIONS

The Cholguán companies are an example of an enterprise that has grown from a small scale and fairly modest operation to a sizeable industrial group making a remarkable contribution to local and national

development. It is an undertaking that has not only been very successful economically but which has contributed to other aspects of development, such as those dealt with in Chapter 3. It would therefore be interesting to consider in greater detail some of the factors which have determined or influenced the development of Cholguán since it commenced operations.

Mention must first be made of the firm's system of planning. It will be recalled that Cholguán has no formal planning structure. Indeed, the gradual growth of the firm was not based on systematic and formal long-term planning, but occurred spontaneously, as the opportunities arose. For example, "Comunidad Irarrázabal-Larrain's" initial short-term aim in planting their lands was to utilize lands for which there was little or no alternative use and to take advantage of the tax incentives offered at the time. There was no clear idea of how the wood should be used when the trees reached maturity. Subsequent plantations and their sale in small individual plots were also carried out with no overall long-term plan in mind. It was only when the plantations reached economic maturity that attempts were made to find different industrial uses for the wood.

The company's decision-making and general planning therefore occurred on a step-by-step basis. This is contrary to the normal recommended procedure which is that all planning should be based on a systematic analysis and should include long-term objectives and clearly defined steps for reaching these objectives.

Cholguán's experience is a clear illustration of the frequently expressed opinion that analytical planning systems are somewhat irrelevant and that what is essential in the final analysis are sound management capabilities able to detect and make good use of the more advantageous investment opportunities. The step-by-step approach which takes account of circumstances existing at a particular time probably works more efficiently when the economic and political climate is very changeable. At such times, the degree of uncertainty tends to be relatively high and long-term planning is likely to depend on factors which are so uncertain as to be irrelevant. It would seem therefore that, insofar as management capability was concerned, Cholguán possessed suitable resources which it used effectively over the years, working through an informal but effective step-by-step planning system.

Secondly, Cholguán has been able to rely on a strong technical base. Outside consultants have been required only for specific tasks and, generally speaking, the plans for the company's industrial and forest operations development have been drawn up by the company's own professionals and technicians. Chile's situation is rather unique when compared to other developing countries which have to depend on fewer trained technicians and professionals.

It is usually argued that importing equipment designed in the developed countries has a dampening effect on the impact that a company could have on the overall employment level, since imported technology is capital intensive. It is true that employment is closely related to the choice of technology. However, one does not always have the choice of using labour intensive technologies. Reasons for this are not always of a technical nature, they can also be economic. The company's industrial processes are usually not flexible in the technological sense. In addition, the strong tendency to turn to international markets which are highly competitive implies the use of capital-intensive production systems and high productivity on the part of the labour force. Choice of technology is therefore largely determined by the market. At the same time it is possible that abnormal exchange rates have prompted companies



to choose more highly capital-intensive technologies than they would have done if the Chilean currency had not been over-valued. We do not have sufficient information to be able to estimate the significance of these factors with any accuracy, but they have certainly to some extent influenced decisions as regards technology.

One problem related to the utilization of capital-intensive technology is that the industry can become isolated in the area in which it operates, i.e., having no significant effect on the rest of the community or society in general. This type of technology also requires highly trained staff and cannot be transferred efficiently when such staff is not available. In the case of the Cholguán companies it is unclear to what extent there has been transfer of technology. A more detailed study must be carried out on this aspect of the matter. As stated in Chapter 4, there has been some informal dissemination of a certain type of information chiefly regarding forest operations. In the case of fibreboard production technology, there has been no transfer, for the simple reason that this is the only company producing this product in Chile.

Cholguán enjoys a monopoly in Chile. However, this does not explain its success as a company since the greater part of its output is placed on the highly competitive international markets. At the local level, the company has had to break into a market dominated by traditional competitive products in which fibreboard was unknown.

The breakthrough was carried out very efficiently by establishing direct contact with the users of the product. Here too, the company adapted well to prevailing conditions.

Production diversification and organization into separate profit-making concerns has also helped the company to adapt to the changing economic climate. In this sense, it has shown considerable flexibility in exporting even unprocessed logs, provided that market conditions are suitable, and exploiting opportunities based on market requirements, i.e., producing packing cases for fruit export (fruit being one of Chile's chief exports). This diversification has not yet been extended to include raw material supplies, for which the company still depends on a single species. However, research studies have been launched to find possible alternatives. All these factors have contributed to the company's flexibility.

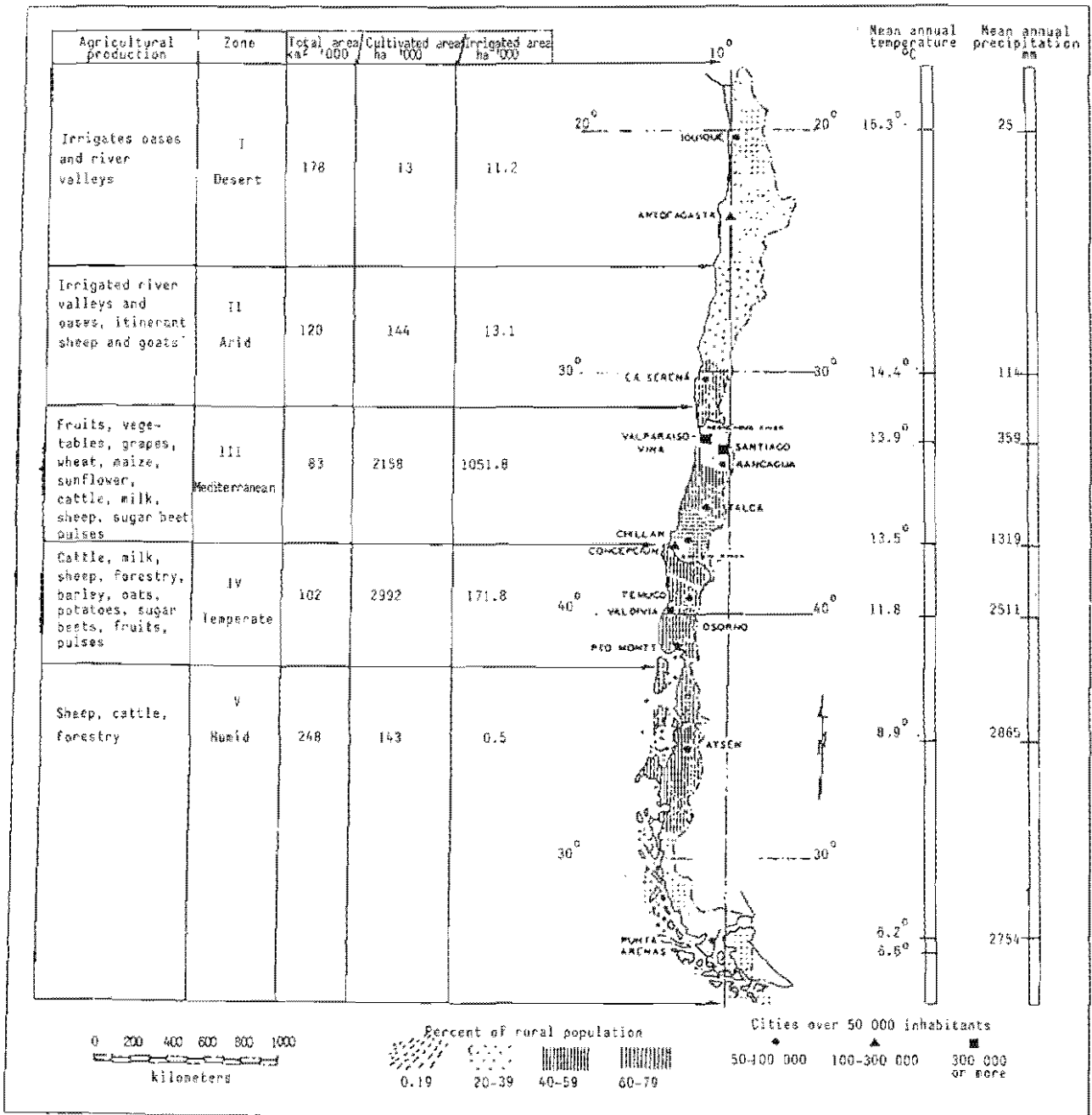
Finally, Cholguán can also be said to have contributed to social and community development. It has improved conditions for the local community, which was very small when Cholguán commenced operations. The growth of the local community has gone hand in hand with the growth of the company. This situation differs from those in which the industry is located in an area where a social nucleus and structure already existed. As we know, when a major external force is introduced into a traditional social system the results can be traumatic.

Most of the conditions mentioned here probably do not exist in other developing countries and it will therefore not be easy to transfer this experience to other situations. However, the case study clearly illustrates some of the factors which determine the extent to which an industrial enterprise can adapt to local conditions.

ANNEX 1

Map of Agricultural Areas

Chile



ANNEX 2

Chile - Basic Indicators

a)	Population (1982)	- total 11.5 million - rate of growth (1970-82) 1.7/year
b)	GNP <u>per caput</u> (1982)	US\$ 2 210
c)	Average growth of <u>per caput</u> GNP (1960-1982)	0.6%
d)	Average rate of inflation (1970-1982)	144.3 per year
e)	Life expectancy at birth	70 years
f)	GDP growth (1960-1970) (1970-1982)	4.4% per year 1.9% per year
g)	Production structure:	
	- Agriculture	
	(1960)	9% of GDP
	(1982)	6% of GDP
	- Industry	
	(1960)	35% " "
	(1982)	34% " "
	- Manufactured goods	
	(1960)	21% " "
	(1982)	20% " "
	- Services	
	(1960)	56% " "
	(1982)	60% " "
h)	<u>Per caput</u> energy consumption (1981)	754 kg petroleum equivalent
i)	Energy imports as a percentage of exports (1981)	20%
j)	Balance of payments and reserves (1982)	
	- Current account balance	US\$ 2 382 million
	- Net direct private investment	US\$ 365 million
	- Gross international reserves	US\$ 2 597 million
k)	Active population (15 to 64 years) as a percentage of total population (1982)	62%
l)	Percentage of labour force employed in 1980:	
	- Agriculture	19%
	- Industry	19%
	- Services	62%

m)	Average annual growth of labour force	2.1%
n)	Urban population (1982)	82%
o)	Percentage of population living in the capital (largest city)	44%
p)	Calorie supplies as a percentage of requirements (1981)	114%
q)	Number of inhabitants per doctor (1980)	1 930
r)	Income distribuion (1968):	
	- lowest 20%	4.4%
	- highest 20%	51.4%
	- highest 10%	39.8%

ANNEX 3

Contribution of the forestry sector to the gross domestic product  
(millions of pesos 1977)

<u>Year</u>	<u>GDP</u>	<u>GDP Forestry Sector</u>	<u>Percentage</u>
1974	290 554	7 005	2.4
1975	253 043	5 392	2.1
1976	261 945	6 452	2.5
1977	287 770	6 940	2.4
1978	311 417	6 891	2.2
1979	337 208	8 111	2.4
1980	363 446	9 420	2.6
1981	384 332	9 994	2.6
1982	329 155	7 309	2.2
1983	323 889	7 879	2.4

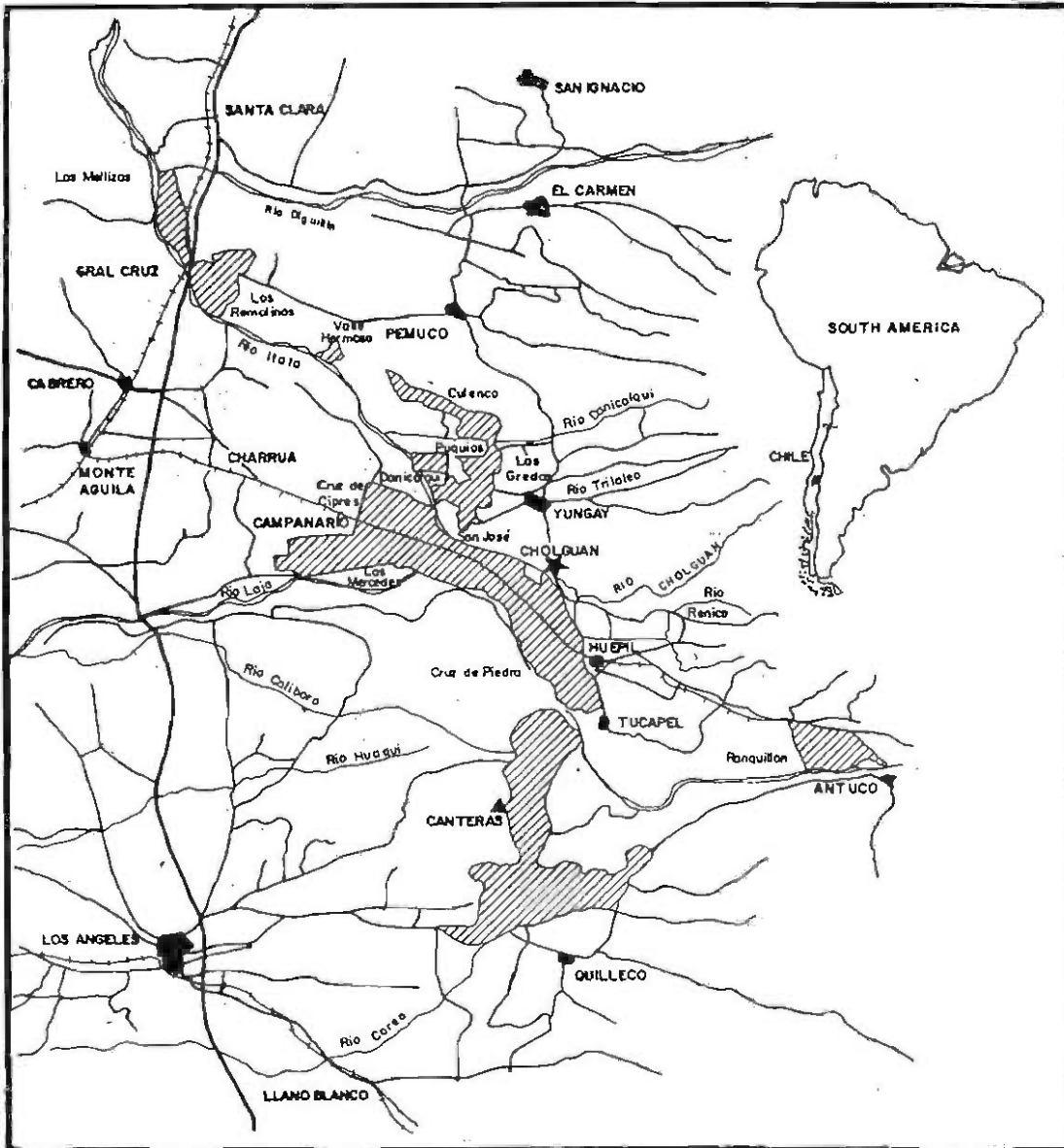
Source: Instituto Forestal. Forestry Statistics 1983. Santiago, April 1984.

Chile: International Trade of Forestry Products  
(thousands of US\$)

<u>Year</u>	<u>Exports</u>	<u>Imports</u>
1972	29 833	8 456
1973	40 161	11 295
1974	131 210	605
1975	128 312	4 970
1976	134 384	10 150
1977	170 932	24 750
1978	221 425	25 350
1979	341 320	43 300
1980	458 761	45 100
1981	368 597	43 300
1982	320 900	43 300
1983	312 108	43 300

Source: FAO Yearbook of Forest Products 1982-1983, Rome, 1985.

Operating Area of Cholgúan



CHOLGUAN'S AREA OF OPERATION

▨ Cholgúan plantations

★ Fibreboard plant, finger-jointing line packing-case plant

▲ Sawmill

CHOLGUAN

Use of Pinus radiata plantations

<u>PINUS RADIATA</u> <u>PLANTATION</u>  (Exploitation 25 to 30 years)	<u>40% WOOD FOR PULP</u> (Ø 17 cm)	Fibreboard plant	
		- Sawnwood	
		- Packing-case plant	
		- Mouldings, etc.	
		50 % to Sawmill (Ø 18 cm)	
		- Residues	- Fibreboard
			- Energy
	<u>60% WOOD SUITABLE</u> <u>FOR SAWING</u> (Ø 18 cm)		
		50% exported as logs (Ø 20 cm)	



A REVIEW OF METHODOLOGY FOR  
EVALUATION OF APPROPRIATENESS

by

Kari J. Mustanoja\*

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## 1. INTRODUCTION

Concern about the effectiveness, efficiency and appropriateness of development cooperation efforts has caused international organizations both to set up evaluation units and to engage external teams for evaluation. Some of the pressure has come from the bodies to which these organizations are accountable. Evaluation systems, methods and techniques have developed rapidly, but are still far from satisfactory. The results of evaluations have also been worrying: even in a sector such as forest industries, some projects seem to have created situations which are socially and economically worse than what they were when the project was conceived.

Not only international organizations, but also financing agencies, recipients, and the general public have become alarmed of the high incidence of non-success. The reported failures may have resulted from project expectations growing at a rate faster than that at which solutions are found to the problems connected with them. There are often discrepancies between what the projects were intended to achieve and what their actual impacts were, i.e. the planning deficiencies. Organizations are today more willing and able to identify and analyze the problems encountered, their impacts and the significance of the impacts.

The content of evaluation has been broadening over the years. The partners in development cooperation are slowly moving from merely pointing out the positive impacts of projects to improving the performance of future programmes or projects. Nevertheless, evaluation is still largely unsystematic - except with regard to financial and certain economic and physical issues and impacts - and the evaluators or evaluation units are sometimes specialists in name only. The situation is just unsatisfactory in the private sector, where the projects are often simple, and in the public sector supported by international organizations.

The evaluation systems, tools and institutions in the forest industries sector rest partly on issues and impacts identified, studied and debated during well over a hundred years. Unfortunately, a consensus has been reached in very few subject areas. What is probably the least understood aspect is that of appropriateness - the suitability of certain forest industrial activities and processing units, for a given social and economic setting.

A large number of evaluations carried out by bilateral and international organizations were screened, in order to determine how forest industrial appropriateness was evaluated by these agencies. Mr. Jorma Paukku of FINNIDA has provided much of the material used in this exercise.

It seems that international organizations have not been able to fully utilize the results of development in evaluation, technology transfer, appropriateness assessment, or even communications methodology for forest industrial development projects. Keeping pace with new technology is of course also one of the major problems of private sector managers and management teams. Often the effectiveness of evaluation has, therefore, depended on the ability to assign experienced outsiders, often commercial consulting units, to do the job. In these cases, additional problems have come up: effective response to the findings from evaluation, or feedback to the evaluators on their assumptions, has been deficient. This has made it hard for the evaluators to know whether they have identified the correct issues, struck the right chords, or even used the correct social and economic objective hierarchy against which to measure project impacts.

## 2. THE CONCEPT OF APPROPRIATENESS

Appropriateness can be understood as the measure of how well a forest industrial activity fits into its technological, physical, economic, legal, political, cultural and social environment. It is one of the dimensions for measuring the consequences of action: the sum of its social impacts in each of these spheres. The other dimensions are economic (including financial) and developmental (e.g., institution building).

Conventional project implementability assessment (feasibility studies, most appraisals) is biased toward quantifiable and technological/economic features. Typical conventional traits of suitable projects are wood availability and suitability; technology in harmony with the raw material resources, market requirements for products, service infrastructure and the physical environment; and the financial profitability of the venture. Some of these traits are covenants to operation; others can vary along a continuum over time and over changing conditions. The conventional measures of implementability are usually well estimated during project planning.

Appropriateness, i.e. the degree of social desirability or acceptability, in the forest industry sector can only be assessed by measuring explicitly impacts in all of the following categories:

- (a) financial: monetary cash flow, net present value and profitability;
- (b) economic: economic cost and benefit streams;
- (c) social: institutional, political, legal, distributional, cultural, and welfare impacts; and
- (d) physical: inflows of physical resources and outflows of products and impacts, in relation to the physical needs of society and its physical environment, and social objectives.

## 3. THE CONCEPT OF EVALUATION

Evaluation is part of the project cycle. A typical project cycle consists of:

- (a) identification;
- (b) preparation;
- (c) appraisal, sometimes called ex-ante evaluation;
- (d) implementation: during implementation, projects are frequently reviewed at least once, in order to ensure that the project document continues to be a valid guide for implementation and that implementation has satisfactorily followed the plan of work and target structure of the project document; and
- (e) terminal evaluation: at the end of the project, evaluation often determines the effectiveness and efficiency of the project as designed and as implemented, and measures project impacts against the goals and objectives set.

Three of these activities are commonly regarded as evaluation: the appraisal or ex-ante evaluation; the implementation review or mid-term evaluation, which contains elements of both ex-ante and ex-post evaluation; and the terminal evaluation, which typifies the ex-post type, i.e. studies what has happened and why, and what should have taken place. This paper will concentrate on ex-post evaluation, whether carried out during or after project implementation.

Evaluation is done for improving future work, or for accountability. Depending on their purpose, evaluation exercises can be carried out either by the implementing group or a group of external specialists. The internal evaluation process ensures that the results of implementation are directly made use of by management in the continuation of the project. External evaluation teams are used for two reasons: accountability - only an external independent auditor can be considered to be unbiased - and specialist knowledge, which the internal implementation team rarely adequately possesses. It is common that both types of evaluation are used as complementary systems in international aid projects.

Typical internal evaluation consists of periodic reviews, supervision missions, or built-in systems of measurement and evaluation of project results against objectives, targets and values. The internal evaluation process functions more or less like a cybernetic system. The measurement of project impacts is frequently the duty of the implementation team even where evaluation is done by outsiders.

In summary, evaluation is the measurement of project impacts against project goals. Appropriateness normally relates to external, usually social, goals or policies. Evaluating appropriateness therefore studies external project impacts.

In order to fulfil their role in promoting economic, social and political goal achievement, forest industries need to be evaluated for appropriateness. This exercise could also be helpful to the entrepreneur since it has a longer time horizon than entrepreneurial decision-making, the latter focusing sharply on the immediate.

Specifying impacts and their hierarchical relationships is the core (or precedent) of evaluation. Many technological and economic impacts can be quantified. Additional study is needed especially for many of the legal, institutional, social or psychological impacts which, although non-quantifiable, must nevertheless be given importance equal to that of the quantifiable categories.

Impact measurement is being increasingly carried out during implementation and operations, as an early warning system designed separately for each project or assignment. Nominally, characteristics of appropriateness are studied together with other impacts of industrial activities, but social values are still mostly assigned on the basis of professional experience, skill and knowledge, with a degree of subjectivity always remaining in the evaluation.

#### 4. TECHNIQUES FOR THE EVALUATION OF APPROPRIATENESS

The following steps are taken by a team evaluating the appropriateness of forest industry:

- (a) Specify the problems, assumptions and approach of the evaluation sponsors: objectives/policy goals of each party for the industry or activity analyzed; assumptions and evaluation techniques; exercise timing; financing; and communications.

- (b) Identify relevant impact areas at the level of the industrial unit or project, the sector, the region, and possibly the national economy and society. Synthesize the impact/goal/activity system, showing interdependencies and their form, and isolating the measurable parameters and target groups, and describing the decision-making system.
- (c) Determine availability and value of impact data, the need for new measurements, and the precision/reliability of the data base, comparing with and without industry situations.
- (d) Evaluate appropriateness of the industrial unit, activity or project, through an impact tree or system model.
- (e) Synthesize alternative courses of action for optimizing the impacts of the industrial unit, activity or project, on the target areas, sectors and populations. Evaluate the expected impacts of following these courses and the effects of the changes.

Impact variables can be selected from e.g. the following checklist:

<u>Appropriateness category</u>	<u>Main impact areas</u>
SOCIAL AND PERSONAL VALUES	Health/safety/life span/infant mortality, skill levels and distribution, education, welfare and level of living, including distribution among social groups
ECONOMIC	Production in relation to supply and demand levels, synergy/competition with existing production, income and its distribution, employment and its distribution
INSTITUTIONAL	Policies and laws, traditions and customs, organizations, administration
PHYSICAL	Pollution/noise/landscape/conservation, serviceability of technology/natural resources

#### 4.1 Toward a Better Definition of Impacts

The broad impact areas outlined above are translated into very specific changes in project plans: reduce destitution in the target area and target population to below one per cent by the year 1987, etc. The impact areas and the characteristic traits of appropriate development efforts vary much from one environment - physical, social, cultural and economic - to another, and from one project to another.

In determining which impacts are to be considered in evaluation, it has been found helpful to systematically identify the first-order, secondary and possibly higher order effects/impacts, and then synthesize them into an operational model of strategic decision-making variables.

Evaluation has tended to concentrate on technical and economic impacts, but it is increasingly emphasized that impact specification and evaluation must be able to handle both quantitative and qualitative information.

A number of numerical assessment techniques have been devised. Straightforward economic and financial analysis is conventionally accepted and the understanding of, e.g., opportunity costs is improving. Quantification in commensurate terms is still difficult and it is therefore very important that all assumptions underlying assessments are clearly stated.

Qualitative evaluation techniques are less well developed. These include i.a. pairwise ranking; the Delphi method and other consensus processes; dimensionless scaling of impacts [beneficial, neutral, undesirable; or none, minor, significant, large; values (+ 0 - or 0,1,2,4 etc.)], possibly weighted; the decision-activity framework (decision trees, etc.), which is a mathematical model of the decision process; and policy capture (weight factors considered in decision-making).

#### 4.2 State of the Art

In both quantitative and qualitative evaluation work, the evaluators' judgements are still considered to be the best way to value impacts, because of insufficient agreement about objective values. However, the values of the evaluation team and those of the sponsors must be compatible.

The evaluator often has to decide how much is to be covered and in what depth and to assign weights to the target impacts. Ideally, the first phase should consist of a thorough clarification of these issues with the sponsoring agency and other parties, but an "organic" system has seldom been devised in practice, describing potential or existing relationships among the variables and parameters. Often even the evaluation framework, the logic underlying the study, is not made explicit.

The result is less fortunate. Because aid agencies or international organizations are all short of staff and funds, in relation to what they are expected to do, evaluations are judged more on the basis of "adequate but not excessive length of text, sufficient number of issues touched upon, and acceptable style," and "sufficient but not excessive criticism of the various project actors." In order to cope with accountability for problems turning up in evaluations, escape ways are identified: deficiencies in the evaluation methods, the evaluators or the evaluation data are not hard to find.

The current evaluation system is partly in numerical form - the financial analysis and its periphery, certain economic and even social analyses can be derived from its modifications; partly in logical form, such as time and locational considerations; partly in judgement form - this is good, that is unfortunate; and part is left for built-in escape avenues.

#### 4.3 Development Trends

Development will consist of at least the following parts:

- a professional breed of evaluators will develop, equivalent in specialization to economists, sociologists or social anthropologists, financial analysts, etc.;
- cooperating donor and recipient governments, international organizations, banks, consulting and research agencies and information services will develop their own evaluation systems, which will provide the feedback they need in the right form; the development of methods and techniques will

be coordinated by international bodies such as the Expert Group on Aid Evaluation of the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD/DAC);

- international aid projects will come under a monitoring, review and evaluation system, which is much more intricate than the present very (general and) informal one; this is made possible by the ease of following results through quantitative electronic monitoring and communication systems.

How quickly this development proceeds and how it is carried out, is not easy to predict. What is clear is that the past provides us with only part of the material for moulding project evaluation. A large part of this comes from theory, which we yet have to fully understand (in order to accept, use or reject it) and only a small part of which we have been able to put into practice.

The development of evaluation techniques has followed two rather separate paths:

- (a) Evaluators have been busy accumulating/compiling data and synthesizing them to fit the decision-making framework of project actors, including international organizations. They have not generally had the means to utilize adequately the theoretical basis developed, or adapt the formal tools available for their analysis.
- (b) Development research institutions and consultants have been employed by international organizations to create evaluation systems, methods and techniques (the evaluation framework and tools) for a more "rational", formalized process. This work has often been financed by bilateral development cooperation agencies or by research funding entities.

The interaction between these two processes has been slight, especially in the evaluation of social impacts.

#### 4.4 Social Impact Assessment

The social appropriateness evaluation of forest industries can draw much on experience from social impact analysis (SIA). This has developed in the industrialized countries in the last ten/fifteen years largely as a complement to environmental impact assessment. In its current form its preparation requires a lot of primary data. SIA can be understood as a study of social impacts in the broad sense, covering the non-monetary economic impacts (equity, employment), legal/political, institutional, and psychological impacts, and possible impacts on individual and social value systems. A set of typical impact categories for industrial evaluations is shown in Table 1.

Impacts can be identified by tracing them through chains or networks of logical causal relationships, or directly either from priority lists of the sponsors, or systematic checklists. It is considered important to place the impacts in a structural framework, even if these are directly identified. The selection of impacts for evaluation is a process which needs good judgement and an analysis of the impact structure, but also interaction between the evaluation team and the users of the results. Excessive categories will easily confound the issues; the process should, however, ensure that all significant impacts are evaluated. The impacts selected have to be assessable in meaningful

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Table 1

Social impact categories

1. Effects on population structure and geographic distribution: growth (movement and net birth/-death), age, cultural and/or ethnic group, family (single males or females only, or complete families), seasonality
  2. Accommodation: new construction growth rates and its distribution by types, persons per room, vacancy rates, prices/costs, rental
  3. Displacement of people and social economic activities: reallocation of land, changing job and skill structure, legal and economic considerations, employment and income level and distribution impacts, changes in the level and distribution of well-being
  4. Transport: communications infrastructure and rate of use
  5. Community growth, structure and institutional development, including informal, statutory and community-cohesion effects
  6. Community services: health, schools, power, water and sewerage, social services, recreation, culture
  7. Noise, air, aesthetic and water degradation
  8. Regional and local balance
-



quantitative or qualitative terms - magnitude, timing, groups or regions affected, etc.

#### 4.5 Economic Impact Analysis

The economic impacts of a change depend heavily on its profitability from the financial and economic point of view. Externalities may have stopped a change, but they have seldom been instrumental in causing it. It has become clear that quantitative financial and especially economic analyses have been based on numerous assumptions about the social input, output and institutional environment, which may not hold. Now techniques are improving. Many evaluations are also attempting at least a rough estimation of who will pay and who will benefit from the changes.

Economic analyses estimate the values and weights of cost and benefit impacts to society by e.g. shadow pricing, using opportunity costs to reflect the value of certain unpriced impacts, and adjusting the discount rate to reflect the time value of a certain cost and benefit stream to society. In principle, the social discount rate can be different for different items. In any case, it should reflect the rate of return to society from the best alternative use of the resources tied to the activity evaluated. Other economic impacts include product prices, which are likely to decrease if larger quantities enter the market.

#### 4.6 Employment Impacts

Employment and income multipliers, input-output tables and price/demand analyses, if available, should be used for estimating effects of these factors on society; the direct impacts are not sufficient.

Projects involving expansion usually employ additional persons. However, if the new industry is competitive, persons employed in other forest industrial units may lose their jobs as a result. Because of the centrality of the employment issue to the impact of forest industry, it can be studied under a separate "employment audit".

#### 4.7 Specific Techniques

The use of structural models for forest industrial activities, including simulation models (environmental impact studies are typically based on accepted models) helps to identify the impacts by major activity categories - forestry, industrial processing, distribution.

Time series analysis enables trend identification, and predicting the likely impacts and their significance in the social and economic environment of the operating industry with and without development. Trend analyses, even if corrected by relationships with several variables, assume that trends will continue on the basis of past relationships in one form or another. To a lesser extent, expert opinion techniques such as the Delphi method, are tied to past experience, but they can handle and weight far more complex structures. Tools also include impact relevance trees, cross-impact matrices, and decision analysis, based on checklists, published or communicated policy objectives, and strategy expressions by the sponsors of the exercise.

Scenarios of the results are helpful: inputs, outputs, impacts and the sensitivity of impacts to changes in the input/output levels and the forest industrial environment. Scenarios can be a very useful component of evaluating or appraising the social and institutional impact

of forest industrial projects. Scenarios can be presented in the form of descriptions of a future or alternative state of the industrial sector environment, or chains of events.

Expert judgements are often the most practical way of assessing technological appropriateness, but care must be taken that they are expressed in terminology understandable to the users of the evaluation.

#### 4.8 Data for Social Impact Assessment

In the measurement of social impacts, population trends and those of the gross domestic product and the economic structure are generally obtained from secondary sources; primary data collection is often based on surveys.

Survey results can often be improved by basing the work on ethnographic studies, which identify the social groups impacted by a forest industrial activity in a similar fashion. Differences in impact may be connected with cultural traditions (e.g. religion), social class, economic activity (basis of livelihood), etc. Data on the responses of each group are collected, studied to identify any patterns, and the existence and nature of such patterns, and interpretations of their significance, discussed with members of the groups, and compared to published information, experience, and theoretical expectations. The study often proceeds in an iterative manner; after the primary impacts and their levels have thus been assessed, a model of their interactions is constructed, and this is commonly also discussed with the representatives of the groups.

Secondary data from statistical publications, newspapers, maps, research reports, budgets and regional and sectoral planning efforts are an indispensable complement to the study. Whatever the manner, framework and assumptions are for the SIA data collection, they must be made explicit, in order for the results to be meaningful.

In thorough evaluations, the depth of the data base is often developed parallel to evaluation framework development, in an iterative fashion. This phased stepwise approach is often more cost-efficient than trying to do the whole thing in one go, but it requires a longer involvement of all parties in the exercise.

#### 4.9 Changes in Impacts and Content with Time

The aims, goals, objectives and targets set by the society and the forest industrialist, and often the impacts pursued, change with time.

One of the reasons for large differences in impacts and project values is the amount of time involved in seeing a project through. From the time that a mechanical forest industries' project is first heard of in an international organization, it takes at least three years, but often between five and ten years, before it has resulted in an operating mill. For pulp and paper projects, the time period tends to be several years longer. Some of the projects planned before the oil crisis, before the mini and micro-computers and in a completely different geopolitical or world employment situation, have yet to reach their target level of activities. Not only does the world economic, political, technological and social environment change rapidly, but major strides have been taken in the forest industrial sector as well. In these conditions, a major element in planned forest industries projects is flexibility. Fortunately the most expensive ingredients - the large machines and most of the structures - can be used in widely changing conditions.

The value relationships among impacts can change markedly as a result of forest industrial development. New availability of power and lower power costs in a community with a new industrial plan and improved roads or services, will change the importance of other aims. Changes in the relationship between monetary and subsistence income may also have drastic consequences in the target impact system and the values of its parts. Pitsawyers entering newly established industrial sawmills will see a new distinction between working hours and leisure, a new work situation, where personal independence in determining the pace and time of work is replaced by decisions of management or the working community. Social and educational goals are likely to change markedly, since status is no longer a direct result of the personal physical production, but also depends on specialized vocational and organizational skills.

#### 4.10 Definition of Scope

Evaluations have to be very clearly identified in scope, in order to ensure that the coverage in depth is adequate for a proper evaluation of the issues and the detail is not excessive or the problems too broad for definitive results - and action. The scope needs accurate definition of the local, regional and national level balance, the time, resource allocation and possible phasing, the first and higher order impact categories and their interrelationships, and the technological systems studied. The quality and quantity of data available have to be known in order to determine the additional information needed and the skill resources and time required for its compilation and synthesis.

The assumptions defining the limits of the problem and the manner of data compilation, analysis and synthesis have to be explicit. The results of the evaluation will have to be categorized so that they are in harmony with the requirements and categories of the sponsors, if they are to be meaningful. The process of ensuring this harmony includes agreeing explicitly on the forest industrial system studied, the impacts of the forest industries, the groups and institutions impacted, and the procedures and values used for analysis, synthesis, evaluation.

### 5. INSTITUTIONAL DEVELOPMENT POSSIBILITIES

The form of impact studies and evaluation, and their function, will need much further improvement in order to make them usable for assessing the appropriateness of forest industries. Developing the social impact framework is probably the highest priority task in this field. The OECD/DAC Expert Group on Aid Evaluation is moving slowly but steadily in this area. It does not, however, cover the needs of forest industries directly, and a separate effort may be required by e.g. the FAO Forestry Department to adapt the framework for sectoral use. After the impact framework has been adequately developed - conceived and tested - it should be usable as the core for evaluating many international aid projects. The evaluation process will, however, continue to depend on the combined expertise of various institutions, specialized in the component inputs required.

It is possible that the cross-sectional expertise needed for sectoral evaluation cannot be developed to an acceptable level of sophistication by any of these organizations individually. Inter-organizational cooperation will be required at least in the early stages.

Some form of impact data collection and measurement will probably be incorporated into the implementation of forest industries' projects. This work is analogous to that of keeping project accounts.

Evaluation will still be the task of independent teams, conceptually analogous to the task of auditors. Once the impact accounting systems have been developed, a combined system of management evaluation (internal auditing) and accountability evaluation (external auditing) can provide the project parties with a sound basis for subsequent action.

The utilization of appropriateness evaluation results in the forest industries' sector has to be carried out at several levels: the bodies responsible for managing the forest industrial activities evaluated, those planning new activities, such as projects, and the bodies responsible for the political guidance of these organizations. Further work appears to be needed for ensuring that the results are effectively utilized. One way is to improve the formats and contents of abstracts and/or reports on the highlights of the findings. The use of the evaluation results is often planned already in the project document.

It is apparent from discussions with bilateral and international organizations that two depth categories of evaluations are needed: one, which is rapidly done, concentrates on simple but well thought-out indicators of appropriateness and other dimensions of worth, and the other, which is broad and deep, and thoroughly analyzes and reliably evaluates project impacts and characteristics in relation to the objectives set and effects desired. There can, and should, be many of the former type, and relatively few of the latter. The in-depth evaluations should concentrate on types of projects or forest industrial activities which frequently recur.

REFERENCES

- Alänge, Sverker, et al. Transfer of technology through small-scale  
1981 sister industry agreements. Two years later. Tanzania 1980.  
Technology Transfer Series NO. 80-01. Institute of Development  
Management, Chalmers University of Technology, University of  
Växjö, Göteborg. 64 p.
- Bundesministerium für Wirtschaftliche Zusammenarbeit. Cross-section  
1984 analysis of the evaluation activities of the Federal Ministry for  
Economic Cooperation (BMZ) in 1983. Report 230-E 7110-340/84.  
Evaluation Unit, Bonn. 31 p.
- Coates, V.T. & Fabian, T. Technology assessment in industry: A  
1982 counterproductive myth, technological forecasting and social  
change 22(3&4):331-341.
- Douglas, James J. A reappraisal of forestry development in developing  
1983 countries. Martinus Nijhoff/Dr. W. Junk Publishers. The Hague.  
178 p.
- Elzinga, Aant. Evaluating the evaluation game: On the methodology of  
1981 project evaluation, with special reference to development  
cooperation. SAREC Report RI:1981. 71 p. Swedish Agency for  
Research Cooperation with Developing Countries, Stockholm.
- Finnish International Development Agency. Evaluation - approach and  
1983 practices. FINNIDA, Helsinki. 4 p.
- Hill, Roy. Today's thorniest management problem: New technology.  
1984 International Management 39(12):58-65.
- IIASA. Systems assessment of new technology: International perspec-  
1978 tives. Excerpts from a IIASA Workshop, 18-22 July 1977. Edited  
by Dobrov, G.M.; Randolph, R.H. Rauch, W.D. CP-78-8.  
International Institute for Applied Systems Analysis, Laxenburg,  
Austria. 92 p.
- NORAD. (Evaluation Handbook). NORAD, Oslo. 49 p. (In Norwegian).  
1981
- OECD. Social assessment of technology. A review of selected studies.  
1978 Organization for Economic Co-operation and Development, Paris.  
290 p.
- OECD. Assessing the impacts of technology on society. Organization  
1983 for Economic Co-operation and Development, Paris. 80 p.
- Overseas Development Administration. The lessons of experience:  
1983 Evaluation work in ODA. ODA, London. 12 p.
- Porter, Alan L. et al. A guidebook for technology assessment and impact  
1980 analysis. North Holland Series in System Science and  
Engineering, Vol. 4. North Holland, New York and Oxford. 510 p.
- Sharif, M.N. & Sundararajan, V. A quantitative model for the  
1983 evaluation of technological alternatives. Technological  
Forecasting and Social Change 24:15-29.

- Sharif, M.N. & Sundararajan, V.      Assessment of technological  
1984      appropriateness: The case of Indonesian rural development.  
            Technological Forecasting and Social Change 25:225-237.
- Swedish International Development Agency.      (Methods manual. Methods  
1983      for preparation, implementation and evaluation).      SIDA,  
            Stockholm. 14 p. (In Swedish).
- United Nations.      Systematic monitoring and evaluation of integrated  
1978      programmes. A source-book. U.N., New York.
- World Bank.      Operations evaluation. World Bank Standards and  
1979      Procedures. Second Edition. World Bank, Washington, D.C. 25 p.

RURAL DENDRO-ENERGY PROJECTS

by

EKONO Oy

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## 1. INTRODUCTION

Dendro-energy means literally a source of energy which is based on the combustion, in one form or another, of wood-fibres, possibly man's oldest energy source besides solar heat. Still today, roughly half of the wood harvested is used to cook food, heat houses and to produce energy for manufacturing. When modern ways of life, with their advanced energy requirements, enter even the remotest villages of developing countries, new approaches to utilize the available wood energy resources are called for. Dendro-energy has the tremendous advantage of being renewable. A sustained energy source can be provided for almost any village if the wood resources are properly managed.

## 2. NEED OF ENERGY

Cooking of food is the most common, and the most important need for energy. On an average 2 m<sup>3</sup> of wood are annually required per caput. In many areas, charcoal is used instead of wood because it is easier to control its heat release rate. In addition charcoal is considered to be a "clean" fuel, when compared with direct wood burning, and it does not deteriorate easily in storage. The disadvantage of charcoal, however, is the poor conversion efficiency from wood to charcoal. Primitive charcoaling methods generally yield only 5 to 10 percent of the weight of wood in charcoal, or 10 to 15 percent of the original calorific value of wood. This results in an extremely high pressure on wood resources in many areas.

Electric power consumption grows in step with the arrival of modern amenities into rural villages, and the gradual integration of the isolated family village-based economy with the rest of the nation. Electricity demands can be looked at in more detail, in order to better understand the issues. It can be classified into three categories - household, institutional and industrial demand - which have different load characteristics and financial capabilities to cover costs.

Households traditionally start using electricity by acquiring a few light bulbs, which are lit during the evening hours. For the rest of the day, the load is zero. The next steps would be to purchase a refrigerator, a TV set and, in tropical climates, cooling fans. The refrigerator and the fans will load the power distribution network evenly throughout the day. The TV set doubles the evening load. As this electrification of households gets off the ground, the load increases very rapidly, particularly in the first five years. This fact has to be kept in mind when establishing the distribution network.

Institutional use of power is most commonly tied to schools, hospitals and other government supported entities. Irrigation schemes may also constitute a substantial baseload for the system. These loads are more evenly distributed over the day. There are also some possibilities for load shedding during peak demand hours, such as cutting off the irrigation pumps. An advantage of these types of consumers in a rural electricity system is that they bring revenues which are not entirely paid for by the household.

Industrial users of electricity are desired since they can create a substantial baseload for the system. They can adjust their load to a certain extent according to the needs of the power distribution system, if proper incentives are structured into the tariffs. These



users - sawmills, flour mills, cold stores, etc. - normally generate revenues from exporting their services or products, and in fact bring fresh money into the community.

To summarize the design features of electricity supply in rural areas, it is essential to have the consumers which would guarantee an evenly distributed baseload for the local power generating and distribution system which is to be established. Regardless of the baseload, there will be quite a high peak after sunset. The other fact to remember is that demand will grow rapidly after the system has been constructed. Economic development of the area, however, will affect the rate of growth.

### 3. ALTERNATIVE SOURCES OF ELECTRICITY

The most usual power sources for rural villages are small hydropower plants, diesel generation sets, or steam engines at a local industrial enterprise. Hydropower plants produce cheap energy, after their high initial cost has been overcome. They are however often vulnerable to low rainfall and its seasonal variation. Normally they can adjust well to the load provided that there is enough reservoir capacity upstream. Man-made civil structures are the most expensive part of the hydropower plant and they should be kept to a minimum, but not too small so that they limit the operability of the plant. A long transmission line is often required, which is also a drawback.

Diesel generator sets are very well suited to these varying levels. Many types and sizes are available, from 5 KW sets to 10 MW large units. The prices vary from US\$ 300 to 600 per KW. Small engines use light fuel oil. Starting with 500 KW units, heavy residual oil models are available. These diesel engines are quite reliable. The after sales service is relatively well established, as there are many units in operation. The main drawback is the cost of fuel, since in many cases fuel has to be imported.

Steam engines used by industry are often fueled by wood waste. A final solution in rural electrification would be the integration of the local distribution network with the national transmission system as the loads grow. The national system may be able to utilize local fuel or hydro resources and transfer this power to remote villages.

### 4. LOCAL NEED OF CASH INCOME AND THE NATIONAL ECONOMY

There is an acute need of cash earning possibilities in rural villages. A dendro-energy project could be an instrument to create employment opportunities and, through these, cash income to large numbers of the rural population. Savings in expenditure on imported fuel oil may be redirected to local production of fuelwood. This would reduce foreign currency payments and direct the money to the rural poor. These benefits of dendro-energy would be enjoyed nation-wide in rural villages as well as in crowded cities. The additional rural employment opportunities would tend to reduce migration from rural areas to large cities. The reduction in the fuel oil import bill could make it possible to reallocate foreign currency for development projects, or to keep the country's debt at a reasonable level.

## 5. PREREQUISITES FOR DENDRO-THERMAL ENERGY

The most critical ingredient in dendro-energy projects is an uninterrupted fuel supply. This can come from various sources: forest residues or wood waste from an existing forestry operation, or from a plantation exclusively established for this purpose.

### 5.1 Forest Residues and Non-merchantable Wood Waste

A natural source of wood fuel is the residues from an industrial operation such as sawmilling, or veneer and plywood manufacturing. The wood has already been transported to the plant, where it can easily be used as fuel since it has to be disposed of anyway. The plant operator "owns" that waste and he would normally use as much of it as possible to reduce his fuel bill. The rest is normally for sale. Part of that wood fuel is quite difficult to handle, as it is dry and powdery: sawdust, or sander dust. Another difficult part is bark, which can be excessively wet, contain sand and clay, or be hard to reduce into small pieces (eucalyptus). These should be used directly at the plant. Slabs, veneer trimmings, lily pads, etc., would be much more ideal to sell.

Much wood is left in the forest in commercial harvesting. Often only a quarter or less of the stemwood volume in humid tropical forests is merchantable, and even in plantations some residual stocking of trees is left after commercial harvesting. The residual stand can often be used for fuel. If other parts of the biomass, especially the crowns, were recovered, the amount of residual wood for fuel would be considerable.

Harvested areas of natural forests are seldom productive after the best trees have been removed. This removal process considerably damages the remaining stand. The trees left are not merchantable for sawmilling, veneer or plywood manufacturing. The areas should be cleared for planting and this process will yield a lot of wood fuel.

Plantations differ from natural forests in that no complete trees are left, only tops, branches and twisted pieces which are not acceptable for industrial use.

In exceptional cases, clear-cutting of an area for farmland or some other purpose, such as for a water reservoir, can yield wood fuel for a certain period of time.

### 5.2 Sustained Supply of Wood Fuel

Special plantations to produce wood exclusively as a permanent source for fuel can guarantee a continuous, uninterrupted supply close to the consumers. Some fundamental prerequisites must be known for establishing successful wood fuel plantations and these include the following:

#### 5.2.1 Availability of land

Sufficient and suitable land must be available for plantations at a reasonable distance from the point of utilization. The following comparisons illustrate the net land area requirements to produce a unit of fuel or electrical energy, based on the assumption that wood production varies from 5 to 25 bone dry tons (BDT) per hectare per year:

- (a) the amount of power generated by one metric ton of fuel oil per year can also be generated by wood from 0.1-0.5 ha of plantations;

- (b) in order to produce 1 000 kWh of electric energy per year 0.05-0.3 ha of plantations is needed;
- (c) in order to generate one ton of steam per hour at an efficiency of 75 percent, for eight hours a day, 15-80 ha of forest are necessary. For the minimum practical base-load (4 t/h), 60-300 ha are needed;
- (d) a wood supply from 15-80 ha of plantations is needed at a 40 percent load factor, and from 30-160 ha at an 80 percent baseload to satisfy the requirements for 100 kW power generation.

The land area requirements depend on many factors which will be discussed later in this paper in more detail. The most important issue is the mean annual increment of wood, i.e. annual growth rate per hectare.

It is important that there is no conflict between food production and fuel plantations. Food production is a top priority for all prime land. Grazing of cattle may also compete for the same areas. If intensive wood fuel production is envisaged that area would not be available for grazing. Grazing would destroy the young seedlings in the beginning, and later the growing trees would suppress all grass.

It is also important that the area for wood fuel plantations be available at minimum or no cost. Fuelwood plantations cannot support major compensation for land. In many cases, the existing forest stand has been cut, and the land is not used for any other purpose. Such areas would be ideal.

Topography is important especially where mechanized harvesting is desired: steep ravines or slopes would be a major problem for operating and transport, which are of course easiest in flat unbroken areas. Modern machinery can operate on slopes of up to 25-30 percent. Ravines and streams would split the area into compartments, more roads would have to be built per net hectare and more work would be needed for transporting products and machinery. In some actual cases, 50 percent of the area has been used for mechanized wood fuel production, and manual, labour intensive methods have been utilized on the steep slopes.

#### 5.2.2 Climatic conditions

The degree of success of an energy plantation project depends greatly on climatic conditions. There should be enough rainfall in relation to evaporation. If annual precipitation is less than 1 000-1 500 mm, the yields will not be as large as with ample rainfall of say 2 000 mm. The annual distribution of rainfall is also important. The length of the dry season, the severity of rains, and the incidence of frosty mornings and gale winds, are all factors to be considered when planning an energy farm.

#### 5.2.3 Infrastructure

The infrastructure of the energy farm area has to be ready or close to readiness for the new development. The items to be considered include, among others, the road network, bridges and their bearing capacity, the existing fuel supply and distribution systems - power generation systems and power lines - repair shops and spare parts suppliers, schools, medical services, banks, Government offices, etc. All these factors together form the particular environment which determines the nature of investment.

#### 5.2.4 Human resources

Employment is one of the key elements in wood energy projects. There will be new possibilities for work close to rural villages. Part of the work is for the entire year, in harvesting or in the management of plantations. Other employment consists of part-time jobs, e.g. in the establishment of the plantations or sometimes in harvesting, often dovetailed with local agricultural work. Harvesting normally has no fixed seasonal timetable, but planting is more related to seasonal variations of local weather. The need of labour will vary from one project to another, but problems in getting the required unskilled labour force are infrequent; it is often more difficult to find the key persons with the required education or skills to manage the programme and to operate and maintain the equipment.

Table 1

Approximate manpower requirements for wood supply in largely manual, and in mechanized operations, under typical tropical conditions

Operation	Manual Man-years/1 000 BDT*	Mechanized
Production of planting stock	10	5
Plantation establishment	10	3
Plantation management	10	5
Harvesting and transport	6	3
Other	2	1
Total	38	17

\* Bone Dry Ton of wood

The organization or financial entity which will carry out the project could have many forms: if people in the area like to use and are familiar with cooperatives, these should be supported by a strong higher level organization to provide the local cooperative with technical, managerial and financial back-up. Another institutional solution is that the national government or a national non-profit organization implements the project. This should be considered when the local people lack the necessary capability to organize the project. It is still of utmost importance to get the local people involved in the energy farm activities, to see it as a way to raise their level of living.

#### 5.2.5 Availability of funds

The investment in new energy farms and wood-fired boiler plants or power plants is substantial, from the beginning of the project, and the financing alternatives have to be studied in detail. They may include low interest loans from international development banks or

national development funds, channelled through the national government or other national agencies in a manner which takes into consideration the high initial costs, the growing demand for electricity, the possible low returns during the first years of operation, etc. The financial scheme should be adequate for overcoming the initial high interest and operating costs.

## 6. TECHNOLOGICAL FEATURES OF FUELWOOD PRODUCTION

### 6.1 Tree Species

There are many promising tree species suitable for the production of wood fuel, and which will yield high quantities of dry biomass per hectare. The energy content per dry kilogram of wood does not vary much among the species. Normally the heating value is around 16 to 18 MJ (Mega Joule) per kilogram of bone dry wood, deducting the heat needed to evaporate the moisture in green wood (50% moisture). In the selection of species for an energy farm, it is not advisable to have species which accumulate silica, or are of low density making the processing expensive. Even though maximum mass production per hectare is aimed at, the trees would need to have relatively well developed stems, and the stems should be straight. Currently some of the most promising tropical species are the giant ipil-ipil (Leucaena leucocephala), and various Acacia and Eucalyptus species.

There has been a lot of enthusiasm over ipil-ipil. It does well at low elevations (under 500 m above sea level), on non-acidic, deep soils, and on sites where its poor resistance against heavy winds is not a problem. The giant ipil-ipil's benefits are high growth rates - up to 100 m<sup>3</sup>/ha/a (50 bone dry tons) - ability to fix nitrogen, produce leaf meal to be used as fodder for cattle and ability to regenerate coppicing.

Acacias and eucalypts often grow well on poor soils, and much experimental work is being done to find the best species and their seed sources. It is important to get the best seeds from the best sources in order to guarantee good growth. There are twenty or so different clones of giant ipil-ipil and only a few of those are really good performers. The seeds will have to come from a source within the same climatic zone.

### 6.2 Seedling Production and Plantation Establishment

After the seeds are procured, they can be used for seedling production in a nursery or for direct sowing, distributed to individual farmers. Planting seedlings is often preferred over sowing in order to ensure a fast start. Strong nursery-produced plants can more easily compete with the existing grass and other vegetation than the seedlings grown from seed on site. Only in those cases, where the soil can be well prepared and/or competition from other vegetation can otherwise be minimized or eliminated, sowing can be considered. Sowing is cheaper in the beginning, but much work is needed thereafter to convert the site into a fast-growing high yield energy plantation.

A central nursery can provide good seedlings at the right time, which means that in seasonal tropical climates, seedling production often takes place during the dry and hot season. The best time to plant is at the start of the rainy season, which would guarantee sufficient moisture for the young seedlings. The nursery period requires artificial watering as well as shading.

In the tropics, the use of barerooted seedlings for wood fuel plantations has gradually been replaced by the use of potted stock. Potted seedlings are generally stronger and easier to handle, although the weight per plant is higher than for barerooted stock. There are various pot systems starting from plastic bags or tubes to complete potted seedling production systems. The potted seedlings often survive better in the hands of inexperienced planters, as they can withstand longer exposures to the sun.

In the preparation of plantation areas, the existing brush or grass can be used for energy generation, or it can be slashed and burned on the site prior to planting. Strong grasses can even be suppressed by a crusher mounted on a farm tractor. If the soil is compact, it may have to be cultivated in order to get air to penetrate to the rooting zone. For acidic soils, liming is recommended to adjust the pH values closer to the optimum for high yields. The same applies for fertilizing: a small amount of fertilizer during planting can increase the growth rate during the critical first months.

Wood fuel plantations are normally dense, 5 000 to 20 000 seedlings per hectare, which means a spacing of 1x2 to 0.5x1 m; usually the best results are achieved by planting 5 000 to 10 000 seedlings per hectare. Harvesting technology should also be considered when determining spacing, especially if a mechanized system is envisaged.

#### 6.3 Plantation Management

After establishment, the energy plantation needs tending and guarding. The growth of the grass has to be suppressed by weeding. Especially during the dry season, fires are frequent, and they can be reduced or eliminated by fire-breaks between blocks, or by organized fire control with manned watch-towers and fire-fighting crews. Fire-breaks can either be open spaces with roads or dense, 10 to 15 m wide bush-like rows of fast-growing hardwoods.

Fuelwood monocultures require the control of diseases or pests. Immediate action may be required to limit damage to a minimum. This work needs support from an organization which has the necessary know-how in this particular field.

#### 6.4 Fuelwood Harvesting and Transport

The time from plantation establishment to fuelwood harvesting is often only four to seven years. Harvesting methods for energy crops are those suitable for material which is small in diameter and even-sized. Manual systems or light harvesting machinery can be used. The degree of mechanization depends on the volume of production and on local conditions such as topography, need for employment opportunities, etc. The wood can be harvested and transported to the utilization point in many forms, from whole trees to chips made in the woods or at the roadside, in short logs, etc.

For small volumes, farmers can use axes or saws to fell the trees. The delimbed stems are then either carried to roadside or hauled by animal power. Large volumes need more mechanization: felling and delimbing by chain-saws, and transport to roadside or to the final point of utilization by a farm tractor, forwarder or skidder. In extreme cases, winching can be used for steep slopes, but this considerably increases harvesting costs. Often the best solution is to use ordinary farm tractors whenever possible, as the local people are more familiar

with operating and maintaining them than special harvesting equipment. Mechanical hoists are preferred over hydraulic ones as they are simple and easy to maintain.

Trucks move the wood from roadside storage to the utilization point, where the distance is more than 5 to 10 km. A farm tractor-trailer combination can be used effectively for short distances to take the wood all the way from the stump to the user, especially when the roads are not of the best.

For harvesting of residual forest stands, clear-cutting of logged-over areas, equipment is required similar to that used in the original harvesting of merchantable large diameter trees.

The timing of harvesting and the need for intermediate storage are determined by local factors, such as the severity of the rainy season and its effect on the wood fuel supply, non-availability of labour during the peak of agricultural activities, etc.

## 7. CONVERSION OF WOOD TO STEAM OR ELECTRICITY

### 7.1 Wood Fuel Processing and Storage

The wood fuel used is either in the form of small sized logs for small, manually infed installations, chips for mechanically fed facilities, or slightly larger blocks for gasifiers or charcoal kilns.

Logs can be hauled to the user in the final form from the forest. Chips and blocks can be produced in stationary chippers or splitters at the plant, in the plantations or at the roadside. These stationary facilities normally have a high capacity and low power requirement; electricity can be used instead of diesel oil. They also produce a homogeneous quality fuel which flows easily through the system. The use of mobile chippers in the plantations is justified in some cases to increase the overall recovery of wood fuel.

Storage for at least one week's requirements has to be available at the boiler to guarantee an uninterrupted fuel supply. The storage volume should be roughly ten times the size of an oil tank with the same energy content.

There has been a lot of discussion on the merits of drying wood fuel prior to feeding into the boiler. It is clear that the recoverable energy increases and the combustion equipment can be simplified as the moisture content is reduced. However, natural air drying, between felling and delimbing or in transport and storage, should be enough to reduce the maximum moisture content to 40 percent of the green weight. Artificial drying combined with a boiler plant is so complicated that it is not advisable for small installations. In some large installations drying may be feasible to increase capacity and performance.

### 7.2 Steam Boilers

To raise steam in small amounts, say up to 5 t/h at relatively low pressure below 15/20 bar, an ordinary fire-tube boiler equipped with a prefurnace is the best and cheapest solution.

If manual infeed is used, the prefurnace can be a simple Dutch oven type refractory-lined box into which the wood fuel is delivered. It has to be stopped for ash removal once or twice a week. It is easy to

operate but its control characteristics are not the same as those of an inclined grate. In order to have a continuous operation an inclined water cooled grate is recommended. Ash can be removed manually during operation. The fuel has to be taken higher up to a chute which feeds the grate by gravity. The boiler load is controlled by induced draft fan inlet vanes or dampers.

If the capacity requirements become more sophisticated, some modifications may be adopted.

Power generation requires relatively high operating pressures in the boilers in order to get good overall heat rate efficiency. This means the use of water-tube boilers instead of fire-tube types. The combustion equipment can be placed directly under the furnace. As the pressures are raised, the requirements related to the quality of feedwater become more stringent. This may affect the overall operation of the boiler plant more than any other factor. Poor water quality results in undesirable deposits on the watersides of tubes, which gradually result in the overheating and failure of that tube. In that respect, a fire-tube boiler could be much more risky than a water-tube boiler. However, although the pressures are lower, this does not mean that an explosion would cause less damage but that the boiler accepts more readily hard water than it does higher pressures. The industrial world went through this experimental period with boilers about 80-90 years ago and, as a result strict pressure vessel codes and water treatment regulations were adopted. For rural areas, the preparation of feedwater can be done using evaporators, instead of adopting processes which require imported chemicals.

This would solve the problem of operating the plant without proper water treatment. Besides the feedwater quality requirement, it is important to have a continuous water-supply in the case of loss of power. Every boiler should have a feedwater tank full of de-aerated water, sufficient for 60 minutes' operation, and there should be a feed pump which draws its driving power directly from the boiler (steam engine or turbine).

The most acute air pollution problem created by a wood-fired boiler plant is due to particulate emissions. These can in most cases be controlled by a multi-cyclone arrangement. Sulphur is not released, since wood does not contain significant quantities of that element. NO<sub>x</sub>-formation is reasonable, as the combustion temperatures are relatively low (1 000-1 200 °C) due to the inherent process moisture, and the high availability of excess air. Carbon monoxide can be emitted occasionally if the air flow to the combustion zone is not sufficient.

The boilers should basically only use wood as fuel. It has to be carefully studied whether supplementary oil-firing equipment is needed. The combined firing of oil and wood results in residue build-up on the boiler surfaces, especially superheaters or the tubes in the second or third pass of a fire-tube boiler.

Generating power by using a steam turbine or a steam engine is a safe way of converting wood energy into electricity. However, the overall efficiency is poor for small units of say 100-1 000 kW. This is attributable to the combined effect of many factors, for instance low overall system efficiency due to fairly low steam pressure and temperature, and the poor expansion efficiency of a single wheel turbine or a steam engine. Technically, it is possible to have a higher systems performance, but the cost of the equipment would be excessive. The following efficiencies can serve as guidelines:



<u>Unit Size</u> <u>kW</u>	<u>Efficiency</u> <u>%</u>	<u>Fuel Consumption</u> <u>kg bone dry wood/kWh</u>
500	15	1.5
5 000	27	0.9
10 000	22	0.8

The availability of fresh water is a vital prerequisite for condensing power generation as it is needed for cooling, 200 m<sup>3</sup>/hr/MW for straight cooling; a cooling tower would need 5 m<sup>3</sup>/hr/MW as make-up to cover the evaporation losses.

If there is a need for low pressure steam for the drying of wood or any other material, the best alternative is to have a cogeneration facility. The efficiency is over 70 percent, which means that only about 0.35 kg of bone dry wood is required to generate one kWh of electricity.

### 7.3 Wood Gasifiers

Gasification has been intensively studied during the last few years. Old designs have been dug out and new materials used to build fixed bed gasifiers, or totally new circulating fluidized bed technology has been developed. Combined with a diesel engine this approach is ideal for building a small wood-based power plant. Wood, a high volatile content fuel, is easy to gasify, and it does not have too much ash which would cause operating problems. For small installations fixed bed gasifiers are cheap and simple to operate, although they need normal tending. The infeed of fuel and the removal of ash interfere with gas production, but this cannot be considered critical in small installations. By using a set of two or three gasifiers to feed one diesel engine, the problems can be overcome. The smallest available unit using circulating fluidized bed technology generates around 2 MW of electrical power.

A gasifier itself has a very high efficiency of around 90 percent. The losses are mainly caused by radiation and the unburnt material in the ash. It produces gas at a high temperature, 400-800°C, depending on the design.

This gas can be used directly for example in an oil-fired boiler, to replace fuel oil. Provided that the wood fuel has a low moisture content, the capacity of the boiler remains almost the same.

For use in diesel engines the gas has to be cooled and cleaned of abrasive particles. Small units up to 50-100 kW can use air-cooled systems with fabric filters. Larger units have to be designed to use water coolers and a wet scrubber. About one-third or one-quarter of the wood energy has to be dissipated into the atmosphere depending on the actual design. A considerable amount of fresh water is needed for this purpose and it picks up some contamination in the process.

To use this gaseous fuel the air intake system as well as the fuel injection system of the diesel engine will have to be modified. They can be dual-fuel operated, which gives considerable flexibility in operation. When operating on wood gas, about 5 percent of the total fuel input has to come from fuel oil for igniting the gas.

The overall thermal efficiency of these gasifier-fueled diesel engines is competitive. A 500 kW unit has almost the same thermal efficiency as a ten times bigger wood-fired condensing power plant: about 1 kg bone dry per kWh. Large units have the same heat rate, or possibly slightly better, than the steam cycle based units.

#### 7.4 Economic Comparison of Dendro-Thermal, Coal and Oil-Fueled Power Plants

In order to provide a rough financial and economic basis for estimating the suitability of wood-based power plants for rural areas, the data shown in Table 2 have been extracted and summarized from the EKONO power plant cost file. The figures are of course only indicative, since conditions vary greatly among regions and localities. The annual operation time at full load has been estimated at five thousand hours. The costs represent the 1984 fall level.

It can be seen from the table that the costs of generating electricity on the basis of wood fuel is roughly the same as for plants using coal. For plants fueled with heavy fuel oil, investment costs are lower, but the cost of the power produced is higher, at the assumed fuel prices. The cost of wood is lower, if industrial residues are used. The cost of other fuels will vary depending on the country, transport costs, etc.

#### 7.5 Concluding Remarks on Planning Dendro-Thermal Power Plants

To summarize the conditions required for the viability of these small wood-based power plants, the following features should be kept in mind:

- (a) There should be enough load to get a baseload type of operation.
- (b) Sufficient technical expertise must be available to support the introduction of the relatively advanced technology to rural areas.
- (c) A financial supporting activity, which would increase the attractiveness of the venture, could be the purchase of excess power by a government-controlled power generating authority, in case the system can be connected to a larger distribution network.

### 8. EXPERIENCE OBTAINED FROM DENDRO-ENERGY PROJECTS

The following information is based on experience gained from two dendro-energy projects in the tropics, one in the Philippines and one in Tanzania.

#### 8.1 Philippines

Studies were carried out in 1980-81, consisting of evaluating the feasibility of producing silvicultural biomass for energy (power generation, alcohol production, or for charcoal production on an industrial scale). These end-uses dictated that mechanized harvesting systems be used. The processing plant was envisaged to be located on the coast of the South China Sea, about 25 km from the plantation. The plan called for tractor or forwarder haulage of wood to the roadside, and then truck transportation to the plant. In order to increase the land area available for wood fuel production some winching from steep slopes was found to be viable. The cable winching distance was limited to 50-100 m.

A 6 000 ha area had been made available to the Manila Seedling Bank Foundation, a non-profit organization established to utilize advanced nursery technology in the Philippines on the Bataan Peninsula

for the production of wood fuel. The area is hilly with deep ravines, and at the time it was covered with grass. Various methods to suppress the grass were experimented with, as well as cultivation methods. Mainly giant ipil-ipil was planted at various spacings. The many ipil-ipil plantations around the Philippines were also visited and measured, in order to establish predictable growth figures for this species. Based on these measurements, 25 bone dry tons of wood fuel per hectare a year was considered to be a realistic growth rate for the area. Systems for harvesting the wood crop were studied. The area with deep ravines could, however, not be used for economically viable fast-growing trees, and only about half of the area was found suitable for mechanized short rotation wood production. The inaccessible slopes were planted with slow-growing, high value mahoganies.

Conceptual engineering for the processing plants was carried out, in order to establish their operating and capital costs.

The overall financial and economic viability was calculated with a view to obtain an idea of the competitiveness of wood-based energy. The internal rates of return listed below show how wood-based energy from the project compared with other possible sources of those energy products:

<u>Product</u>	<u>IRR %/a</u>	<u>Compared with</u>
Electricity	10 %	Oil-based condensing
Alcohol (99 %)	10-20 %	Oil-based ethanol
Charcoal (metallurgical)	14 %	Export price

No industrial development has so far taken place but the area has been planted and the first plantations are ready for harvesting. The wood is sold to nearby industrial plants as fuel to replace oil in their boilers. The project in that respect has proven to be a success.

In the Philippines, the National Electrification Administration (NEA) has an ambitious plan to construct 70 dendro-thermal installations from 3 to 5 MW each in rural areas by 1987. However, it has so far ground to a halt, after encountering difficulties in obtaining wood for the few completed facilities. The wood is supposed to be supplied by cooperatives and private farmers from 1 100 ha of which 1 000 ha are managed by private farmers and the rest is taken care of by the cooperative. Sowing is the method mainly used to establish those plantations. Recently new efforts by the Government and the U.S. Agency for International Development have been announced to reforest wasteland, in order to make the plants operational.

## 8.2 Tanzania

Southern Paper Mills Inc. has constructed a pulp and paper mill in Mufindi which is expected to commence operating in the second half of 1984. The wood supply of the mill is based on pine plantations established in the late sixties. The mill assumed that it had secured the supply of balancing fuel from local coal mines. The original mill had been designed accordingly. Gradually, it became evident, however, that local coal would not be available by the time the mill would start operating. Investigations were carried out to modify the existing 60 t/h coal-fired boiler for wood firing, and explore the potential of utilizing either forest residues as fuel, or establishing fast-growing tree plantations for fuel production. It was found that the boiler could

be converted to wood firing at marginal cost. The construction of wood fuel receiving facilities would also be needed. The wood supply alternatives were explored and it became clear that starting fuelwood plantations from scratch at the mill's back door would be more costly than utilizing logging residues. A system was, therefore, devised for collecting the tops, branches, cones and other logging residues, chipping them in the plantations, and then hauling the chips to the pulp mill.

Table 2

Typical investment and electricity generating costs and manpower needs,  
of plants of various types and sizes, and using different fuels

	Condensing Power Plants				Diesel Power Plants			
	10 - 15 MW	20 - 30 MW	5 - 10 MW	25 - 35 MW	10 - 15 MW	20 - 30 MW	5 - 10 MW	25 - 35 MW
	Coal	Oil	Wood	Oil	Coal	Oil	Wood	Oil
a. Investment Costs US\$ Million/MW								
Plant	0.58	0.55	0.45	0.50	0.48	0.40	0.43	0.38
Civil Works	0.15	0.13	0.10	0.13	0.12	0.09	0.20	0.10
Project Costs	0.08	0.07	0.05	0.07	0.07	0.05	0.07	0.03
Total	0.85	0.79	0.63	0.74	0.70	0.57	0.74	0.56
b. Power Costs <sup>2)</sup> US\$/MWh	41	40	67	39	37	66	45	55
c. Number of Personnel <sup>3)</sup>	44	40	30	48	44	32	30	8

1) Heavy fuel oil

2) Includes investment and operating costs. The cost of oil is estimated at US\$ 215/t, of coal at US\$ 54/t and of wood at US\$ 30/BDT.

3) Personnel requirements are estimated for developing countries during normal plant operation.

A CASE HISTORY OF THE ARACRUZ  
PULP MILL PROJECT IN BRAZIL

by

Jaakko Pöyry Oy

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## 1. INTRODUCTION

In order to put this case history into perspective and to give an understanding of what was involved, we will begin with a brief description of the Aracruz Pulp Mill Project as it stands today, followed by a short introduction to the economy of Brazil in the mid and late seventies.

Now, in its sixth year of operation, Aracruz Celulose has an annual output of 460 000 t of bleached eucalyptus pulp, mainly for export. In 1983, around 83 percent of the mill's output was sold to foreign exchange in excess of US\$ 130 million. Located on the coast of the state of Espirito Santo in south-east Brazil (Figure 1), the enterprise is an integrated project with forest, pulp mill, chemical plants, port, and residential community where part of the 6100 employees live.

The total investment outlay to the project at the time of start-up in 1978 was some US\$ 616 million:

	<u>US\$ million</u>
- pulp mill	397
- chemical plants	35
- forest plantations	65
- port (participation)	5
- residential community	12
- other infrastructure	32
- administration and financial costs	70
	<hr/>
	616

The Aracruz Project is basically a private enterprise operating mainly with Brazilian capital. Of the equity, 65 percent comes from Brazilian sources and the remainder from foreign investors. Loan capital amounted to over 60 percent of the total investment outlay. Apart from the private shareholders, the leading institutional partner and investor in the project is the National Bank for Economic Development (BNDE) together with its affiliate FIBASE.

Organizationally, the enterprise is grouped into four units, each of which has a clear-cut area of responsibility in the management of their respective functional field:

- Aracruz Celulose S.A. is the leading company of the group, and operates the pulp mill and the chemical plants, provides central administration, and is responsible for the marketing of the mill's output. The chemical plants make Aracruz self-sufficient in all basic pulping chemicals except sulphuric acid.
- Aracruz Florestal is responsible for the plantations, forestry research, and logging operations. Altogether, Aracruz owns 98 000 ha of land, of which 72 000 ha are planted with eucalyptus and native trees and 13 000 ha have been set aside as a preservation area for natural flora. The plantations make Aracruz also self-sufficient in wood raw material. Through genetic improvements, better soil nutrition, and effective control of plant diseases, the obtainable yield levels are now sufficient to operate at the mill capacity.

- Santa Cruz Urbanizadora, another subsidiary, runs the residential community built by the seaside 17 km from the mill. The community houses some 4000 people and has two schools, a shopping centre, medical facilities, clubs, etc.
- The port of Barra do Riacho, located 1.5 km from the mill and specially designed to handle pulp, was built and is now operated by Portocel. Aracruz is a majority shareholder (51%) in this company, with Celulose Hipo Brasileira CENIBRA having 49 percent of the shares. The port can berth ships of up to 27 000 TDW.

## 2. BACKGROUND AND FACTORS THAT LED TO THE DECISION TO ESTABLISH THE MILL

Brazil is by far the largest country in Latin America, taking up almost half the continent. Brazil's population of 125 million people (1982) is richly endowed with products from the soil and subsoil needed by industry and people at home and abroad. One critical weakness in Brazil's economic base is the relative scarcity of fossil fuels. Another problem is that regional income differences are pronounced, as is income disparity. Nearly all industry is located in the south-central portion of the country.

The Brazilian approach to development has been pragmatic. To cope with the huge import bill and to reduce dependence on capital inflow in the long term, the Government has been stressing exports and development of capital equipment industries aimed at import substitution. Subsequently the nation's total external debt soared from US\$ 17 200 million in 1974 to US\$ 43 500 million by year-end 1978, a period that coincided with the construction and start-up of the Aracruz mill. Inflation also accelerated from a relatively stable 41 percent average growth rate in 1975-78 to 77 percent in 1979.

By and large, Brazilian governments through the years have believed in the efficiency of free enterprise as a dynamo of economic and social progress. And yet, the economy of Brazil is essentially a mixture of state and privately owned enterprises - both local and/or foreign - often occurring within a single industry.

Institutions controlled by state and federal governments predominate in banking and credit. The Government supplies about 60 percent of all investment in Brazil but, as a matter of policy, the Government often seeks to enlist private capital, both local and foreign, in joint undertakings requiring a heavy investment outlay.

Brazil's reserves of natural forest cover are still immense, despite centuries of cutting. In addition, programmes of reforestation with fast-growing pine and eucalyptus for pulp and paper making have been under way since 1967 with the aid of tax incentives to private investors.

### 2.1 Tax Incentives

It can be argued, successfully, that a starting point for the investment idea in the case of Aracruz was provided by Government tax incentive laws. In 1967 the Brazilian Government passed a bill which provided favourable tax incentives to encourage private investors to establish forest plantations.



Export incentives were also available. Companies are able to obtain income tax exemption on profits resulting from export operations. Other such tax breaks include deduction of expenditures for promotion of sales abroad, etc.

## 2.2 Man with a Vision

Tax incentives alone would certainly not have been sufficient; the prime force behind the project was a man of vision and entrepreneurial spirit. This man was Dr. Leopoldo Brandao. In his mind's eye he saw that the key element in the forest products industry in Brazil would always be low-cost wood; and the key to that is sun, rain and land, all abundantly available in the country, coupled with new technology. Even today in 1984, the cost of wood at the mill gate is still US\$ 10 per m<sup>3</sup>, a figure which was used back in 1974 in the assessment of the economic feasibility of the project. Dr. Brandao also saw that the overall project concept should aim at total integration from tree nursery to port (market).

A great deal of spadework, an enthusiastic entrepreneurial spirit and skills were required before potential investors were convinced of the viability of the scheme, and joined in. First among them was Mr. Erling S. Lorentzen, a leading Brazilian businessman and industrialist, who believed in the concept. With his support and leadership, the vision was gradually transformed into a viable investment project.

The first tasks were to formulate a sound project concept, to find suitable land for forest plantations, a mill site which would have access to an ocean port, and an ample source of fresh water for a future mill.

## 2.3 Concept Definition

While the new forest was being established, the wheels began turning on mill design, financing, marketing, and infrastructure planning. This was the critical step toward success. The effort that went into the formulation of a conceptual framework for the project amounted to approximately 100 man-months. Aracruz was aided in this task by Billerud and Jaakko Pöyry Oy; the former became eventually the know-how, marketing and management partner, and the latter the engineering and construction management consultant.

The main tasks which were tackled at this stage were: the overall project concept, market and product, mill concept, equipment and engineering, implementation arrangements, financing and financial plan, and human resources. The underlying themes in this exercise and in the subsequent engineering phase were: each and every link in project design must be strong, and each link in the chain must be thoroughly checked and proven ahead of time, before it is implemented.

### - Overall Project Concept

From the project sponsor's point of view, the overall project concept was formulated as follows:

"... to create a Brazilian private enterprise which can grow and remain economically profitable. Based on wholly-owned planted forests the enterprise shall as far as possible be independent of outside supplies, be served by a proper harbour for export of the products and be supported by adequate infrastructure and improve the standard of living in the area."

- Market and Product

After analyzing the markets and eliminating a number of product alternatives, it was decided that the Aracruz mill would produce high quality, bleached eucalyptus kraft paper grade pulp, mainly for export to Western Europe and the Far East.

- Mill Concept

From the outset the consultant's and the know-how partner's work aimed at designing a mill with a capacity as high as technically possible, while still consistent with operational reliability, considering proven techniques, and using commercially tested equipment.

The consultant asserted in the final feasibility study, prepared as a basis for the final go-ahead, that it was his "firm belief that new projects to be implemented in an area such as Aracruz should be sized in this way. This is due to the high costs of infrastructure development, the high cost of staffing and training, and the economy of scale for the mill as such."

- Equipment and Engineering

The chosen pulping process was the conventional kraft process, which is preferred for high quality hardwood pulp and particularly well suited for eucalyptus.

- Implementation Arrangements

As Aracruz was a new company with limited technical staff, it was decided that a joint management organization be set up between the sponsor, the consultant, and the technical know-how partner. Furthermore, civil works were divided into four separate contracts due to timing considerations, the nature of the work, and in order to minimize the potential risk involved in one large contract.

- Financing and Financial Plan

Although as a project Aracruz had been in the planning stage for some years prior to 1974, access to Government financing was made easier when a new national plan was formally established by the Government in that year. The plan called for a build-up of the domestic pulp and paper industry to make Brazil more self-sufficient and able to begin exporting to conserve foreign exchange. The National Bank for Economic Development (BNDE) was put in charge of providing financing; at the time, the BNDE had some 14 projects under consideration, of which only two others besides Aracruz have so far materialized (Cenibra and Jari).

BNDE and FINAME provided the project with US\$ 215 million in the form of long-term loans and guarantees.

The equity capital, invested by more than 200 Brazilian and foreign shareholders, amounted to approximately US\$ 70

million plus the planned increase of US\$ 160 million. This provided the basic funds required for the realization of the project, involving a total investment of US\$ 569 million (December 1975).

A sound financial plan was established (1975) to cover the total investment outlay; and all infrastructural requirements, including a special export harbour in the vicinity of the mill, to be built under the control of the Federal Port Authority, were carefully programmed. It was by no means an easy task to draw up such a plan in an environment of rampant domestic inflation and frequent, intricate monetary corrections (Figure 2). The initial budget, prepared in 1973, amounted to US\$ 339 million, of which the share of the mill itself was 65 percent. But as detailed planning proceeded, the accuracy of the budget was increased to the extent that the final go-ahead budget at the end of 1975 represented 92 percent of the actual cost of the project at start-up. It was on the infrastructure side where cost increases were highest as compared to the established budget.

#### - Human Resources

The philosophy in human resources deployment was basically that the use of expatriates should be kept to a minimum without unduly endangering the managerial, technical and operational capability of the project organization. As a result, only some 15 expatriates were employed by Aracruz Celulose S.A. itself. It also led to an extensive training effort on all staff levels, and a large number of Brazilians received intensive on-the-job training, varying from 6 to 12 months. At present only two expatriates are employed by the company.

### 3. ESTABLISHMENT OF FIBROUS RESOURCES

Aracruz began to look for land in 1967. A suitable site with a subtropical climate was found about 60 km north of Vitoria in the state of Espirito Santo, at a latitude of 20° south of the equator. Rainfall is good throughout the year (1 300 mm/a), and the average temperature ranges from 20°C to 30°C. The coastal site has an altitude of 50 m above sea level; and the topography is good, a flat landscape being well suited for mechanical wood harvesting. The soils are deep and permeable, ranging from sandy to clayed loam, with a sandstone baserock. But when acquired by Aracruz, the area had been repeatedly logged over by centuries, and the soil was deficient in various nutrients.

Planting commenced in 1967. In eight years, the planted area grew from the initial 1000 ha to 43 500 ha at the time of the final go-ahead in 1975, with annual increases ranging from 35 to 75 percent over the previous year. The planted area in 1975 was equivalent to 75 percent of the total area of plantations required to sustain the mill operating at full capacity, based on a conservative increment estimate (36 m<sup>3</sup>s over bark/ha/a).

Aracruz now has 98 000 ha of land, all located in the state of Espirito Santo. Of this, 72 000 ha are planted: 42 000 ha adjoining the mill, and 30 000 ha in another location about 150 km away.

### 3.1 Scientific Base

It was apparent from the beginning that a solid scientific base was required in the key areas related to plantation forestry. In the case of Aracruz this meant an emphasis on soil chemistry, genetics, and entomology.

In 1973, Aracruz staff members, assisted by an FAO expert in forest ecology, visited areas with similar climatic conditions; they visited Australia, Indonesia, Zimbabwe, Timor, and several other countries, in search of strains of seeds mainly from Eucalyptus grandis and E. urophylla, which so far had proven most promising. Seed selection was followed by an intensive testing programme to find suitable provenances with desired properties in terms of disease and insect resistance, yield, physical properties (fibre ratio, density, and bleached pulp yield), and botanical aspects (form, bark, leaves, and branches).

Today the very best natural individuals of hybrids and of hybrids produced by controlled pollination are being multiplied by vegetative propagation. As a result of intensive research and development efforts, the plantations show very high growth rates; for example, the first generation of eucalyptus (E. saligna and E. grandis), planted in the early seventies, produces an average of about 35 m<sup>3</sup> of wood per hectare per year, with a rotation of seven years. This generation is still marked by very great variations in yield. More recent, improved, younger stands of selected hybrid clones are expected to reach a yield of at least 60 m<sup>3</sup>/ha/a. By using clones of the best trees, the company is not only improving the yield per hectare, but also developing wood of much greater uniformity, with higher specific gravity and higher pulp yield per unit of dry weight than that of wood from normal forests. For this relevant contribution to science the Aracruz team responsible for the work was awarded the Marcus Wallenberg price, Sweden 1984.

Genetic improvement is only one of the benefits derived from the research programme. It has also been possible to reduce the hazards connected with large monocultures (such as insects, fungi, erosion, forest fires and soil compaction).

In the poor soils of Aracruz, soil improvement is a high priority matter and an integral part of efforts to achieve and sustain very high wood yields. Commercial fertilizers are used only during planting. In addition, ash from the mill's residual wood-fired auxiliary power boiler is taken to the plantations and spread with tractors. This returns part of the mineral content of the wood to the soil. The trees themselves drop some 6 t/ha/a of leaves, which decompose quickly into nutrients. The humus layer is growing: and as the years go by, eucalyptus actually improves the soil.

### 3.2 Harvesting Pulpwood

Felling, delimbing and cutting to 6 m lengths is done with chain-saws; but from then on harvesting is mechanized to take the best advantage of the topography. Specially designed, Brazilian-made forwarders move wood to the roadside, where grapple boom units load the logs on to truck-trailer units for hauling to the mill.

The annual requirement of the mill at full capacity is approximately 2.0 million m<sup>3</sup>. All this wood is supplied within an average distance of 30-35 km from the Aracruz area and 170 km from the northern area. Such a concentration of the wood supply is unique in the

world. Productivity in logging is estimated at 22 m<sup>3</sup> per person per shift, which is better, for example, than the average 12 m<sup>3</sup> in Finland. This is mainly due to the more favourable conditions at Aracruz such as good terrain, dense stands, and fewer branches; but it is also due to the intensive training of the loggers, and the fact that their tools and equipment, tested and developed for Brazilian conditions, are comparable in this respect to the standard in Sweden and Finland.

### 3.3 Energy and Fuelwood

After pulpwood harvesting, the crews go back for residual or energy wood harvesting. The residual wood is chipped in the plantations and delivered as fuel to the mill's power boiler. The mill received in 1983 some 485 000 m<sup>3</sup> of chips for energy uses. In 1984, the bark from mechanical barking practically replaced forest residues, and, therefore, tops and branches were used very little. Biomass, in fact, accounts for 87 percent of the energy supply of Aracruz, and imported fuel oil for only 1.4 percent, the rest being covered by purchased electric power and natural gas.

### 3.4 Institutional Support Facilities and Incentives Provided by the Government

As noted in the beginning, regional and sectoral incentives played a major role in financing the initial plantation activities, not only in the case of Aracruz but also elsewhere in Brazil. For example, between 1967 and 1973, almost 5 000 reforestation projects covering one million hectares were authorized by the Ministry of Agriculture, calling for an investment of US\$ 257 million.

As the scheme of income tax credits for investments in developing regions and sectors was so successful, the Government decided to revise the percentage of credits granted for investment in reforestation; they were trimmed in 1975 to 20 percent from the original 25 percent, and further to 12.5 percent in 1978. Reforestation projects must also be approved by the Brazilian Institute for Forestry Development (IBDF).

## 4. CONSTRUCTION, TRAINING AND START-UP

### 4.1 Project Management

A joint project organization was established in 1973, two years before the firm investment decision was actually made, involving the project sponsor (Aracruz), the market and process know-how partner (Billerud), and the engineering and construction management consultant (Pöyry). Essentially the three parties made the critical decisions affecting the project. This made the decision-making process relatively quick as, for example, no external institutional investors were involved.

### 4.2 Engineering

It was agreed from the outset that the process technology should be proven and yet advanced.

The strategic and by far the most expensive item in the process design was the recovery boiler, which is one of the world's largest, built for a capacity of 1 800 t of dry solids a day. The starting point

for dimensioning the boiler was the question: "Do we have enough wood and land to sustain continuous operation?" The answer was negative and more land had to be secured.

The mill is basically built in one line; but, for equipment reasons, bleaching and drying are carried out in two parallel lines. The wood was originally chipped and pulped unbarked, but two barking lines have now been installed as part of a programme to increase pulp production. The chips are fed to a Kamyr digester, giving Aracruz one of the largest single-line, continuous-cooking capacities in the world. From the digester, the pulp is divided into two lines for washing and screening. Bleaching is done in two parallel plants, whose equipment was made in Brazil.

The power boiler is fired with wood waste, bark and fuel oil. The substitution of imported fuel has been a special concern of the management of Aracruz. In fact, their success has been remarkable: in 1979 the mill consumed 144 kg of fuel oil per ton of pulp, while in 1984 the corresponding figure was only 9 kg.

#### 4.3 Equipment Manufacture

Government policies relating to the financial terms of Government loans and their implied preference for domestically manufactured equipment had a major impact on equipment manufacture and on the choice of suppliers of the main equipment. After rigorous financing negotiations, the obligation was set at having 60 percent of the equipment to be installed in the mill of Brazilian origin. Achieving this high level presented a formidable challenge both to the project organization and the potential suppliers. In the engineering phase of the project it required an extensive amount of study, adaptation, and collaboration with the key suppliers, which were basically foreign companies, some of them having only recently established manufacturing subsidiaries in Brazil. The capability of these affiliates to manufacture the specialized equipment had to be ascertained, as well as their parent companies' willingness to transfer their technical know-how. To cite just one example: Kamyr do Brasil, the supplier of the huge continuous digester for Aracruz, was established only a few years before the final go-ahead for the project was given. The company had first established only an engineering unit but, due to the lack of reliable subcontractors, the unit was enlarged into a manufacturing outfit.

#### 4.4 Construction and Time Schedule

Construction and erection were performed by Brazilian contractors. A peak work-force of 12 000 construction and forestry workers with past experience in similar projects was employed during construction. The mill was built in 36 months, which is a remarkable achievement under any circumstances, and even more so on a site located far from any major urban areas. On 21 August 1975, the go-ahead signal was given for the mill project; and the first pulp was produced on 4 September 1978, on schedule.

Implementation was so scheduled that it enabled a staged check-out and testing sequence. This permitted testing and actual operation of most of the mill systems and departments with proper media and processes during the last few months prior to the actual start of pulp cooking.

The start of auxiliary systems (water and steam) were scheduled very early in the sequence of activities, followed by chipping, and then testing the drying machine using purchased pulp.

#### 4.5 Training Programmes

It was realized that the recruitment and training of personnel would be one of the most important items in the implementation of the project. Remuneration and social fringe benefits, such as housing and recreational facilities, were adapted accordingly, taking into account the distance from population centres. Billerud undertook to select and train the mill personnel and manage the start-up. Already early in 1974 - four years before start-up - a mill manager was on the payroll and working, devoting a large part of his time to recruiting mill personnel and organizing their training as well as preparing the start-up and operation phases. Engineers were hired starting in late 1974, and all skilled staff completed their 6-12 months' training before the start-up.

Detailed job descriptions and instruction manuals were prepared for every operator in the mill, covering instrumentation, electrical and technical data, operations procedures prior to start-up, start-up sequence, normal operations, and shut-downs. Workers were selected through careful testing and interviewing. All received three months of basic training in the training school at Aracruz, while the mill was under construction. Most operators also worked in other mills in Brazil and were on duty at Aracruz during the final installation stages. Emphasis was also placed on emergency procedures, so that each employee would know precisely how to recognize, and react to, any disturbances in process operations.

#### 4.6 Start-up

A problem-free start-up took place on 4 September 1978 and by the end of that year, i.e. within only four months of production, the mill had manufactured a quantity of pulp which corresponded to about 40 percent of the rated full capacity. The reasons for this success lie in a number of factors: operational procedures had been very thoroughly rehearsed, the equipment had been inspected before delivery to the site and during installation, etc.

### 5. OPERATIONS, MARKETING AND FINANCIAL RESULT

#### 5.1 Product

The use and production of bleached hardwood market pulp in the western world has grown considerably in recent years. By far the biggest share of that growth has come from bleached eucalyptus pulp. Its main use has been in making fine papers both for printing and writing; but it is also used in tissue papers, where high water absorption and softness is important and the quality advantage of eucalyptus pulp has been particularly recognized. And in the case of Aracruz, because of its specially selected trees and its cooking and bleaching process, the pulp has a very low content of extractives, providing an extra bonus to the paper millers in a better operation of their machines.

#### 5.2 Operations

Production and sales figures are impressive. The mill has operated continuously at near full capacity, and the sales record proves that the original market and product concept was valid.

Bleached pulp:

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
	- '000 metric tons -					
- Production	291	361	401	413	430	456
- Sales	286	371	394	421	438	438
of which exports	66%	78%	72%	74%	83%	77%

### 5.3 Marketing

Arrangements for marketing the mill's output were made well before the scheduled start-up. By an agreement signed with Aracruz, Billerud of Sweden, with its efficient marketing organization in Europe, committed itself to sell on a best-effort basis up to 50 percent of the output. In marketing, Aracruz has not relied solely on its know-how partner, but has worked toward building up its own sales network; in 1982 Aracruz opened a marketing subsidiary in England. Domestic markets were covered by Aracruz itself, and through a consistent marketing effort Aracruz has built up a substantial new market in the U.S.A.

Pulp prices have not necessarily favoured Aracruz on the world market. From the last quarter of 1979 to the end of 1981, pulp prices remained basically stable, around US\$ 520/t; but during 1982 they dropped considerably, to as low as US\$ 360, and have after that again exceeded US\$ 500/t. Nevertheless, the company has been able to capture a 7-8 percent share of the world's short-fibre bleached pulp market. It is interesting to note in this connection that the project's original economic feasibility was based on a sales price of US\$ 255 (c.i.f. Rotterdam), resulting in an internal rate of return of 15 percent.

### 5.4 Financial Results

The financial results indicate that sales revenues have been commensurate with the liabilities that the company has toward various interest groups. Aracruz has been able to reduce its financial liabilities significantly (Figure 3), from US\$ 425 million in April 1979 to US\$ 80 million in 1984, record a net profit each year since the mill came on stream, and more recently (1983) propose to pay a dividend to its shareholders. This was after only three years of industrial and commercial operations, and fifteen years since the beginning of its afforestation activities.

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
	million US\$			
- Gross sales revenue	130.7	136.5	124.8	96.4
- Net income (profit)	34.7	41.7	24.3	17.8

The net profit has varied between 19 percent and 30 percent of the gross sales revenue. Operating expenses per ton of pulp sold have been around US\$ 150, and sales costs per ton have been pushed down to around US\$ 35 from the initial level of close to US\$ 50.

### 5.5 Later Comments from Aracruz S.A.

Gross sales revenue and net income have been calculated using the US dollar exchange rates of the last day of each fiscal year, which



originates strong distortions. Using the average US dollar exchange rate the results are the following:

	<u>1980</u>	<u>1981</u> million US\$	<u>1982</u>	<u>1983</u>	<u>1984</u>
- Gross sales revenue	162.4	187.6	175.8	164.6	196.7
- Net income (profit)	43.2	57.1	34.2	30.5	131.2
- %	26.0	30.0	19.0	18.0	66.7

We underline that the translation for net income was literal. The FASB 52 procedures were not used. If more exact figures are needed, the effective value of gross sales in US dollars should be asked from Directoria Comercial. In 1984 operating expenses were around US\$ 121 per ton of pulp sold, while commercial expenses, including departmental expenses reached US\$ 53 in the same year (literal translation, average annual rate).

#### 6. PLANS FOR THE FUTURE

Having established its competitive position in the export markets, thanks to its high quality product and efficient mill, Aracruz has expanded its yearly pulping capacity by 60 000 t. This expansion was completed in 1984.

Now there are already advanced plans to nearly double the present mill capacity by building a second pulping line of 300 000 t/a. The total investment cost is some US\$ 400 million (at November 1983 prices), including the new line, interest during construction, working capital, afforestation costs and forest land acquisition, as well as some additional infrastructure. It should, however, be noted that there will now be very little need for investing in the latter, as most of the mill infrastructure and utilities were originally dimensioned with a view to possible doubling of the capacity of the mill. This time it is expected that the equipment will be 90 percent of Brazilian origin (vs. 60% in the first phase).

Integration into paper making has also been contemplated, but from a strategic point of view there is no great advantage in having a paper mill at Aracruz other than the availability of pulp. And specifically, an export-oriented paper mill would have to compete on the same basis as paper mills closer to the main markets, and on a much less flexible basis in serving the market.

Areal expansion of forest holdings is not required, but further investments will be made in the renewal of the less productive and poorly disease-resistant forests. Benefitting from its own research, Aracruz has developed technology for planting highly productive forests resistant to most of the known pathological risks.

#### 7. REASONS WHY THIS PULP MILL IS AN APPROPRIATE INDUSTRY

As could be expected, an investment of this scale also attracted harsh criticism as to its financial viability, before the final go-ahead. Some of the potential financiers were concerned with its size, i.e. that it would be too large for Brazil as a single investment item; that the project would not be manageable under Brazilian conditions; and that its investment cost per ton was excessive in a situation where the pulp price was going down and the market uncertain.

Now in retrospect, there are several things that stand out as factors making Aracruz a successful project.

First of all, success was primarily due to the notion that every link in project design must be equally strong, and to the dramatic effort and commitment on the part of the management and other interested parties that went into achieving this objective. Approximately 75 percent of the pulpwood resources required had already been planted at the time of the final go-ahead (1975), and the minimum requirement was exceeded with a considerable margin by the time of the start-up (1978).<sup>3</sup> The price of wood from own forests is still low, only around US\$ 10/m<sup>3</sup> at the mill gate.

Also, as sales figures and net profits testify, the project was indeed able to take advantage of its economies of scale. The product is of high quality, competitive in price, and in great demand also on the domestic market. The start-up was fast, thanks to strong technical backstopping and extensive training, and well timed to take advantage of the economic boom and the better prices. Mill efficiency, coupled with intensive marketing efforts, has carried Aracruz through recessionary periods and downswings in prices without jeopardizing the profitability of the company.

The financial package and the cost estimates on which it was based were by and large adequate; for example, no stoppage during construction took place because of lack of finance. Tax incentives, and soft loan terms helped the project through its prolonged gestation and investment period.

Major potential risks were thoroughly researched beforehand, and adequate safeguards made. These risks related mainly to the domestic manufacture of the specialized equipment; availability, competence and skills of staff and operators; forest biology; marketing; and, on the financial side, to potential cost overruns. Also in these areas, one of the key links - good project preparation - was solid.

Secondly, the project complied with Government development objectives and priorities. Thus it was natural that it enjoyed a great deal of good will and preferential treatment on the part of the Government. As an ex-post evaluation, it can be said that the Aracruz project proposal met most of the criteria in the Brazilian programme of fiscal and other incentives for investment in basic and priority industries (contained in Law and Decree 1137, and managed by the Industrial Development Council):

- (i) The project contributes to exports: the accumulated export earnings at the end of 1984 were US\$ 800 million, which, after only six years of commercial operations, exceeded the initial investment outlay of the project.
- (ii) It helps to promote decentralization and reduce regional imbalances, as it is located in a thinly settled, underdeveloped area in south-east Brazil, away from congested industrial cities such as Sao Paulo, and provides direct employment to 6100 people.
- (iii) It promoted more intensive use of local inputs because as much as 60 percent of the mill equipment was actually manufactured in Brazil.

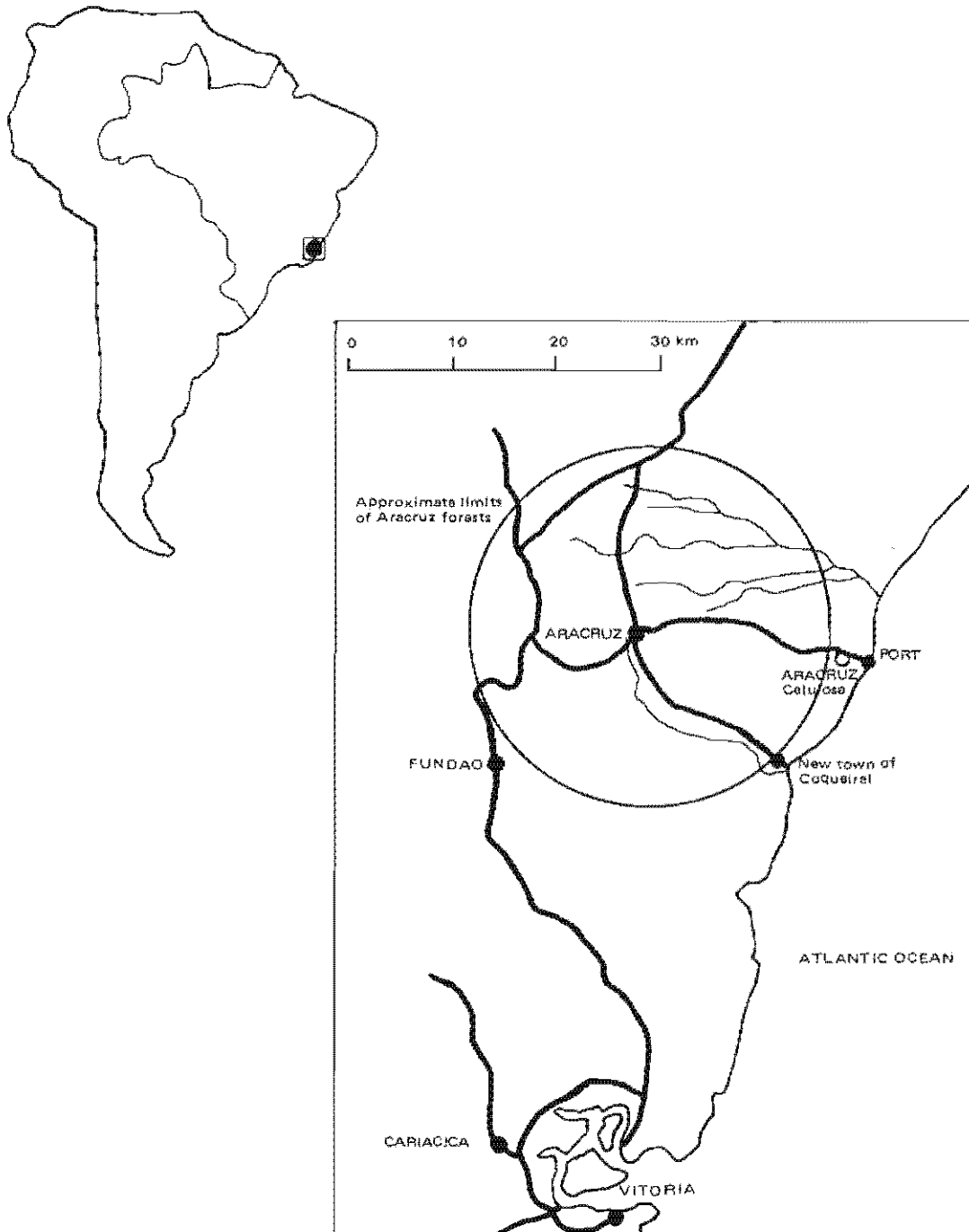
- (iv) It uses technological processes adequate for regional and sectoral development. This is particularly true in the case of forestry operations (i.e. reforestation and harvesting technologies).
- (v) It has introduced production scales large enough to keep prices competitive despite the considerable investments that went into the construction of support infrastructure (port, residential community).
- (vi) It has recognized antipollution needs: in the absence of Brazilian legislation, the strict Swedish antipollution standards were applied in emission and effluent treatment.

Thirdly, the project was basically a private enterprise, but with high financial backing provided by the Government. Success is also due to the conduct of the men in charge of the project, who acted with integrity in the utilization of the Government funds.

From the above it should be clear that the Aracruz Project proved to be a technically feasible, manageable and profitable undertaking; but in answering the question as to why it was an appropriate forest industry project, we should be careful not to draw too simplistic or straightforward conclusions for other such projects from this experience, as so many variables were in play. We should only re-emphasize the criteria that made the project successful. There was a clear vision of what the project should be; men with entrepreneurship and an ability to lead; an economically sound project concept and the resources to prepare the project thoroughly before the start of disbursements; a competent and able organization and institutional framework to make decisions and act upon them; an adequate financial package to enable making the right choices, thus avoiding second-best solutions; and thorough training.

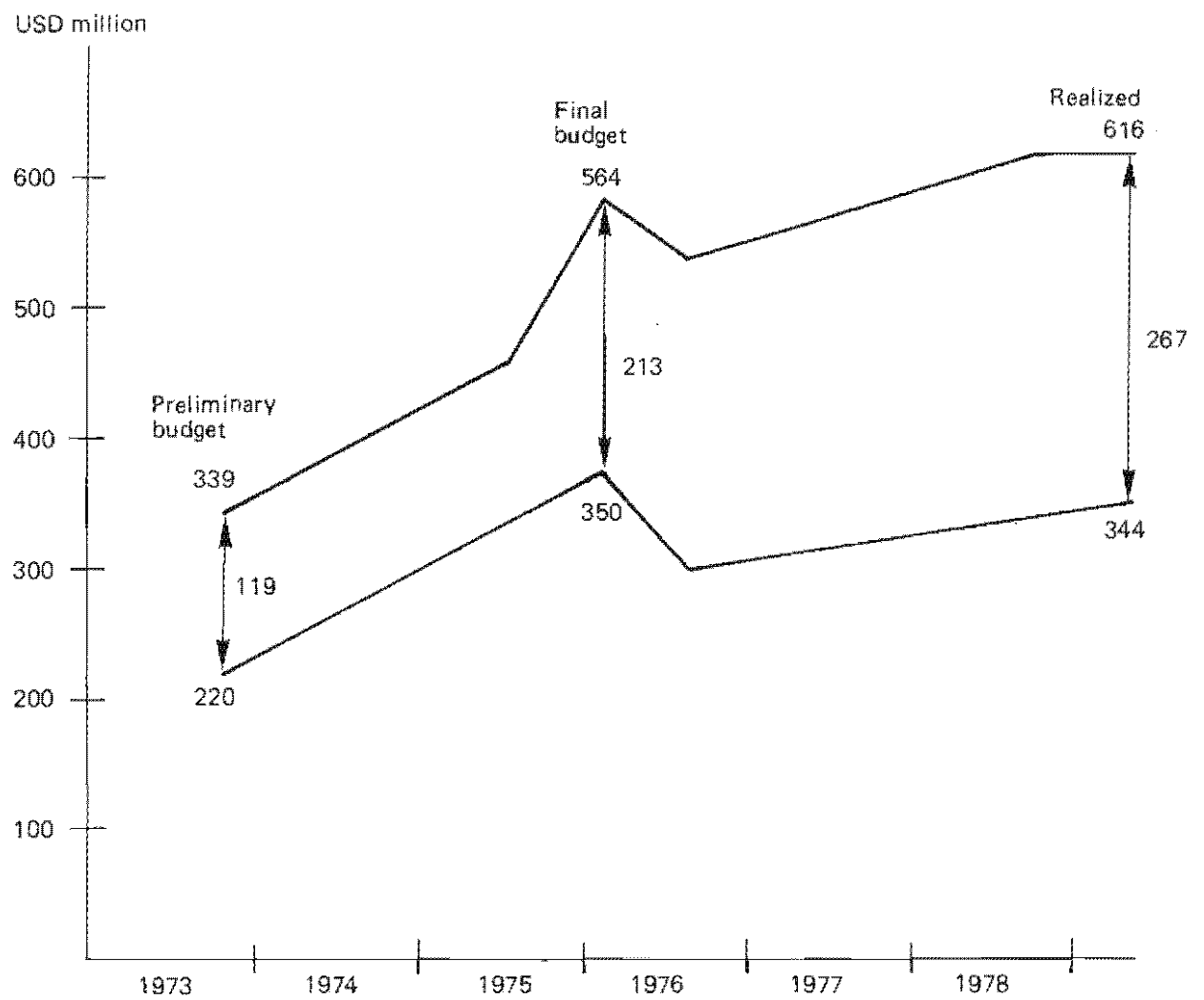
In the end, the project also had a fair share of something required in all human endeavours: luck and good timing to bring the final seal of success.

Figure 1  
Location of the Aracruz Project

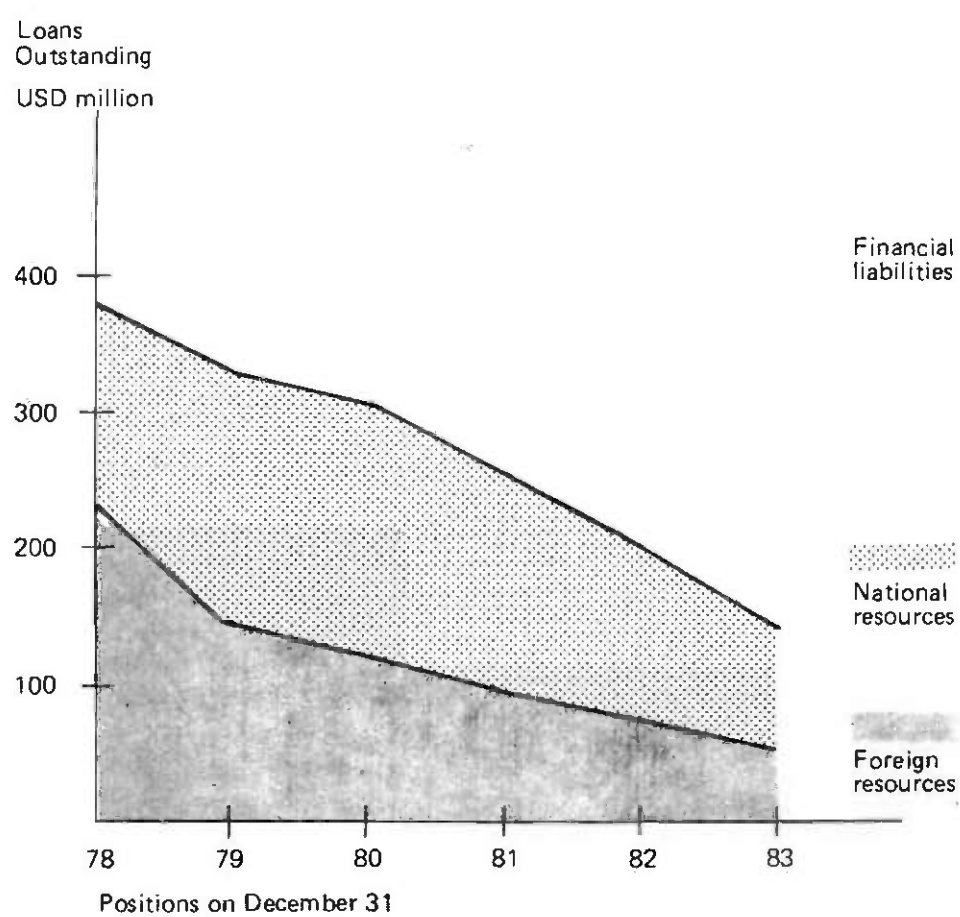


Totality of integration, forest to port is key to Aracruz.

Figure 2  
Development of the Investment Estimate



**Figure 3**  
**Amortization of Loans**



Source: Annual Reports, Aracruz 1983

SOCIO-ECONOMIC APPRAISAL OF  
ALTERNATIVE TECHNOLOGIES FOR THE SAWING OF SOFTWOOD  
AT SAO HILL SAWMILL IN TANZANIA

by

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## 1. INTRODUCTION

One important issue facing the governments of the less developed countries (LDC's) is that of technological choice. The question of how existing natural resources, labour, capital and skills can best be combined to counteract employment problems and provide a stable base for a future increase in the standard of living, is a complex, but crucial one.

Recently interest has increased in matters relating to technology which, in the context of this paper, means the machinery, skills and procedures for providing goods and services. One problem, however, is the lack of studies on the socio-economic effects of alternative choices of technology in actual development projects, particularly those relating to forestry and forest industries. The objective of this paper is to analyze the effects of alternative sawmilling technologies at the Sao Hill Sawmill (SHS) project in the Iringa region of Tanzania, a project partly financed by the Norwegian Agency for International Development (NORAD).

The analysis was made taking into consideration the following criteria:

- production efficiency from a national economic point of view;
- production efficiency from a business economic point of view;
- direct and indirect employment effects;
- working conditions;
- integration with the present economic and social structure of Tanzania;
- independency;
- ecological effects;
- distributional effects;
- flexibility;
- uncertainty;
- other factors.

The choice of the appropriate technology depends on physical, technical, socio-economic and political factors. It is, therefore, necessary to scrutinize these factors and to specify the assumptions on which the analysis is based.

## 2. MAIN ASSUMPTIONS

Three alternative technologies - A, B, and C - for the production of sawnwood are compared, in which it is assumed that the production units of each alternative will have an annual input capacity of 14 000 m<sup>3</sup>s in one shift, for which 11 500 m<sup>3</sup>s will be supplied from softwood clear-fellings and 2 500 m<sup>3</sup>s from softwood thinnings.

Alternatives A and B represent centrally located sawmills and each mill consists of one double slabber, one circular split saw, two circular resaws and one circular double edger. For larger logs there is an additional circular saw bench which can be operated as a separate unit, or in combination with the resaws. Alternative C consists of five semi-mobile sawmills, each with a one-shift input of 2 800 m<sup>3</sup>/a, and consisting of one slabber, one resaw and one cross-cut saw. These five sawmills will have a common central unit for sorting, drying, trimming, dipping, impregnation, for sales of sawnwood, for administration and for repairs and maintenance of the logging and sawing equipment.

A is identical to the existing SHS project, while alternative B is a modified version of alternative A, in which the following modifications have been assumed:

- The location of the mill will be on site B, indicated on map 1, closer to the forest resource.
- The main sawmill building will be of simpler construction and will cost 1.2 million Tanzania shillings<sup>1/</sup> instead of the 2.2 million T.shs. for the sawmill building of A.
- Logging equipment will be simpler and less expensive.
- Only 70 houses for junior staff will have to be constructed instead of 100 as for A.

Social infrastructure costs (housing, etc.) for alternative A will correspond to the actual costs of the present Sao Hill Sawmill project. For alternatives B and C more of the employees will be recruited from the villages around the sawmills and, except for the skilled personnel, these employees will continue to live in their present homes.

A and B are powered by electricity from installed diesel generators, whereas each sawmill of C will have its own diesel engine.

When comparing centralized and decentralized sawmills, transport costs, influenced by the location of the forest resources, are of importance. This analysis is based on the actual timber situation at Sao Hill with annual sawlog quantities available for the first 10-15 years as indicated in Table 1.

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<sup>1/</sup> January 1977 exchange rate: US\$ 1 = T.shs. 8.42

Table 1

Sources of origin and quantities of sawlogs  
available annually

<u>Forest reserve</u>	<u>Type of logging</u>	<u>Annual quantity</u> <u>available</u> <u>(m<sup>3</sup> u.b.)</u>
Msiwasi	clear-cut	12 300
Irunda	clear-cut	6 200
Mninga	clear-cut	6 200
Sao Hill	thinnings	5 200
Total (rounded off)		30 000

A is located at the present SHS site, point A on map 1; B would be located on site B of map 1; the central unit of C would also be situated at Site B. The five sawmills of C would be spread out as indicated on map 1:

1 sawmill (B)	central unit
2 sawmills (C and D)	in Msiwasi Forest Reserve
1 sawmill (E)	in Irunda Forest Reserve
1 sawmill (F)	in Mninga Forest Reserve

Since the sawnwood is loaded on tractor trailers directly after being sawn, no storage sheds are necessary except at the central unit. The sawmill buildings will be of simple construction with eucalyptus poles, a corrugated iron roof and a cement floor. Investment for site preparation and the sawmill building is estimated to be T.shs. 70 000 per sawmill, of which T.shs. 40 000 represent investments with a write-off time of three years, because the mills will be moved every three to four years.

Transport of sawnwood from the sawmills to the central unit will be carried out by agricultural tractors with 2-axle trailers, which can carry a load of up to 5 t. Each sawmill produces about 13 m<sup>3</sup> (approx. 7 t) of sawnwood per day. In addition, about 1.3 m<sup>3</sup> of the best slabs and off-cuts will be taken per trailer-load to the central unit for the production of boxboard. This means that each mill will have to be visited twice a day by a tractor for the collection of sawnwood, slabs and off-cuts. To cover the requirements for transport between the sawmills and the central unit, three tractors and eight trailers will be required, which will allow for an overcapacity in transport.

A, B and C will each require a four-wheel drive vehicle, one tipper truck and one stone crusher for road construction. A workshop manager, mechanics and tool maintenance personnel will have to be engaged.

The need for access roads is the same for all three alternatives. However, in alternative C skidding will mainly be done directly from stump to industry and less feeder roads will, therefore, be required. In all alternatives clear-felling operations will be carried out utilizing agricultural tractors, particularly in more difficult terrains from which 20 percent, or 6 000 m<sup>3</sup> of the timber volume will be extracted annually. In thinning operations, manual skidding with a sulky is assumed.

The analysis relates to the logging and sawmilling activities only, i.e. planing, boxboard production and impregnation activities, which take place in the present SHS project, were not taken into consideration because they involve the same additional benefits and costs for all alternatives. Full capacity utilization is assumed.

The percentages of sawnwood recovery have been taken to be the same for all alternatives. Based on experiences at SHS, the following recovery percentages have been used:

- 47 percent for sawnwood production from clear-fellings
- 44 percent for sawnwood production from thinnings
- 5 percent for boxboard production

## 2.1 Assumptions Made in the Financial and Economic Calculations

All market prices are quoted in Tanzanian shillings based on the 1977 price levels in Tanzania. In the economic analysis shadow prices have been used for un/semi-skilled and skilled labour and for foreign exchange (import), which are 0.7, 1.3 and 1.6 respectively.

It is assumed that all personnel will be employed on a permanent basis - i.e. casual labourers, which are paid about 30 percent less than permanent employees, have not been considered. Social benefits for the workers, paid by the employer, are 15 percent of gross salary, corresponding to actual practice at SHS.

In the analysis the term "direct import" refers to those items for which in 1977 there were no sales agencies in Tanzania and which, therefore, had to be imported directly by the project. Stocks of spare parts have been calculated at 10 percent of the initial investment costs if they are sold by a Tanzanian agency and at 20 percent if they have to be imported directly. Working capital has been assumed to be 30 percent of recurrent expenditures (i.e. all costs except depreciation and interest costs).

In the financial analysis depreciation costs (d) are calculated using the linear formula

$$d = \frac{I - A}{n}$$

where: I is initial investment amount  
A is scrap value for the item in question  
n is write-off time

If nothing else is stated, it is assumed that A is 10 percent of I, and interest costs of machinery are 9 percent per annum of  $\frac{I + A}{2}$

The requirements in machinery and equipment, etc., for each of the three alternatives are presented in Appendices 1A, 1B and 1C, together with corresponding costs and write-off times.

## 3. CALCULATION OF DIRECT COSTS AND INDIRECT ECONOMIC EFFECTS

Since the production output is the same for all three alternatives, a comparison may be made by calculating their individual production costs. It is assumed that full production on one shift will

be reached one year after completion of construction of the sawmill and that the quantity of sawnwood produced during the first year is 50 percent of full production.

Based on the assumptions indicated in Chapter 2, Appendices 2A, 2B and 2C show the direct annual production costs at full production for the three alternatives, based on 1977 market prices.

Appendix 2D indicates the net present value of the calculated production costs using the following formula:

$$(1) \quad NPC = \sum_{t=0}^n \sum_{i=1}^m \frac{C_{t,i} \cdot r^t}{(1+r)^t}$$

where:

NPC is net present value of costs  
n is length of the project (years)  
m is the number of cost components considered  
t is years,  $t \in (0, n)$   
i is cost component,  $i \in (1, m)$   
 $C_{t,i}$  is amount of cost component  $i$  at time  $t$   
 $r^t$  is shadow price of component  $i$  ( $r$  equals one in the financial analysis, or all  $i$ )

This calculation method takes care of the time profile of the costs, in particular the length of the running-in period and the differences regarding investment costs and recurrent expenditures.

### 3.1 Indirect Effects

The indirect economic effects of the three alternatives were calculated using the input/output table for Tanzania presented in UNDP (1975). The indirect effects of the three sawmill alternatives have been estimated by adding one sector ("sawmilling sector") to the original input/output matrix.

Each of the recurrent expenditures of the three alternatives were used to calculate the direct and indirect effects as shown in Appendix 2E.

## 4. EFFECTS ON CRITERIA

The following treatise is based on assumptions and calculations indicated in the preceding chapters. It concerns the appraisal of the three alternatives in relation to the criteria mentioned in Chapter 1.

### 4.1 Production Efficiency from a National Economic Point of View

#### 4.1.1 Direct economic effects

Appendix 2D shows that alternative C is significantly more favourable, from a national economic point of view, than B which, in turn, again is more favourable than A. The present values of costs for the three alternatives, using a 9 percent discount rate and assuming constant prices, are as follows:

Alternative A	T.shs.	60.9 million
Alternative B	T.shs.	52.6 million
Alternative C	T.shs.	40.6 million

From a national economic point of view, alternatives A and B are 50 and 30 percent more expensive respectively than C when based on the afore-mentioned assumptions.

The main reason for the large differences between alternatives A and B on the one hand and C on the other, is the relatively low investment cost for the latter, as shown in Appendix 1.

#### 4.1.2 Indirect economic effects

Appendix 2E shows that the indirect use of economic resources, where the marginal propensity to consume is 0, is the highest for alternative A and lowest for C. The largest difference relates to depreciation; alternative C has an indirect economic effect which is 27 percent lower than A and 24 percent lower than B. The main reason for this is that alternative C requires less vehicle repairs and maintenance.

When the marginal propensity to consume is changed to 0.5, alternative C rates an indirect total (gross) production figure which is approximately 2 percent higher than A and 3 percent higher than B. The main reason for this is that alternative C is the most labour intensive alternative.

All alternatives, but in particular C, have a high indirect import usage when compared with the direct import component. The main reason for this is that the agricultural tractors contemplated for all alternatives are assembled in Tanzania, thus giving a low direct import, but a high indirect import component.

Adjusting for the indirect operating surplus and taking into account the indirect import effects, it is fair to conclude that, if the marginal propensity to consume is about 0.5, the indirect economic effects of the three alternatives are about equal.

#### 4.2 Production Efficiency from a Business Point of View

The first line of Appendix 2D indicates that the present values of costs, using shadow prices of 1.0 and a 9 percent discount rate, are the following:

Alternative A	T.shs.	52.1 million
Alternative B	T.shs.	47.1 million
Alternative C	T.shs.	39.6 million

This means that alternatives A and B are 32 and 19 percent more expensive respectively, from a business point of view, than alternative C. The above cost differences between alternatives A and B relative to C correspond to an average of T.shs. 1.95 and 1.17 million per year, or T.shs. 139 and 84 per m<sup>3</sup> of sawnwood produced. Appendix 2D also shows that the cost differences between alternative C and alternatives A and B decrease with increased labour and energy costs, but they increase with increased import and other costs, for reasons stated in Chapter 4.1.

#### 4.3 Employment

##### 4.3.1 Direct employment

Table 2 shows the direct employment effects of the three alternatives.

Table 2

Direct employment effects of producing  
14 000 m3 of sawnwood per year

Type of personnel employed	Direct employment generated (man/year)		
	Alt. A	Alt. B	Alt. C
Un/semi-skilled	167	171	201
Skilled	57	56	55

It can be seen that alternative C has a direct total employment effect which is approximately 13 percent higher than the other two alternatives. The employment of skilled personnel in the three alternatives is about equal, but alternative C employs about 20 percent more un/semi-skilled personnel than the other alternatives.

##### 4.3.2 Indirect employment effects

Wages and salaries indicated in Appendix 2E show that the indirect employment effects of the three alternatives are about equal.

#### 4.4 Working Conditions

Alternative C will probably entail more physical strain for the employees than for those of the other alternatives in the handling of sawlogs at mill site and in loading sawnwood on trailers. With proper planning, however, it should be fairly easy to keep this strain below a harmful level.

As far as psychological strain and risks of personnel accidents is concerned, there is little difference between the alternatives. It may be argued, however, that alternative C has an advantage because more workers will be able to live at home in already existing villages.

Regarding workers' influence on their own working situation, the three alternatives seem to be about equal, although alternative C represents smaller production units, where each worker might have more influence than in larger production units.

#### 4.5 Integration

Alternatives A and B have a considerably higher import usage (particularly direct import) than C. The latter is, therefore, more integrated in the present economic structure of Tanzania.

Regarding integration with the present social structure and the future economic and social development of Tanzania, it may be argued that C is easier to integrate in the existing social infrastructure than A and B, and thus gives a higher positive spin-off effect.

#### 4.6 Independency

Regarding independency on micro level (i.e. project level) the financial profitability is an indicator, which was covered in Chapter 4.2, concluding that alternative C is the most preferable alternative. This conclusion also emerges from Appendix 2E regarding the independency on macro level indicated as direct and indirect import usage.

#### 4.7 Ecological Effects

The three alternatives are approximately equal with respect to ecological effects, which may be termed as not damaging.

#### 4.8 Distributional Aspects

The most important distributional effect, except personal income, is, in this case, regional income. Alternatives A and B are about equal, but alternative C, which will employ about 20 percent more un/semi-skilled personnel, is likely to have a greater indirect effect in Iringa region and Mufindi District.

#### 4.9 Flexibility

As alternatives A and B consist of only one sawmill unit, they are more vulnerable to breakdowns, changes in production output, etc., than alternative C, which consists of five units. These units might, however, be more difficult to administrate, even though one extra person will be employed per unit for this.

#### 4.10 Uncertainty

The productivity estimates assumed in the analysis have been proved to be realistic at Sao Hill for alternatives A and B. Alternative C, however, has not been tried at Sao Hill, and its assumed productivity is therefore uncertain. However, Wickström (1984) indicates a productivity for one mobile saw bench of 1000 m<sup>3</sup> of sawnwood per year and an average recovery percentage of 47 percent from softwood thinnings in Tanzania. The productivity figures mentioned in NTI (1959) imply that the productivity estimates assumed in this paper for alternative C are on the low side.

Control of the operations presents another uncertainty, although the SHS project has proved that units like A and B can easily be managed. Five smaller mills spread out in the forest reserves may, however, be more difficult to supervise. Lack of control could in theory imply either:

- (a) decrease in production of sawnwood;
- (b) no decrease in production, but an increase in production costs;
- (c) no decrease in production, but a decrease in official sales; or
- (d) a combination of these factors.



From a national economic point of view, situations (a) and (b) represent the worst cases. However, situation (c) could be vital for the project's existence, as a necessary condition for an industrial project in most LDC's is that it is financially self-sufficient.

Alternatives A and B are more vulnerable to import shortages and changes in import prices than C which, on the other hand, is somewhat more vulnerable to changes in prices for oil and diesel.

If a profitable further utilization of wood residues at mill site is considered, for example for board or pulp production, it is quite clear that alternatives A and B have an advantage over C. In the case of Sao Hill, this consideration was in fact one argument for choosing its location. However, time has shown that this type of expansion did not materialize at SHS.

In relation to uncertainty, alternatives A and B are better than C.

#### 4.11 Other Main Factors

Alternative C will give employment to about 30 more persons and will, therefore, create more skill than alternatives A and B.

### 5. CONCLUSION

When comparing one centralized sawmill with five smaller mills at Sao Hill, it is not fair to use alternative A for this comparison because it has features which are irrelevant to the sawmilling technology used (e.g. unnecessary high investment costs in buildings and logging equipment). In appraising the two types of technology, it is fairer to make a comparison between alternatives B and C. From the discussion in Chapter 4, it may be concluded that alternative C was superior or equal to alternative B in 1977, except for the uncertainty factors discussed in Chapter 4.10.

From 1977 till mid-1982 prices in Tanzania for the items listed below increased as follows:

Diesel	89 % higher than in 1977
Vehicles	100 % higher than in 1977
Sawmill machinery	55 % higher than in 1977
Spare parts	130 % higher than in 1977
Tyres	150 % higher than in 1977
General consumer price index	65 % higher than in 1977
Foreign exchange rate	0 % higher than in 1977 (T.shs/US\$)
Salaries	54 % higher than in 1977

If we compare these increases with the calculation results shown in Chapter 3, it is evident that the superiority of alternative C is even higher in 1982 than it was in 1977. It may be concluded that, except for the uncertainty factors already mentioned, the technology represented by alternative C would have been a better choice both in 1977 and 1982.

One should be careful in drawing conclusions from this study for projects which have other physical, technological and socio-economic characteristics. Three factors in particular favour alternative C at Sao Hill:

- (a) The timber supply areas were relatively widely scattered. If larger timber concentrations had existed, alternative A and B are likely to have been more attractive than shown in this analysis, because transport costs would have been less decisive.
- (b) No electricity is yet available at Sao Hill, which means that all three alternatives have to use diesel or steam for energy production. If public electricity were available at prices below diesel or steam, the operating costs for alternatives A and B could be lowered to a larger degree than those for alternative C.
- (c) Investment costs for social infrastructure in the case of alternative C are lower than those for A and B, because C is more decentralized and more of the workers will be able to live in their existing homes.

Finally, the study shows that in a country like Tanzania sawmill technologies exist which are highly compatible with more capital-intensive alternatives.

APPENDIX 1A

INVESTMENT FOR ALTERNATIVE A

Item	Investment costs (1000 shs)		Assumed write-off time (years)
	Total	Direct import	
<b>1. Sawmill and administration</b>			
Site preparation	520		20
Main sawmill building	2 480		20
Workshop building, one shed for storing sawnwood (1000 m <sup>2</sup> ), one shed for trimming unit, petrol station, office building	560		20
Sawmill machinery	4 890	4 890	10
Green chain	450	450	10
Saw-filing equipment	90	90	10
Trimming unit	370	370	10
Diesel power plant	800	800	10
Electricity installations	180		10
2 wheel loaders	1 050	1 050	5
1 lorry with 2-axle trailer	690		5
2 agricultural tractors with trailer	320		5
1 4-wheel drive vehicle	90		5
Misc. items	450		
<b>Total</b>	<b>12 940</b>	<b>7 650</b>	
<b>2. Logging and road transport of logs</b>			
2 forwarders with trailers	2 200	2 200	5
1 agricultural tractor	230		5
Logging equipment for above	50	50	5
2 lorries with trailer	1 490		5
2 hydraulic grapple loaders for above	360	360	5
1 4-wheel drive vehicle	90		5
1 tipper truck	410		5
Roads	560		20
1 stone crusher	60		10
Misc. items	200		10
<b>Total</b>	<b>5 650</b>	<b>2 610</b>	
<b>3. Social infrastructure</b>			
20 senior staff houses	1 400		20
100 junior staff houses	1 500		20
Water supply	300		20
Misc. items	240		20
<b>Total</b>	<b>3 440</b>		
<b>4. Pre-operational costs</b>	<b>980</b>		<b>20</b>
<b>GRAND TOTAL</b>	<b>23 010</b>	<b>10 260</b>	

APPENDIX 1B

INVESTMENT FOR ALTERNATIVE B

Type	Investment costs (1000 shs)		Assumed write-off time (years)
	Total	Direct import	
<u>1. Sawmilling and administration</u>			
Site preparation	520		20
Main sawmill building	1 200		20
Workshop and other buildings	560		20
Sawmill machinery	4 890	4 890	10
Green chain and dipping tank	450	450	10
Sawdoctor equipment	90	90	10
Trimming unit	370	370	10
Diesel power plant	800	800	10
Electricity installation	180		10
2 wheel-loaders	970		5
1 lorry with trailer	690		5
2 agricultural tractors with trailers	320		5
1 4-wheel drive vehicle	90		5
Miscellaneous	450		10
Roads	330		20
<b>Total</b>	<b>11 910</b>	<b>6 600</b>	
<u>2. Logging and log transport</u>			
3 agricultural tractors	650		5
Logging equipment for 3 above units	200	200	5
3 trucks	1 100		5
3 piggy-back trailers and hydraulic grapple loaders for the above 3 lorries	770	770	5
1 tipper truck	400		5
1 4-wheel drive vehicle	90		5
1 stone crusher	60		10
Access roads	230		20
Miscellaneous	200		10
<b>Total</b>	<b>3 700</b>	<b>970</b>	
<u>3. Social infrastructure</u>			
20 senior staff houses	1 400		20
70 junior staff houses	1 050		20
Water supply	260		20
Miscellaneous	240		20
<b>Total</b>	<b>2 950</b>		
<u>4. Pre-operational costs</u>	980		20
<b>GRAND TOTAL</b>	<b>19 540</b>	<b>7 570</b>	

APPENDIX 1C

INVESTMENT FOR ALTERNATIVE C

Type	Investment costs (1000 shs)		Assumed write-off time (years)
	Total	Direct import	
1. Sawmill			
Preparing of site (cement floor, timber intake, building materials which cannot be reused)	40		3
Building materials which can be reused (corrugated iron sheets, office equipment, etc.)	30		10
Sawmilling machinery	219	214	10
Diesel engine (160 hp)	44		5
Power transmission	13	13	5
Misc. items	35	20	10
Total - one mill	381	247	
Total - five mills	1 905	1 235	
2. Logging			
5 agricultural tractors	830		5
2 trailers (for tractors)	60		5
5 sets of skidding equipment for tractors	200	200	5
1 tipper truck	390		5
1 4-wheel drive vehicle	90		5
9 sulkies, various equipment, etc.	40		5
1 stone crusher	60		10
Misc. items	160		10
Total	1 830	200	
3. Road transport of sawnwood to Central Unit			
3 agricultural tractors	700		5
8 trailers (for tractors)	240		5
Access roads	230		20
Total	1 170		

(cont.)

APPENDIX 1C (cont.)

Type	Investment costs (1000 shs)		Assumed write-off time (years)
	Total	Direct import	
4. Central unit			
Site preparation	200		20
Buildings	600		20
Sorting and dipping arrangement	150		20
Sawdoctor equipment	90	90	10
Trimming unit	370	370	10
2 diesel engines 60 hp	75		5
1 wheel-loader	485		5
2 agricultural tractors	230		5
2 trailers (for tractors)	40		5
1 4-wheel drive vehicle	90		5
1 lorry with trailer	690		5
Roads	330		20
Pre-operational costs	980		20
Misc.	360		10
Total	4 690	460	
5. Social infrastructure			
20 senior staff houses	1 400		20
50 junior staff houses	750		20
Water supply	250		
Miscellaneous	240		
Total	2 640		
GRAND TOTAL (rounded off)	12 240	1 900	

AVERAGE ANNUAL OPERATING COSTS FOR SAWMILLING ALTERNATIVE A  
AT FULL PRODUCTION  
(at 1977 market prices in 1000 T.shs./year)

Type of costs	Logging and road transport		Sawmilling*		Administration and sales**		Social infrastructure		Total	
	Direct	import	Total	Direct	Total	Direct	Total	Direct	Total	import
Depreciation	837	416	1 037	769	191		155		2 200	1 185
Interest***										
On machinery/buildings	259	114	591	374	95		170		1 115	488
On stock of spare parts	63	42	141	136	7				211	178
On working capital	43		43		27		2		115	
Insurance	91		60		30		10		191	
Fixed machinery/building costs	1 293	572	1 872	1 279	350		337		3 852	1 851
Energy (diesel, oil)	256		335		76				667	
Tyres	261	90	70		83				414	90
Spare parts and consumables										
excl. tyres	410	202	320	144	110		50		840	346
Other costs	50		186	22	335				621	22
Total machinery/building costs	2 270	864	2 783	1 445	954		387		6 394	2 309
Salaries										
Un- and semiskilled pers.	415		432		60		Included in saw-		907	
Skilled personnel	163		181		292		milling & admin.		636	
Total shs/ycar	2 848	864	3 396	1 445	1 306		387		7 937	2 309
Total shs/m <sup>3</sup> sawnwood	203	62	243	103	93		28		567	165

APPENDIX 2A

- \* Including trimming unit and loading of sawnwood.  
 \*\* Including pre-operational costs, office building, one 4-wheel drive vehicle and one lorry.  
 \*\*\* At 9 percent per annum real term rate of interest.

AVERAGE ANNUAL OPERATING COSTS FOR SAWMILLING ALTERNATIVE B  
AT FULL PRODUCTION  
(at 1977 market prices in 1000 T.shs./year)

Type of costs	Logging and road transport		Sawmilling*		Administration and sales**		Social infrastructure		Total
	Direct	import	Total	Direct	Total	Direct	Total	Direct	import
Depreciation***	613	175	993	594	191	133	1 930	769	
Interest***									
On machinery/buildings	185	48	542	327	95	146	968	375	
On stock of spare parts	37	17	141	119	7		185	136	
On working capital	38		43		27	2	110		
Insurance	75		60		30	8	173		
Fixed machinery/building costs	948	240	1 779	1 040	350	289	3 366	1 280	
Energy (diesel, oil)	235		336		76		647		
Tyres	191		70		83		344		
Spare parts and consumables									
excl. tyres	313	148	320	144	110	50	743	292	
Other costs	50		186	22	335		621	22	
Total machinery/building costs	1 737	388	2 691	1 206	954	339	5 721	1 594	
Salaries:									
Un- and semi-skilled pers.	437		432		60	(incl. in sawmill-	929		
Skilled personnel	152		181		292	ling and admin.)	625		
Total shs/year	2 326	388	3 304	1 206	1 306	339	7 275	1 594	
Total shs/year m <sup>3</sup>	166	28	236	86	93	24	520	114	

\* Including trimming unit and loading of sawnwood.

\*\* Including pre-operational costs, office building, one 4-wheel drive vehicle and one lorry.

\*\*\* At 9 percent per annum real term rate of interest.



AVERAGE ANNUAL OPERATING COSTS FOR SAWMILLING ALTERNATIVE C  
AT FULL PRODUCTION  
(at 1977 market prices in 1000 T.shs./year)

Type of costs	Logging		Sawmilling		Road trans- port of sawn- wood to Cen- tral Unit		Central Unit exc. admin. and sales		Adminis. and sales*		Social infra- structure		Total
	Direct		Direct		Direct		Direct		Direct		Direct		
	Total import	Total	Total import	Total	Total import	Total	Total import	Total	Total import	Total	Total import	Total	
Depreciation	310	36	226	117	178		274	41	191		119		194
Interests**													
on machinery/buildings	91	10	94	61	56		137	23	95		131		94
on stock of spare parts	18	4	25	22	8		17	8	7				34
on working capital	29		23		5		25		27		2		111
Insurance	28		15		5		26		30		7		111
Fixed machinery/building costs	476	50	383	200	252		479	72	350		259		322
Energy (diesel, oil)	231		225		42		129		76				703
Tyres	90				29		42		83				244
Spare parts and consumables													
excl. tyres	169	2	150	112	44		162	34	110				148
Other costs	30		25		25		163	22	335		48		22
Total machinery/building costs	996	52	783	312	392		975	128	954		307		492
Salaries													
Un- and semi-skilled pers.	402		273		27		329		60		(incl. in	1 091	
Skilled personnel	115		145		14		93		320		Central Unit costs)	687	
Total - shs./year	1 513	52	1 201	312	433		1 397	128	1 334		307		492
Total - shs/m <sup>3</sup>	108	4	86	22	31		100	9	95		22		35

\* Same costs are assumed as in Alt. A and Alt. B, except that one person more is employed for supervision in Alt. C.

\*\* At 9 percent per annum real term rate of interest.

APPENDIX 2D

THE COSTS OF THE THREE SAWMILL ALTERNATIVES  
CALCULATED AS DISCOUNTED PRESENT VALUES  
(1977 prices)

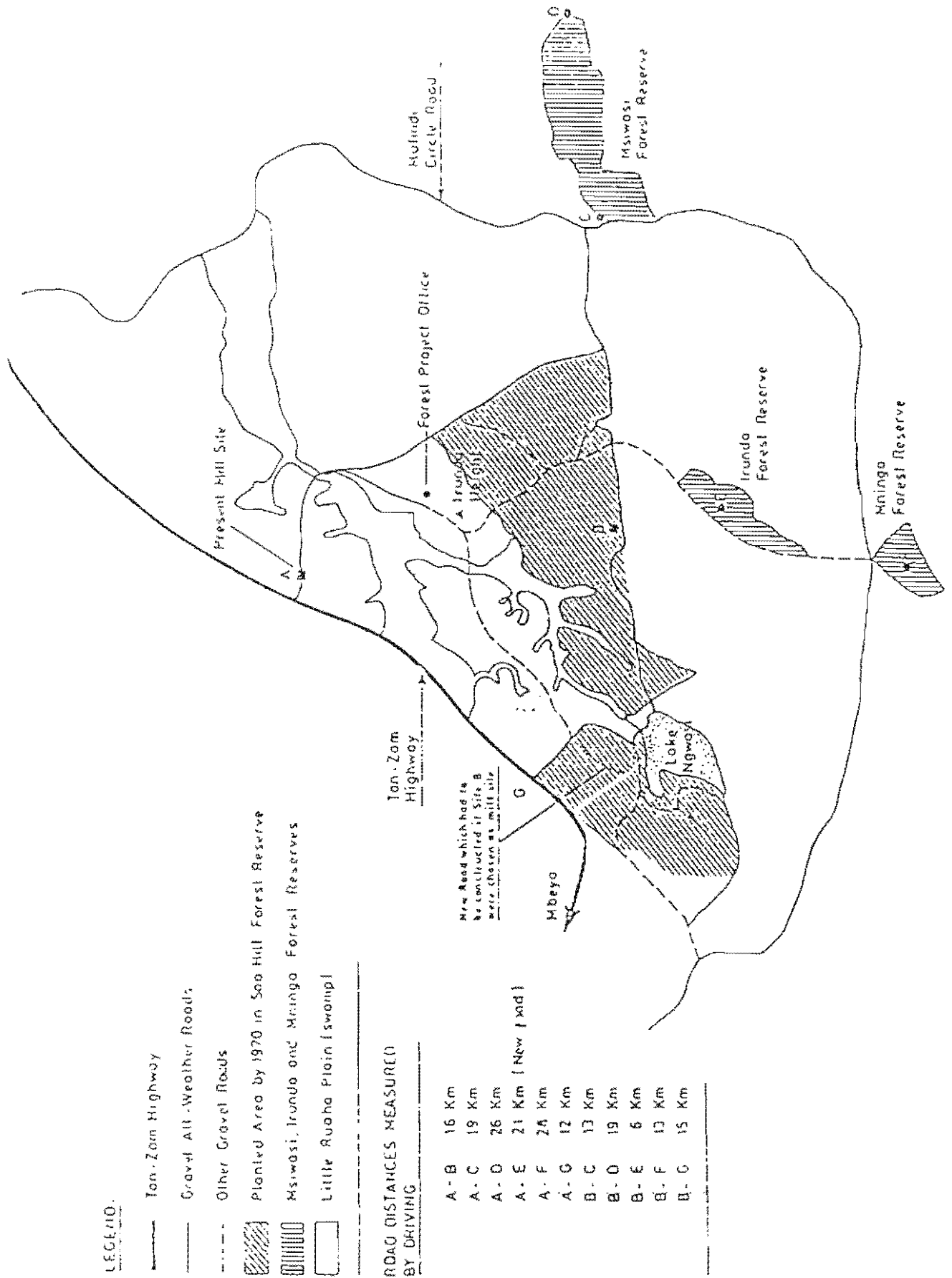
Price increases (%)				Shadow prices*		Discounted present values of costs (mill.T.shs)										
Labour		Energy		Import		Other		Un/semi- skilled labour	Skilled labour	Import	At 6%/a interest			At 9%/a interest		
											Alt. A	Alt. B	Alt. C	Alt. A	Alt. B	Alt. C
0	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	55.4	50.2	43.0	52.1	47.1	39.6
10	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	56.7	51.5	44.5	53.3	48.3	40.8
30	0	0	0	0	0	1.0	1.0	1.0	1.0	1.0	59.3	54.1	47.3	55.7	50.6	43.4
<hr/>																
0	10	0	0	0	0	1.0	1.0	1.0	1.0	1.0	55.9	50.7	43.5	52.5	47.5	40.0
0	30	0	0	0	0	1.0	1.0	1.0	1.0	1.0	56.8	51.6	44.5	53.4	48.3	40.9
<hr/>																
0	0	0	10	0	0	1.0	1.0	1.0	1.0	1.0	57.0	51.3	43.4	53.7	48.1	39.9
0	0	0	30	0	0	1.0	1.0	1.0	1.0	1.0	60.2	53.4	44.1	56.9	50.3	40.6
<hr/>																
0	0	0	0	10	0	1.0	1.0	1.0	1.0	1.0	57.5	52.4	45.1	54.2	49.2	41.5
0	0	0	0	30	0	1.0	1.0	1.0	1.0	1.0	61.8	56.9	49.1	58.3	53.3	45.3
<hr/>																
0	0	0	0	0	0	0.7	1.3	1.6	1.6	1.6	64.2	55.8	44.1	60.9	52.6	40.6
0	0	0	0	0	0	0.5	1.3	1.6	1.6	1.6	62.7	54.2	42.3	59.4	51.2	39.0
0	0	0	0	0	0	0.7	1.7	1.6	1.6	1.6	66.3	57.8	46.2	62.7	54.5	42.5
0	0	0	0	0	0	0.7	1.3	2.0	2.0	2.0	70.7	60.0	45.4	67.2	56.9	41.9

\* This corresponds to  $s_1$  in the equation mentioned in Chapter 3.

DIRECT AND INDIRECT ECONOMIC EFFECTS OF ALTERNATIVE  
SAWMILL TECHNOLOGIES FOR PRODUCING 14 000 m<sup>3</sup> OF SAWWOOD (1000 T.shs/a)

Variables	Alternative A			Alternative B			Alternative C		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
1. Marginal propensity to consume is 0									
Domestic inputs*	2 275	843	3 118	2 214	816	3 030	2 149	820	2 969
Imports	458	701	1 159	314	674	988	170	672	842
Wages and salaries	1 543	682	2 225	1 554	683	2 237	1 778	684	2 462
Operating surplus	0	438	438	0	420	420	0	416	416
Depreciation	2 220	283	2 503	1 930	271	2 201	1 298	207	1 505
Net value added	1 121	1 543	2 663	1 554	1 103	2 657	1 778	1 100	2 878
Gross value added	3 763	1 403	5 166	3 484	1 374	4 858	3 076	1 307	4 383
Total (gross) production	6 496	3 286	9 782	6 012	3 208	9 220	5 395	3 118	8 513
2. Marginal propensity to consume is 0.5									
Domestic inputs*	2 275	2 177	4 452	2 214	2 158	4 372	2 149	2 296	4 445
Imports	458	911	1 369	314	884	1 198	770	904	1 074
Wages and salaries	1 543	860	2 403	1 554	862	2 416	1 778	880	2 658
Operating surplus	0	1 075	1 075	0	1 060	1 060	0	1 120	1 120
Depreciation	2 220	340	2 560	1 930	329	2 259	1 298	270	1 568
Net value added	1 543	1 935	3 478	1 554	1 921	3 475	1 778	2 000	3 778
Gross value added	3 763	2 274	6 037	3 484	2 250	5 734	3 076	2 271	5 347
Total (gross) production	6 496	5 822	12 318	6 012	5 757	11 769	5 395	5 923	11 318

\* Excl. wages and salaries and operating surplus.



REFERENCES

- Bavu, I. et al.      Evaluation of Sao Hill Sawmill. NORAD, Oslo.  
1983
- Fergus, M. et al.      Report on the evaluation of the Sao Hill sawmill  
1977      project, Tanzania. NORAD, Oslo.
- Nagoda, L.      Personal communication. Department of Wood Technology,  
1983      Agric. University of Norway.
- NTI      Produktivitetsundersøkelse innen sagbruksindustrien. The  
1959      Norwegian Institute of Wood Working and Wood Technology, Oslo.  
May 1959.
- Roos, K.      Steam power generation of electricity - a cost comparison  
1983      with diesel power. The Swedish University of Agricultural  
Sciences, Dept. of Forest Products, Uppsala, Research Note  
No. 122.
- Skjønberg, E.      Sao Hill sawmill from a socio-economic and political  
1983      point of view. In: BAVU et al. 1983: Evaluation of Sao Hill  
Sawmill, NORAD, Oslo. Appendix F.
- Solberg, B.      Choice of technology and employment in development  
1981      projects - some methodological considerations. Proceedings  
Div. 4, XVII IUFRO World Congress, Kyoto:237-256.
- Solberg, B.      Choice of technology in forestry development projects  
1985      - some theoretical aspects and a case study from Sao Hill  
Sawmill, Tanzania. Report, Department of Forest Economics,  
Agricultural University of Norway.
- UNDP      Project findings and recommendations. Tanzania. UNDP Report  
1975      DP/UN/URT-68-005/1.
- Wickstrøm, E.      Personal Communication. Tanzania Wood Industries  
1984      Cooperation. Dar es Salaam.

RECENT DEVELOPMENTS IN SAWMILL  
AND PLYWOOD INDUSTRIES IN INDONESIA

by

L.W.M. Meulenhoff\*

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## 1. INTRODUCTION

Indonesia is a widespread archipelago consisting of 13 667 islands of which 992 are inhabited. It stretches from 95° E to 141° E (about 5 000 km along the equator) and between 6° N and 11° S (more than 2 000 km). The main islands are Sumatra (lying almost parallel to the west of Peninsular Malaysia across the straits of Molucca), Java, Kalimantan (part of the island of Borneo and sharing common borders with East Malaysia), Sulawesi and Irian Jaya, as shown in Appendix 3.

Indonesia has a humid tropical climate with an average daily temperature of 26°C in the lowlands and about 22°C in the highlands. The annual rainfall varies from island to island, with an average of 3 300 mm in Kalimantan and 2 000 mm in the eastern part of Nusa Tenggara.

Java averages 2 000 mm in the mountains. There is a pronounced dry season (between April and October), and a wet or rainy season (between November and March) particularly on Java and Nusa Tenggara island. The natural vegetation is an evergreen mixed tropical rain forest abounding with a wide variety of tropical mammals and birds.

Rice, maize, tobacco, tea, palm oil, rubber, coffee, beetlenut, nutmeg, kapok, pepper, coconut, cloves and other products from plantations add their share to the resources of the country. Oil, wood and wood-based products comprise approximately 80 to 90 percent of the country's exports.

The population of Indonesia in 1980 was 147.5 million. It is increasing at an annual growth rate of 2.3 percent. The bulk of the population, 91.3 million or 61.9 percent, lives on Java, which constitutes only 7 percent of the total land area of the country. This concentration makes Java the primary consumer of the country's production. However, the natural minerals and forest resources needed to provide a large portion of this consumption have to be obtained from the other islands, separated by large expanses of water from Java. The capital city is Jakarta which has a population of 6.5 million.

Indonesia is a Pancasila<sup>1/</sup> democracy, and in foreign affairs a non-aligned country.

The gross domestic product (GDP) at market prices was US\$ 69 800 million in 1980, or US\$ 473 per caput. The gross national product (GNP) is US\$ 430 per caput, with an annual average growth rate of 4 percent between 1960-1980. In 1980 industry contributed 42 percent to the GDP, services 32 percent, and agriculture and forestry combined 26 percent. The economy is export oriented with a positive trade balance. Indonesia, a member of OPEC, is a main oil producer in South-East Asia. It is also a member of the Association of South-East Asian Nations (ASEAN).

Light and heavy industries are being developed and government policy encourages the rapid growth of industrialization, particularly since Indonesia commenced its first Five-Year National Development Plan in 1968/69. In the current fourth Five-Year Development Plan, the REPELITA IV (1984/85-1988/89), emphasis is placed on industrial expansion.

Forest-based industry is one of the important economic sectors in Indonesia.

---

<sup>1/</sup> Pancasila democracy is the Indonesian system of democracy based on the Indonesian value system and way of life as expressed in the National Constitution, the Undang-Undang Dasar, 1945.

## 2. PAST AND PRESENT SITUATION

### 2.1 Forest Area

The present land-use data show that Indonesia's forest land covers 143 million ha, which is about 74 percent of the total land area. About 113 million ha are classified and designated as permanent forests, and 30 million ha as non-permanent forests.

Non-permanent forest lands are those which can be utilized for purposes other than forestry, such as resettlement, transmigration, agriculture, estates, etc., if so required. Table 1 shows the classification of designated forest lands, distributed by region.

Table 1  
Land area and forest resources in Indonesia  
(in thousands of hectares)

No.	Region	Land area	Permanent forest land	Non-permanent forest land	Total forest land	Percent
A.	Java	13 219	3 013	-	3 013	23
B.	<u>Other islands</u>					
	- Sumatra	46 949	25 251	5 049	30 300	64
	- Kalimantan	54 825	36 674	8 293	44 967	82
	- Sulawesi	19 661	11 277	1 602	12 879	65
	- Nusa Tenggara	8 778	3 365	3 007	6 372	73
	- Maluku	8 573	5 097	436	5 533	65
	- Irian Jaya	41 066	28 816	11 775	40 591	99
Total other islands		179 853	110 481	30 164	140 645	78
Indonesia (A + B)		193 072	113 404	30 164	143 568	74

Source: Agency for Forest Inventory and Land Use, Department of Forestry, Bogor.

### 2.2 Wood Resources

#### 2.2.1 Natural forests

There are five types of natural forests in Indonesia:

1. mangrove forests;
2. fresh water swamp forests;
3. lowland tropical rain forests;
4. hill tropical rain forests; and
5. moist forests.

The bulk of the commercial forests of Indonesia, on which the wood-based industry relies for its raw material supply, are lowland tropical rain forests and hill tropical rain forests.



Inventories carried out since the sixties up to 1982 have covered 92 million ha. The natural forest potential, based on an outer diameter breast height (dbh) of 50 cm and up, is about 78 million m<sup>3</sup>. Including commercially less accepted species, the annual potential cut would be about 100-150 m<sup>3</sup>/ha, varying from region to region. The known commercial species which are marketed at present include meranti (*Shorea* spp.), kapur (*Dryobalanops aromatica*), keruing (*Dipterocarpus* spp.), kempas (*Koompassia* spp.), mangir (*Callophyllum*) merawan (*Hopea* spp.), ramin, rengas, matoa, intsia, and other broadleaved tropical hardwood species.

## 2.2.2 Plantation forests

The production potential per annum is about 1.5 million m<sup>3</sup> from the 2.2 million ha mostly on the island of Java. The main species are teak (*Tectona grandis*), pine (*Pinus merkusii*) and agathis.

Large scale plantations, linked to reforestation programmes, have been started recently.

## 2.2.3 Logging and industrial residues

Logging residues are estimated at about 30-40 percent of the logs felled. Industrial residues are, respectively, about 50 percent from sawmilling and about 55 percent from plywood mills, as shown in Table 2.

Table 2  
Estimated industrial wood residues  
from sawmilling and plywood industries in Indonesia

<u>Sawmilling industry</u>		<u>Plywood industry</u>	
<u>Type of residue</u>	<u>%</u>	<u>Type of residue</u>	<u>%</u>
Log ends	25.0	Log ends	11.0
Sawdust	15.0	Cores	13.0
Others	10.0	Green veneer	13.0
		Dry veneer	12.0
		Trimmings	4.5
		Dust (from sanders)	1.5
<hr/>		<hr/>	
Total	50.0	Total	55.0

Source: Agency for Research and Development,  
Department of Forestry, Bogor.

This implies that out of the 55 million m<sup>3</sup>/a of the log production target, there are about 22 million m<sup>3</sup> of potential logging residues per year left in the forests. Out of the 13.5 million m<sup>3</sup>/a of the sawnwood production capacity, there will be about 6.75 million m<sup>3</sup>/a of potential residues. Out of the 5.0 million m<sup>3</sup>/a of the plywood industry, potential residues amount to about 2.75 million m<sup>3</sup>/a.

These wood residues are not yet utilized, except for the production of blockboard cores and as boiler fuel in the plywood industry.

## 2.3 Logging Operations

The natural forests outside Java are logged and managed by applying the Indonesian Selective Cutting System which defines, among others, a minimum cutting limit of 50 cm dbh and up, maintaining seed trees or nucleus trees in residual stands in order to ensure natural regeneration. The teak forests and other man-made forests on Java are cut and managed by a clear-cutting system.

Forest utilization consists of logging, processing and marketing, and reforestation after logging. The natural forests outside Java are utilized by private and state enterprises through 20-year concessions. For small timber lots concessions of two years are granted.

On Java all forest lands are managed by a State Forest Corporation.

Logging operations in lowland forest areas utilize heavy equipment for moving logs from the stump to a navigable river or forest roads. The most common method used for off-road transport in lowland and hill tropical rain forest is skidding. Skyline logging and highlead yarding are not used in logging operations in Indonesia.

The bigger islands are criss-crossed by large rivers suitable for log transport. The presence of these rivers creates accessibility and results in low transportation costs. However, some rivers cannot be used for rafting during long draughts.

Until March 1984 there were 573 concessions in operation, covering an area of about 63.5 million ha with an investment of US\$ 2 213 384.

## 2.4 Mechanical Wood-Based Industries

### 2.4.1 Sawmilling industry

#### Production

Based on scale of operation, the sawmilling industry in Indonesia can be divided into:

- (a) Small scale sawmilling with an annual production capacity of under 6 000 m<sup>3</sup>.
- (b) Medium scale sawmill industries with an annual production capacity of 6 000-12 000 m<sup>3</sup>.
- (c) Large scale sawmill industries, with an annual production capacity of 12 000 m<sup>3</sup> and up.

There are over 2 500 sawmills with a total combined capacity of about 14.9 million m<sup>3</sup> of sawnwood a year. Of these, 700 sawmills, with a potential capacity of approximately 12.9 million m<sup>3</sup>/a, account for most of the exports.

The structure of the sawmill production capacity as of December 1984 is shown in Table 3.

Table 3

Production capacity (output) of the Indonesian  
sawmilling industry as at December 1984

Type of raw material	Number of mills	Production capacity in m <sup>3</sup>	Percent
Teak wood <sup>1/</sup>	72	266 455	1.79
Non teak wood			
- Concessions	294	8 723 600	58.48
- Non-concessions	2 205	5 927 100	39.73
Total	2 571	14 917 155	100.00

Out of the above 294 sawmills with concessions, about 250<sub>3</sub> sawmills, with a combined annual production capacity of 7.4 million m<sup>3</sup> are the main potential producers of sawnwood for export. Mill capacity utilization during the period 1980/81-1983/84 increased from 45 to 50 percent for non-teak wood and from 65 to 70 percent for teak, as shown in Table 4.

The December 1984 status and planned capacity of non-teak sawmills with concessions, covering the entire country, are indicated in Appendix 1.

Table 4

Sawnwood production, 1980/81-1983/84 - Indonesia

Type of raw material	Production (1000 m <sup>3</sup> )			
	1980/81	1981/82	1982/83	1983/84
Teak wood	173.2	181.1	186.5	180
Non-teak	5 379.7	5 618.8	5 977.5	6 935
Total	5 552.9	5 799.9	6 164.0	7 115

Markets

Traditional markets for sawnwood from Indonesia are Asian countries (65%), EEC and other European countries (30%), and others (5%). The volume and value of sawnwood exports from Indonesia are as shown in Table 5.

<sup>1/</sup> Including also other fancy woods.

Table 5

Sawnwood exports from Indonesia, 1980/81-1983/84

Year	Volume (m <sup>3</sup> )	Value (US\$)
1980/81	1 182 960	243 900 000
1981/82	1 302 960	209 810 000
1982/83	1 389 590	201 600 000
1983/84	1 424 000	222 324 420

Species composition

In the last three years sawnwood species exported from Indonesia were ramin (43.4%), meranti (20.6%), keruing (4.0%), teak (1.4%), agathis (1.0%), kapur (0.8%), pulai (0.5%). Other species accounted for 28.3 percent of the total export volumes.

Problems of sawnilling industry

Some of the predominant problems of the sawnilling industry in Indonesia are:

- low production and productivity;
- low conversion from the wood raw material (below 50%);
- processing techniques are inadequate;
- selection of machinery and equipment is inappropriate;
- scarcity of skilled employees (mill operators, sawdoctors, etc.);
- low quality control.

2.4.2 Plywood and veneer industry

Production and export

Indonesia is becoming one of the world's largest plywood producers. There were 28 plywood mills in operation in 1980/81 with a total capacity of 1.5 million m<sup>3</sup>/a. In 1981/82 this number increased to 32 mills with a combined production capacity of 1.8 million m<sup>3</sup>/a. By April 1983, there were 61 mills with a combined capacity of 3.3 million m<sup>3</sup>/a. By the end of December 1984, there were 96 mills in production with a total capacity of 4.7 million m<sup>3</sup>/a. Production and export of plywood and veneer from Indonesia in 1980-84 are as shown in Table 6.

Table 6

Production and export of plywood and veneer - Indonesia

Year	Production capacity (1000 m <sup>3</sup> )	Actual production (1000 m <sup>3</sup> )	Export			
			Volume (1000 m <sup>3</sup> )		Value (million US\$)	
			Plywood	Veneer	Plywood	Veneer
1980/81*	1 500	1 000	635.8	133.8	203.9	37.9
1981/82	1 800	1 400	713.7	226.5	167.9	31.2
1982/83	3 300	1 900	1 222.3	143.0	295.4	30.1
1983/84	4 700	2 500	2 106.1	450.9	785.0	75.8

\* In Indonesia the fiscal year runs from 1 April to 31 March.

On the average 60 to 70 percent of the production is exported. Indonesia's plywood industry is largely based on meranti, which has excellent properties, and on other mixed light tropical hardwoods.

Most of the production consists of moisture resistant quality. Some exterior grade quality is manufactured. Glue is mainly urea formaldehyde; some phenolic/melamine glue is used for special purpose plywood.

Main plywood industry regions are: Sumatra (North, Riau, South, Jambi), Kalimantan (West/Pontianak, South/Banjarmasin, East/Samarinda); Java (Serang, Semarang, Gresik); and Maluku.

The December 1984 status and planned capacities of plywood industries throughout the country are shown in Appendix 2.

#### Plywood markets

The growing domestic market absorbs + 40 percent of the total production. The main size is 4' x 8' (1220 x 2440 mm). Sales are executed via sales agents or distributors.

Indonesia exports its plywood all over the world, among others to the USA (20%), EEC countries (11%), Middle East countries (22%), Asian countries (43%), Australia (1%) and others (3%).

#### Sliced veneer

Indonesia also produces sliced veneer. Main wood species are teak and ebony.

There are still many more species in Indonesia which could be sliced into attractive decorative veneers. Most of the sliced veneer production is sold on the local market.

#### Problems of the plywood industry

The main problems of the plywood industry in Indonesia are:

- Want of infrastructure facilities, such as transportation, port facilities, power supply.
- Repair and maintenance are often impeded by lack or delay in delivery of parts and tools.
- Glue is still mainly imported.
- Inconsistency of grading and quality.
- Tariff barriers in some importing countries.

#### 2.4.3 Other wood-based industries

Other wood-based industries produce blockboard, particle board, chipboard, pulp and paper and rayon. The status of these wood-based industries by the end of December 1984 and their planned capacity is shown in Table 7.

Table 7  
Other Wood-Based Industries in Indonesia at December 1984

Product	Unit	In production		Under construction		Approved and applied for	
		No. mill	Capacity	No. mill	Capacity	No. mill	Capacity
Blockboard	m <sup>3</sup> /a	17	223 150	2	28 550	53	545 900
Particle board	m <sup>3</sup> /a	2	103 000	1	12 000	4	30 200
Wood chips	t/a	3	474 000	-	-	1	154 000
Pulp	t/a	1	100 000	-	-	5	752 500
Paper	t/a	-	-	1	90 000	5	287 200
Rayon	t/a	-	-	-	-	2	59 800

Source: Directorate of Forest Industries, Jakarta 1985.

## 2.5 Economic Importance of the Mechanical Forest Industries

### The economic importance of sawmilling

Sawmilling is an important industry for the economy of Indonesia, as can be seen from Table 8.

Table 8  
Economic importance of sawmilling for Indonesia  
1982/83-1983/84

	National currency (million Rupiah)		US dollars <sup>3/</sup> (million)	
	1982/83	1983/84	1982/83	1983/84
Gross output value (turnover) in the sawmilling industry <sup>1/</sup>	801 764	928 250	801.8	928.3
Value added in the sawmilling industry <sup>2/</sup>	462 300	456 750	462.3	456.8
Value of exported sawnwood	201 600	338 250	201.6	338.3
Value of imported sawnwood	100	-	0.1	-

### The economic importance of the plywood industry

The economic importance of the plywood industry is illustrated in the following table.

Table 9  
Economic importance of the plywood industry for Indonesia  
1982/83-1983/84

	National currency (million Rupiah)		US dollars (million)	
	1982/83	1983/84	1982/83	1983/84
Gross output value (turnover) in the plywood industry	825 000	807 000	825.0	808.0
Value added in the plywood industry	198 000	307 000	198.0	307.0
Value of exported plywood <sup>4/</sup>	325 500	495 000	325.5	495.0
Value of imported plywood	-	-	-	-

<sup>1/</sup> Gross output value: (export of sawnwood production x f.o.b. prices) + domestic trade x domestic price.

<sup>2/</sup> Gross output value - purchase of materials.

<sup>3/</sup> Exchange rate: 1 US Dollar = + 1000 Rupiah

<sup>4/</sup> Including veneer products.

3. PROSPECTS FOR THE INDUSTRY: SUGGESTIONS  
FOR IMPROVING THE INDUSTRY

3.1 Sawmilling Industries

Prospects for the sawmilling industry in Indonesia remain bright. In order to increase its contribution to the national economy as well as to meet the increasing sawnwood demand of the world, steps should be taken to improve the industry.

- Sawmilling should be developed in provinces with an adequate raw material supply;
- Improvement of information/inventory data on the long-term supply in quality and quantity of the forests;
- Improvement of existing sawmills by replacement of obsolete machinery; installation of drying facilities;
- Training for managerial and operational skills;
- Improvement of infrastructure (road network, harbour facilities, etc.);
- Initiate quality control measures;
- Stimulate research and development;
- Provide market surveys and promote lesser known species.

3.2 Plywood Industry

No doubt the plywood industry in Indonesia will play a significant role in the development of the national economy. The plywood industry in Indonesia is labour intensive, which is the main reason why the Government is encouraging its development.

However, there is still much to be done to improve the industry:

- Development of glue factories in major plywood producing areas;
- Establishing training centres, supported by adequate facilities;
- Cooperation with plywood importing countries; elevation of bilateral and multilateral cooperation in market intelligence and operation of early warning systems;
- Promotion and increased utilization of lesser known species;
- Improving the machinery technology of the industry;
- Integration of blockboard and particle board production with plywood mills through the utilization of wood residues.

3.3 Other Wood-Based Industries

The prospects for the other wood-based industries are good, in view of a growing domestic market and export potentials.

To ensure development of these industries, the following steps should be taken:



- Building and working conditions must be improved, industrial estates with adequate facilities should be developed;
- Modernization of machinery and equipment;
- Improvement of furniture design;
- Industrial training;
- Expansion of research and development in cooperation with foreign technical centres, bilateral organizations/agencies, etc.
- Improvement of marketing studies and techniques.

Present status of sawmilling industries and planned capacity as at December 1984  
(this refers only to sawmills with concessions for species other than teak)

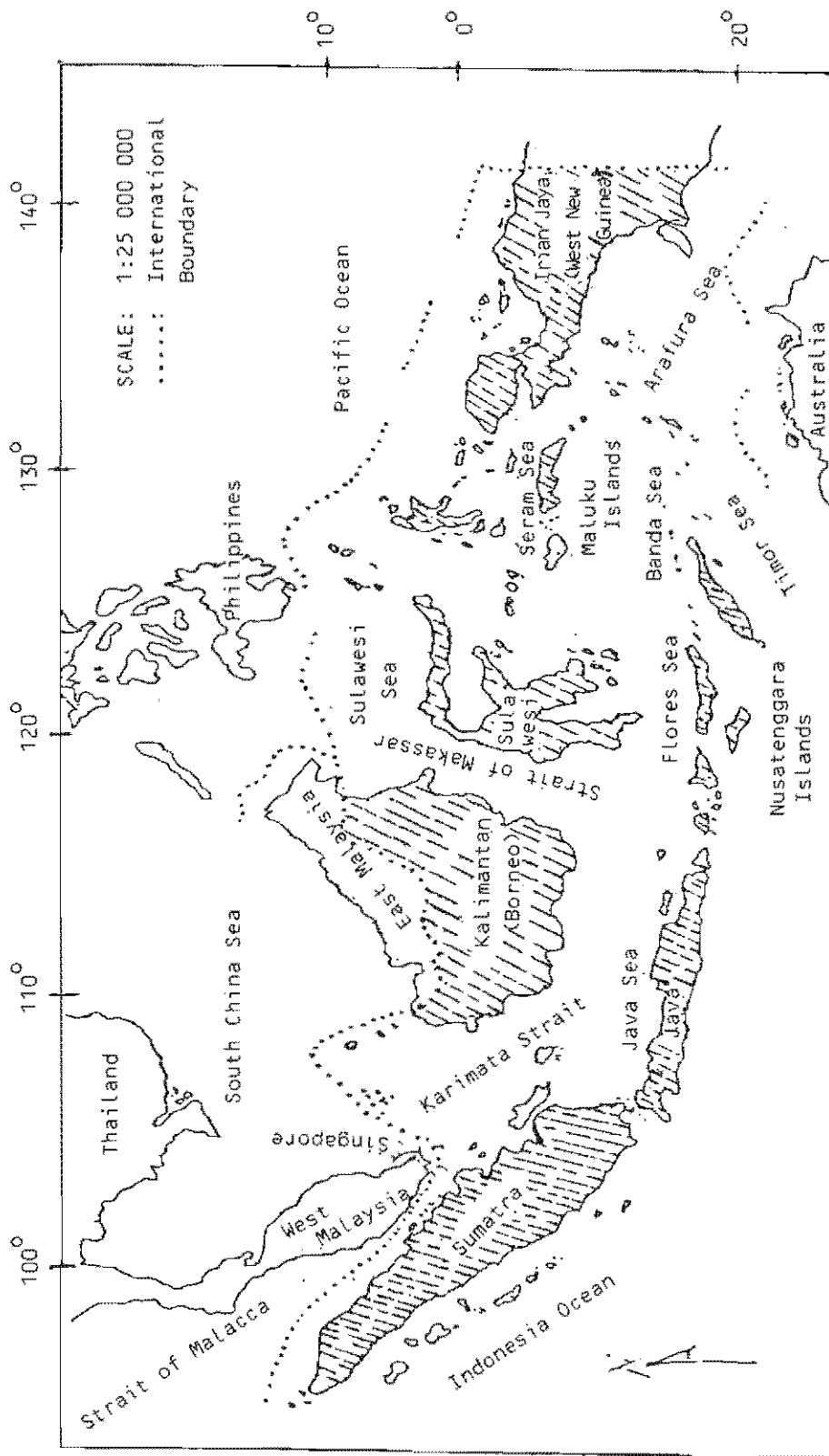
No.	Province	In production		Under construction		Approved/applied for		Total
		No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	Capacity (m <sup>3</sup> /a)
1.	Aceh	12	338 700	-	-	4	126 000	464 700
2.	Sumatera Utara	15	424 000	-	-	1	25 000	449 000
3.	Sumatera Barat	5	112 000	-	-	2	54 000	166 000
4.	Riau	36	793 000	-	-	12	240 000	1 033 000
5.	Jambi	21	556 500	-	-	5	107 000	663 500
6.	Bengkulu	2	36 000	-	-	2	84 000	120 000
7.	Sumatera Sel.	16	540 300	-	-	1	25 000	565 300
8.	Lampung	3	84 000	-	-	2	33 000	117 000
9.	Jawa Barat	1	24 000	-	-	-	-	24 000
10.	Jawa Tengah	1	12 000	-	-	-	-	12 000
11.	Jawa Timur	3	54 000	-	-	-	-	54 000
12.	Kalimantan Bar.	40	1 278 500	-	-	5	93 000	1 371 500
13.	Kalimantan Teng.	54	1 525 000	1	15 000	11	305 000	1 845 000
14.	Kalimantan Sel.	22	730 800	-	-	3	96 000	826 800
15.	Kalimantan Tim	41	1 570 600	6	214 000	22	661 500	2 446 100
16.	Sulawesi Ut.	-	-	-	-	-	-	-
17.	Sulawesi Teng.	8	261 000	1	15 000	5	93 000	369 000
18.	Sulawesi Sel.	5	107 000	-	-	-	-	107 000
19.	Sul. Tra	-	-	1	12 000	-	-	12 000
20.	NTB/NTT	1	30 000	-	-	-	-	30 000
21.	Maluku	6	168 000	1	48 000	14	323 000	539 000
22.	Irian Jaya	2	78 000	8	270 000	11	351 000	699 000
		294	8 723 400	18	574 000	100	2 616 500	11 914 100

Source: Directorate of Forest Industries, Jakarta, 1985.

Present status of plywood industries and planned capacities as at December 1984

No.	Province	In production			Under construction			Approved			Applied for			Total
		No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	No. mill	Capacity (m <sup>3</sup> /a)	
1.	Aceha	2	95 000	-	-	-	-	-	-	-	-	2	95 000	
2.	Sumatera Utara	4	86 400	1	24 000	-	-	1	40 000	-	-	6	150 400	
3.	Sumatera Barat	1	35 700	-	-	-	-	-	-	-	-	1	35 700	
4.	Riau	7	337 550	3	104 000	4	159 700	-	-	-	-	14	601 250	
5.	Jambi	7	243 665	1	22 000	-	-	-	-	-	-	8	265 665	
6.	Bengkulu	-	-	-	-	-	-	-	-	-	-	-	-	
7.	Sumatera Selatan	3	177 000	-	-	1	25 700	-	-	-	-	4	202 700	
8.	Lampung	1	35 700	-	-	-	-	-	-	-	-	1	35 700	
9.	Jawa Barat	1	71 400	-	-	-	-	-	-	-	-	1	71 400	
10.	Jawa Tengah	1	186 900	-	-	-	-	-	-	-	-	1	186 900	
11.	Jawa Timur	3	243 507	-	-	-	-	-	-	-	-	3	243 507	
12.	Kalimantan Barat	14	537 100	1	40 000	2	115 000	1	80 000	1	80 000	18	772 100	
13.	Kalimantan Tengah	5	301 000	2	58 000	7	315 500	-	-	-	-	14	674 500	
14.	Kalimantan Selatan	13	628 450	1	40 000	2	114 820	-	-	-	-	16	783 270	
15.	Kalimantan Timur	22	1 121 783	10	476 900	10	551 500	1	42 500	1	42 500	43	2 192 683	
16.	Sulawesi Utara	-	-	-	-	-	-	-	-	-	-	-	-	
17.	Sulawesi Tengah	-	-	4	272 500	-	-	-	-	-	-	4	272 500	
18.	Sulawesi Selatan	2	71 050	-	-	1	35 700	-	-	-	-	3	106 750	
19.	Sulawesi Tenggara	-	-	-	-	-	-	-	-	-	-	-	-	
20.	NTB/NTT	-	-	-	-	-	-	-	-	-	-	-	-	
21.	Maluku	10	542 300	2	80 000	2	65 000	1	40 000	1	40 000	15	727 300	
22.	Irian Jaya	-	-	2	139 000	4	183 000	-	-	-	-	6	322 000	
		96	4 714 505	27	1 256 400	34	1 605 920	3	162 500	160	7 739 325			

Source: Directorate of Forest Industries, Jakarta 1985.



Map Showing the Country of Indonesia Consists of a Broadly-Spread Archipelago.

GUIDING MODERN FOREST-BASED INDUSTRY DEVELOPMENT IMPACTS

by

the Secretariat

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## 1. INTRODUCTION

Forest-based industrialization will necessarily take place in many developing countries. It is likely that an important proportion of future industrialization will be based on modern, large scale enterprises (MLE)<sup>1/</sup>. Countries may wish to foster the development of MLE's for a variety of reasons such as greater economic efficiency and the need to expand export markets that cannot be adequately supplied by smaller, traditional enterprises. Also, it is often administratively easier to implement development strategies based on a few MLE's than on a myriad of smaller operations. Finally, in certain cases, technological minimum sizes which are beyond the possibilities of small enterprises are imposed by existing technology. Whatever the case may be, there are some significant issues which arise when large scale forest-based industrialization takes place. Government decision-makers and the public at large may become concerned about the likely impacts of MLE's on society, the economy and the environment. They may become concerned with aspects such as job creation, competition with traditional enterprise, pollution, government revenues, and foreign exchange. This paper explores the nature of the likely impacts of modern, large scale enterprises in the forest-based sector. Also, and because governments have opportunities to guide forest industry development, a major purpose of this paper is to analyze the nature of these opportunities from a policy point of view.

From the outset it should be emphasized that this document is not focused on the broader policy choices between large and small industry or the many hybrid combinations that are possible. The task undertaken here is more limited, namely to identify policies and means to maximize the positive and minimize the negative impacts of MLE expansion, once it has been accepted as an objective or a goal. In this sense this document is complementary to, and should be read in conjunction with the Secretariat document Small scale forest-based processing enterprises: their characteristics and impact on rural employment and income.

## 2. A POLICY FRAMEWORK

Four main development objectives or impact areas are studied: i) employment and income expansion, including government income; ii) technology growth and modernization; iii) the physical environment; and iv) foreign exchange earnings. These objectives are shown in column 1 of Figure 1.

In order to productively use expanded MLE activity to achieve objectives without major negative impacts, certain actions need to be taken. The ones considered most important are shown in column 2 of Figure 1. As indicated, a number of the action areas relate to two or more of the objectives. This is to be expected, given the complex, interactive nature of an economy.

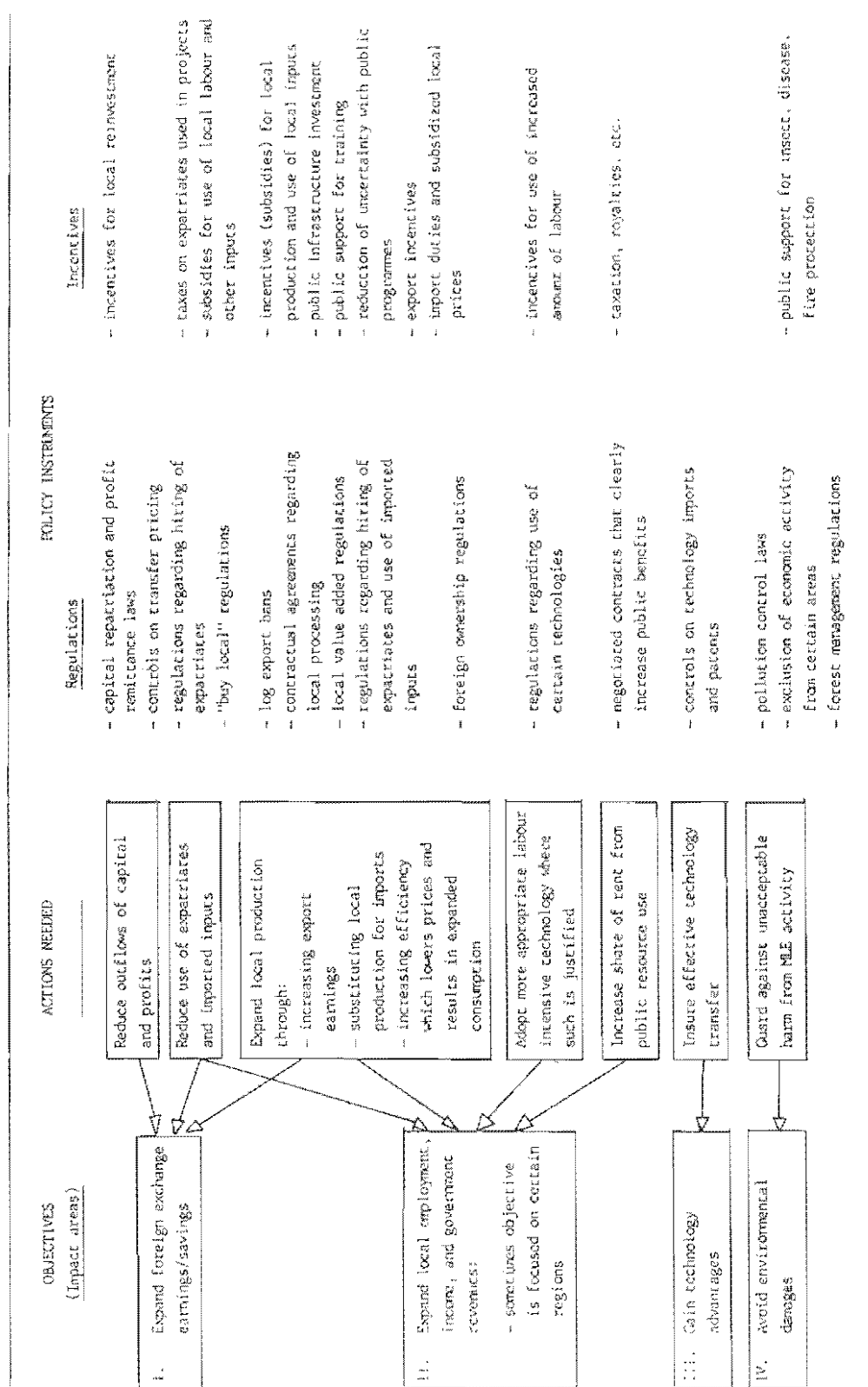
The administrative devices or policy instruments that governments can effectively use to effect or encourage the needed actions are shown in columns 3 and 4. Basically, government can regulate or it can use incentives. Of course, a third option is direct government investment, operation and ownership. The present paper deals mainly with the situation where at least some private involvement exists or where the government enterprise acts in a quasi-private form, subject to many of the same incentives and regulations that affect private enterprises.

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<sup>1/</sup> The terms "large" and "modern" are used here in a rather loose sense and should be considered in the context of the industry in a given country. Thus, a MLE in one LDC might be considered a small, average technology enterprise in, for example, Canada or a Scandinavian country.

Figure 1

Objectives, actions needed and policy instruments for managing impacts of MLE activity in the forest-based sector



While in the following pages policy instruments are discussed in terms of accomplishment of specific tasks or objectives, in reality the whole system of instruments and mechanisms used needs to be coordinated to avoid conflicts, voids and duplication of efforts. For example, some instruments can contribute to accomplishing a number of objectives at the same time. Thus, subsidies for local labour use can help to increase labour intensity in production, but they can also result in lower private cost of production and thus, perhaps, lead to improved competitive positions which permit expansion of exports and foreign exchange earnings. More use of labour could also result in savings in imports or machinery, thus further helping the foreign exchange situation. Finally, the changes in processing needed to adapt to greater labour use might result in an overall less environmentally damaging technology, thus contributing to the environmental objectives of a country.

Of course, conflicting results could also occur. A subsidy which contributes toward meeting one objective could well lead the country away from meeting another objective. At the same time, the various policy instruments serve different objectives with different degrees of effectiveness. Their application also entails different administrative demands and costs. Therefore while from the analytical point of view it is convenient to discuss each type of objective and policy separately, in practice a coordinated approach to policy formulation and instrument design should be pursued.

Most of the policy instruments discussed in the following sections can equally as well be adapted for promoting the expansion of small scale processing activities in the sector. The main differences will often only be in implementation cost and difficulty of application. In general it is more costly and more difficult to apply a given tax policy, subsidy programme or pollution abatement regulation to 100 small mills than to one MLE producing the same total output. The basic policy instruments may not change, but the form of implementation and its cost will.

In what follows, each of the major objective or impact category (column one in Figure 1) is discussed in terms of needed actions (column two) and the policy instruments (columns three and four) which have been and can be used to guide MLE investment and development.

### 3. FOREIGN EXCHANGE EARNINGS AND SAVINGS

MLE's are the main earners of foreign exchange in the forest-based sector. While small, traditional enterprises can produce some exports of artisan and other wood products, such earnings are insignificant in terms of the total. Similarly, industries that save substantial amounts of foreign exchange through import substitution tend to be those for which MLE activity is the rule rather than the exception, e.g., paper and paper products.

The objective of increasing foreign exchange availability and the associated policies for export expansion and import substitution are discussed below. However, a word of caution is necessary. Gross export earnings and the value of imports substituted are important elements in determining total foreign exchange availability but their consideration in isolation can, in many cases, give a very exaggerated picture of foreign exchange benefits. Net benefits or "retained value" is what counts, i.e. what is left after transfer of profits abroad and allowing



for the import content of production and salaries paid to expatriate workers. Thus, for example, Gillis studying the impact of transnational corporations operating in the sector estimates that in the early seventies net export earnings in Indonesia were probably as low as 25 percent of the gross earnings (Gillis, 1983).

### 3.1 Export Expansion

MLE's, particularly if they have close working relations with foreign firms or investors, can help to open up export markets for a country's forest products. Once such markets are open, smaller domestic firms often find it more feasible to enter them, if quality and timing standards can be met. Thus, the MLE can, indirectly at least, help development of the smaller enterprises in a country. More directly, MLE's enter into various types of contractual arrangements with the smaller firms producing products for export, e.g., "piggybacking" arrangements, where the small firm markets its output through the MLE.

Export incentives or subsidies can be used to promote forest products exports. They take many forms in different countries and include fiscal incentives (tax exemptions, export subsidies, export financing, deferments, remissions), non-fiscal (subsidized inputs, provision of export marketing expertise, price supports, insurance, export performance awards, multiple exchange rates, etc.) and indirect price incentives through government training, research, export promotion programmes, marketing information programmes, etc. In many cases countries combine export incentives for processed products with bans, penalties or taxes on log exports. In these cases the combination of policies is meant to discourage primary product export and to encourage processed product exports with higher employment and local value added. In still other cases, such as Honduras, all exports of certain forest products are directly administered by the Government.

Export development programmes can be quite complex, since there are many key requirements for success which have to be addressed at the same time if the effort is to be successful. There are at least three commonly cited categories of requirements which merit consideration: i) quality and dimensional standards - particularly importers in industrialized countries demand uniform and high quality in their imports; ii) timing and size of shipments - most importers want fairly large shipments and they demand punctuality; iii) the price must be right, i.e. competitive with other potential suppliers. Figure 2 lays out the requirements, the common deterrents to meeting them and the possible corrective programmes or actions which can be taken in a comprehensive overall systems approach to export expansion.

The figure illustrates the complexity of policies which can be adopted to promote exports. Deterrents can be numerous and corrective actions may be very costly. In fact, there have been situations in which the cost of policies have exceeded benefits derived from export expansion.

### 3.2 Import Substitution

Import substitution can be encouraged with a number of policy instruments. First, there are potentials to subsidize import substitution industries. Such subsidies can be in the form of bonuses or rebates for labour use, across the board grant subsidies based on output measures, and several types of tax incentives.

Figure 2

Latin American lumber and board products exports: importer requirements, deterrents to meeting requirements and possible corrective programmes

Type of Equipment	Requirements by Importers	Common Deterrents to Meeting Requirements	Possible Corrective Programmes
Quality and Dimensional Standards	<p>Guaranteed quality and dimensions:</p> <ul style="list-style-type: none"> <li>- uniformity</li> <li>- generally conforms to NHLMA rules</li> <li>- proven characteristics: light in weight and colour, easily worked, dimensionally stable, easily finished</li> </ul>	<p>(1) great variety in characteristics for a given species from different areas.</p> <p>(2) inadequate treatment and seasoning facilities for lumber</p> <p>(3) inadequate information and tests on species characteristics</p> <p>(4) few areas with adequate concentrations of known species meeting quality and physical requirements</p> <p>(5) inadequate quality and site controls in processing</p>	<p>(1) research and training programmes in processing and treatment</p> <p>(2) cooperative treatment plants</p> <p>(3) incentive programmes for quality production units</p> <p>(4) establishment of uniform export standards</p> <p>(5) improvements in sorting and grading</p> <p>(6) research on wood proportions and uses</p>
Timing And Size Of Shipments	<ul style="list-style-type: none"> <li>- Guaranteed delivery dates</li> <li>- generally fairly large quantities in a shipment</li> </ul>	<p>(6) uncertainty in scheduling ocean transport in advance for many ports</p> <p>(7) coordination problems between logging and processing (seasonal and distance problems)</p> <p>(8) lack of concentration of products for export due to: low volumes of commercial timber per unit area, lack of acceptable species groupings, generally small sizes of production units, poor transport and storage facilities</p>	<p>(7) export concentration yards (associations or cooperatives)</p> <p>(8) integration of processing facilities</p> <p>(9) research on product (or species) groupings and expansion of commercial species</p> <p>(10) selected conversion to plantations (species concentration)</p> <p>(11) renovation of transport facilities and methods</p> <p>(12) improved market information dissemination</p> <p>(13) improved storage facilities</p>
Cost/Price Relationship	<ul style="list-style-type: none"> <li>- Competitive delivered price</li> </ul>	<p>(9) high overall costs due to lack of markets for lower quality by-products</p> <p>(10) high logging and log transport costs due to low commercial volumes per acre, low level of transport infrastructure and long hauling distances</p> <p>(11) high processing costs due to: small average size of plants, poor plant layouts and outdated equipment, poor equipment maintenance, low efficiency (conversion ratios), etc.</p> <p>(12) high marketing and product transport costs due to poor shipping facilities, inadequate promotion, existence of outdated trade restrictions and tariffs</p>	<p>(14) relocation of processing capacity (export oriented)</p> <p>(15) specialization and longer production runs, larger units (economies of scale)</p> <p>(16) innovations in logging and transport (cost reductions)</p> <p>(17) initial export subsidization</p> <p>(18) training and technical extension (public programmes)</p> <p>(19) ties with (U.S.) companies</p> <p>(20) increased production and management research</p> <p>(21) market research and education</p> <p>(22) associations of producers and exporters (economies of scale)</p> <p>(23) trade barriers reductions</p> <p>(24) "piggybacking"</p> <p>(25) stimulate domestic market for by-products</p>

Source: Adapted from Gregersen (1972)

Quite often subsidies may be complemented with high import duties on the product being substituted by local production. In this respect it is interesting to note that, although protectionist barriers and particularly tariff escalation policies are usually identified with industrialized countries, both the absolute level of protectionism and the magnitude of escalation are usually higher in developing countries (Table 1).

Countries also make use of several non-tariff restrictions to induce import substitution. These include total prohibitions, conditional prohibitions which include prohibition for trade as well as other, e.g. health and sanitary reasons, quotas and discretionary licensing, and automatic import authorizations (UNCTAD, 1983).

Import restrictions often result in higher prices in the local market, and therefore in incentives for investment in local production. Additionally, there may be transport cost reduction advantages. To encourage increased local value added in such import substitution activities, "buy local" policies, or policies which restrict imported inputs may also be used.

Table 1

Average tariff rates facing wood and wood products  
imports from developing countries

	Wood in the rough	Primary wood products	Secondary wood products
<hr/>			
Developed country markets (Post Tokyo round)			
EEC	0.0	1.9	1.5
Japan	0.0	7.4	4.8
USA	0.0	5.6	1.7
Major developing regions			
Africa	14.4	16.2	24.1
America	26.2	37.6	52.5
Asia	34.1	57.8	73.1

Source: UNCTAD (1983).

Despite the fact that import substitution policies have been, and still are, very popular in many developing countries, available evidence shows that they may lead to many undesirable results. These include excessive capital intensity, low value added at international prices and lack of competition. Protection also inhibits exports from developing countries, as the main thrust of protectionist policies is to promote import substitution not export expansion. This bias against exports is now widely recognized as detrimental to economic growth. In fact, there is strong evidence that growth improves where a high proportion of domestic production is exported (Clausen, 1984). For this reason, import substitution policies that discriminate against exports are being increasingly attacked.

### 3.3 Foreign Investor Involvement in MLE's

In many cases foreign investors have been involved in MLE activity in developing countries, particularly in very large projects. This participation may generate a series of complex impacts on the availability of foreign exchange. There is initially an inflow of foreign capital. At the same time the foreign investor may provide access to advanced technology and to certain markets as well as to superior management and technical skills, thus improving the competitive position of a developing country in international markets. If production is oriented toward the satisfaction of domestic needs, foreign involvement may be sought to substitute imports in a more efficient manner.

However, once MLE activity is established with significant foreign participation, keeping foreign exchange earnings in the country may be a major challenge facing many governments. Judicious use can be made of profit remittance laws, exchange controls, capital repatriation and reinvestment laws, and regulations regarding use of foreign inputs, including expatriate labour. A number of these types of concerns can be alleviated by writing controls into contracts with MLE's for use of public timber. With experience and some bargaining power, countries can also control to some extent the negative aspects of transfer pricing that essentially keeps out a portion of the foreign exchange earnings which otherwise would flow into the country in question.

The problem of "transfer pricing" commonly crops up in discussions of the role of transnational companies (TNC's) in developing countries. Abuses result in values, both for exports and imports, that do not correspond to prices found in markets that TNC's cannot control. One widely used method is underinvoicing unit values of exports sold to affiliated companies. This reduces the host country's yield from income taxes and, as in Indonesia and Sawawak, also reduces export tax revenues where these are levied on an ad valorem basis. Host countries can counter this by using "posted prices" for exports which are based on national export values for different species of timber. This system is in use in Papua New Guinea, Indonesia and Sabah. Practical difficulties arise because it is often very difficult to obtain reliable information on competitive prices in different markets (De'Ath, 1980; Gillis, 1981).

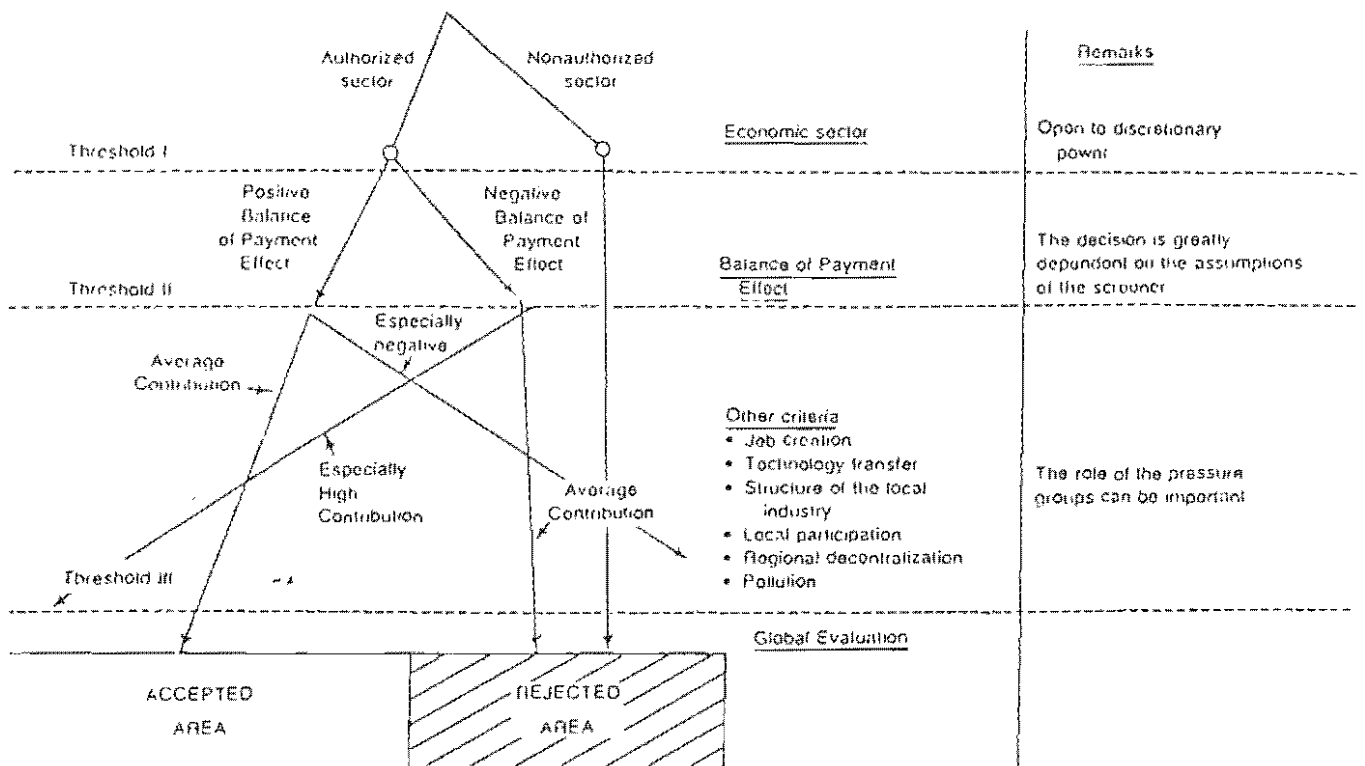
Of course, the first and most appropriate place to enter this process of guiding foreign investment and the influence of foreign MLE's is at the stage where such involvement commences, i.e., at the point where foreign capital or entrepreneurs initiate efforts to enter a country, or where a country goes seeking such involvement. At this stage, a number of things can take place. One is for the government to step in and become involved with the proposed new enterprise. There is growing tendency in the Asia region for this to happen, for example in Indonesia, Sabah and Thailand.

Another approach is to set up a screening process, such as the one illustrated in Figure 3 for Colombia. Potential projects are looked at in terms of their relationship to existing policy constraints and national objectives. There are also possibilities to encourage various forms of investment which limit the extent of foreign involvement either in terms of restrictions imposed on the proportion of total investment that can be foreign-owned or in terms of the time span during which the foreign investor is allowed to operate. Each of these institutional arrangements involves different responsibilities, potential benefits and potential negative impacts for the country. A representative sample of some different forms of investment strategies for MLE activity which are alternative to wholly foreign-owned operations is shown in Figure 4.

Finally, it should be pointed out that "saturation" laws can be instituted to guide foreign involvement in the sector. These laws specify the transition from foreign to domestic ownership and the maximum proportion of a project's capital and/or control that can be in foreign hands. Some examples are given in Figure 5.

Figure 3

Representation of the foreign investment screening process in Colombia



Source: Lombard, 1978

Figure 4

Six forms of international investment

Joint Venture: Assets, risks and profits, and ownership participation are shared by more than one firm, economic group or state. Fade-out agreements, where there is an initial 50% equity participation, at least, by the developing country partner in cases where the other partner is in a developed country, or where the partners are from more than one developing nation, are interesting examples of international joint ventures.

Turn-key Operations: A product-in-hand operation, where the supplier's responsibilities are over when the project is operated completely by local personnel. Turn-key operations have been in the limelight recently because of the multi-million dollar contracts to build industrial complexes being given foreign suppliers by OPEC nations.

International Subcontracting: A firm or trading house in a developed country places orders with subcontractors in a developing country. Materials are provided by the principal, who also sells the finished product -- sometimes in his home market or in a third country market. Tariff regulations in developed nations and "free export zones" in some developing countries have increased the importance of this international investment form.

Licensing Agreements: Licensees are given specific rights of access to and use of one or more technologies in return for a fee, a percentage of sales, royalties, shares of equity or goods produced by the licensee and bought by the supplier at a discount. A licensing agreement often relies on an enterprise already in operation in a host country. The issue of right to give out licences for specific technologies -- especially information technology -- has been a source of controversy in North-South relations.

Management Contracts: A supplier manages -- and provides training to local workers for -- a project or enterprise in the developing country. The contract may include handing over authority to locals after a certain time or the host country may use independent experts to monitor the managing company.

Trilateral Cooperation or Tripartite Industrial Cooperation: Three firms or organizations from three regions -- Eastern Europe, Western Europe, North America or Japan; and the South -- join to carry out programmes or projects in the developing country.

Figure 5

"Saturation" laws for foreign investments in timber projects  
in insular Southeast Asia and Papua New Guinea

Country	Nature of Saturation Law in Forest Sector	Joint Venture Requirements: New Timber Investments
Indonesia	TNC must offer for sale to local investors (including the central government 51% of shares within a specified period (usually 10 years from the beginning of operations.	Since 1974, all new foreign investments in timber must involve local joint venture partners.
Philippines	TNC's may enter only as minority partners (40% of equity or less).	Since 1974, all new foreign investments in timber must involve local joint venture partners.
Malaysia: Sabah	Sabah foundation to be sole concessionaire by 1984; Equity shares flexible, but in general Sabah Foundation expected to have a minimum 51% share of equity.	From 1984 onward, all foreign timber projects must take form of joint venture with Sabah Foundation.
Papua New Guinea	<p>A. <u>Log Exporting Enterprises (smaller scale)</u> Foreign involvement to be restricted to 10 year management contracts with locally owned firms.</p> <p>B. <u>Timber Processing Enterprises</u> Projects in which a minimum of 30% logs are processed require a 26% equity shares for government in first five years of projects, with option for purchasing a majority share after 5 years.</p> <p>C. <u>Log Exporting Enterprises (Large Scale)</u> Foreign shareholder restricted to minority share of equity.</p>	<p>A. <u>Log Exporting Enterprises</u> No joint ventures; management contracts only.</p> <p>B. <u>Processing Enterprise</u> Joint Ventures Required.</p> <p>C. <u>Log Exporting (Large Scale)</u> Joint ventures allowed.</p>

Source: Gillis, 1981

### 3. EMPLOYMENT AND INCOME GENERATION

A public goal associated with forest industry growth is expansion of employment. Specific concerns may focus on certain high unemployment regions - often those in which major forest resources are found. Long-term concern is with steady expansion of economic activity beyond the direct impacts of the newly established forest-based industry, i.e., indirect employment generation becomes an issue, often tied up with the strength of the forward and backward linkages associated with the particular industry being established or expanded. Finally, when exploitation of a nation's natural forest resources is involved, then governments become concerned with appropriate sharing of the rents from exploitation.

MLE's vary greatly in terms of their employment impacts. At one extreme, pulp and paper mills use some of the most-capital intensive industrial processes while other production processes such as sawmilling can be highly labour intensive. Large scale forest products enterprises can have major local employment impacts. For example, direct employment at the Paper Industries Corporation of the Philippines has in the last three or four years fluctuated around 10 000 persons and a reforestation/charcoal subsidiary of Belgo-Mineira in Brazil employs some 8 000 in the forestry and charcoal operations alone.

Some of these MLE's have substantial forward linkages to other activities which employ additional labour. Further, the indirect effects on employment in local communities can be significant. As a rule of thumb, for each ten persons employed directly in the MLE, at least eight additional jobs are created in related sectors.

In connection with the proportion of unskilled versus skilled workers required in industrial processing, forest-based MLE's show a wide variation. Thus, pulp and paper mills require a proportion of highly skilled workers, while sawmills and other types of wood conversion activities may be heavy users of unskilled labour. Available evidence indicates that, among industries in general, wood products manufacturing, excluding pulp and paper, is particularly intensive in the use of unskilled labour (Balassa, 1979).

A common past criticism affecting those MLE's that are foreign owned or operated has been the fact that they tend to use a high proportion of permanent expatriate labour, thus reducing the possibilities for effective transfer of scarce skills and local employment.

In fact the problem seems to be more related to the proportion of foreigners in managerial positions or in positions which require a high level of skills than to their proportion in the total labour force. De'Ath, for example, documents the case of the Jant project in Papua New Guinea where, after several years of operation and despite the desire of the government to accelerate transfer of responsibilities to local people, superior management and technical expertise persistently remained in hands of expatriates (De'Ath, 1980).

In many countries the problem of excessive use of expatriate labour has been virtually eliminated. For example, Indonesia instituted a tax on use of foreign personnel in 1974, when the estimated percentage of foreigners in total labour force of large transnationals in the forest-based sector was around 25 percent. By 1978 the percentage had dropped to around 5 percent (Gillis, 1981).



Another common criticism of MLE's operating with large timber concessions in LDC's is the fact that governments have captured a very small part of the economic "rent" from tropical forest exploitation. Figures cited for Asia and for some African situations indicate that in the past governments have generally not captured more than 25 percent or so of available rents. The rest has gone to the MLE's. In particular projects the proportion captured by the government may be very low indeed (De'Ath, 1980).

The following sections examine some of the most common policies which governments can put into effect to increase the impact of MLE's on employment and income.

#### 4.1 Policies to Increase Government Revenue

Tax policy has become the prime instrument to capture timber rents from MLE activity in several Asia-Pacific nations. In the Asia Pacific region, the early stages of tropical timber exploitation were characterized by light taxation - for example, tax holidays for transnational corporations were usual in the Philippines and Malaysia in the sixties and Indonesia during 1967-75. Since then tax treatment has been substantially tightened, particularly in Indonesia and Sabah.

Income taxes remain relatively minor sources of revenue although tax holidays have been stopped nearly everywhere. For example, by 1979-80 in Indonesia corporate taxes paid by TNC's were still less than 7 percent of total timber taxes. The big increases came from export taxes and royalties. Indonesia increased export tax rates sharply in 1978 and the government share of the rent approached 50 percent (Gillis, 1980).

#### 4.2 Encouraging Hiring of Local Workers

The most direct way to address the problem of excess hiring of expatriates or foreign workers, technicians and managers is through laws that set a maximum percentage of foreigners which can be used in any given forest-based enterprise. Oftentimes, such as in Indonesia, such laws provide for a gradual decline in the permissible percentages of foreign employees over time. This is coupled with training for locals. Regulatory measures have been quite effective in countries such as Brazil. Other effective approaches involve taxes on the use of expatriate labour (e.g., Indonesia) and, in a more positive vein, the provision of subsidies for use of local labour.

#### 4.3 Policies for the Expansion of Employment and Local Value Added

Expansion of employment and local value added can be achieved through regulations and stipulations in contracts for public timber concessions. For example, Indonesia and several other countries have established the principle that operations which start as log exporting activities must over time progress to domestic processing activities. While some countries have had problems with such provisions, other have found them to be relatively effective in promoting employment and local value added. These types of regulations or contractual obligations are often supported with log export bans or regulations which permit only a certain percentage of production to be exported in log form.

Some countries encourage local processing by taxing log exports much more heavily than processed timber products (e.g., Indonesia, Malaysia, Ivory Coast, Ghana, Gabon). Regulations and incentives to encourage local sourcing of inputs can also be effective.

Over the longer term, local employment will be expanded if skills improve, productivity is increased, and exports or import substitution increase. In a realistic economic context, this is also the only way to achieve upgrading of employment and wage levels. A number of successful policy measures have been instituted to address this issue. In some cases governments have directly subsidized worker training programmes, either in public institutions or directly through private enterprises involved in forest-based activity. In other cases, a clear training obligation is included in contracts with the forest-based MLE.

Because of this size, MLE's have the economic resources to provide training and education facilities. PICOP, for example, has emphasized the need for local training at technical, professional and management levels. The management training programme is exceptionally large and for example in 1979 twenty-two management seminars were conducted by the company with a total attendance of 575 employees (Simula, 1985). Even companies of a smaller relative size can provide effective facilities for training and education of company personnel.

#### 4.4 Regional Distribution of Income and Employment Impacts

There is no question but that introduction of MLE's in a backward, isolated region has a number of disruptive economic and social impacts on traditional society. Such impacts have been well documented by authors such as De'Ath (1980); Moore (1965); Kobrin (1977) and Mead (1961).

One group of social costs associated with large scale forest-based activities are the so-called "boomtown" effects. They occur when substantial immigration is induced by increased economic activity into a resource rich area. Once the forest resource has been depleted unemployment and economic stagnation follow. There is evidence of this in East Kalimantan in Indonesia, which had about half a million inhabitants prior to the onset of logging activity in 1968. The population grew to more than 1 million by 1981 - an annual growth rate of 4.9 percent or more than twice the rate for the whole country during the same period. Production of timber began to decline in 1980 because the very high cutting rate could not be sustained and the government imposed a reduction in log exports with the consequent effects on employment in the area. These undesirable effects can be avoided or at least mitigated provided there is the possibility and the political willingness to impose sustained yield policies that would ensure a certain level of economic activity.

East Kalimantan and Sabah provide examples of a related source of social costs in terms of the regional distribution of income which have been called "Alberta" effects. In both cases the local governments receive a disproportionate share of the wealth generated by the forestry sector: the regional government of the former receives two-thirds of all timber royalties collected and, in the latter, all royalties go to the state government. The regional concentration of easily taxable timber resources and the failure to distribute them more widely to other regions may, in such cases, lead to distortions in the allocation of resources in the nation as a whole.

The problem is not a trivial one as it has been calculated that Sabah received about US\$ 450 for every citizen in 1979. The state government responded to this flood of royalty revenue by making annual cash payments to all adult citizens of US\$ 46.5 and spending nearly twice as much per caput as it spent overall in Malaysia. A comparable situation has occurred in Indonesia where East Kalimantan spends about six times the national average for all provincial governments (Gillis, 1981).

Another issue that has to be faced when a MLE moves a region which previously depended on imports or small scale industry is the impact on competition and local market structures. Impacts in this respect can be both positive and negative. On one hand the MLE may have the undesirable effect of forcing out small local businesses. On the other hand, it can set some improved local standards for quality, efficiency, pricing, and competition in general, which can benefit local consumers. In other instances, the large company may develop ways of using and marketing previously unused species. Such experience and access to new markets may in turn be utilized by the smaller firms and result in expanded overall benefits, particularly if exports outside a region can be initiated or expanded. Also the MLE generally creates business opportunities for smaller local businesses, i.e., suppliers of services, parts, etc. (Haq, 1982).

Government policy can effectively influence the location of MLE's and thus the regional guide distribution of impacts. The most common policy instruments used to guide industry to one region or another are region specific incentives such as tax holidays, tax rebates and labour subsidies. Policies for location of industry in the Brazilian Amazon provide an excellent example. Similar programmes have been developed to encourage industry in remote areas in Indonesia and other Asian countries.

In addition to the instruments mentioned above, governments have used subsidized credit, location specific grants, loan guarantees and preferential access to raw materials. Also direct government investment in infrastructure and establishment of industrial estates have been used as incentives for regional location of industry.

## 5. TECHNOLOGY ACQUISITION AND DEVELOPMENT

With the exception of a few studies dealing with technology choice and transfer in the pulp and paper industry (Meyer, 1974; Ansalem, 1983) there is little documentation available on the subject of technology acquisition, adaptation and innovation in LDC's. Some studies indicate that at least in the case of some industrial processes technology options can be very flexible. The possibilities in the case of the sawmilling industry are well known. Mechanical pulping can also be efficiently carried out by several alternative processes. However, in other cases flexibility is more limited.

A rather exhaustive study of the "technical rigidity" of some 181 manufacturing industries (Forsyth et al., 1980) indicates how forest-based industries range from some of the most rigid (paperboard, fibre building paper) to some of the most flexible (wooden furniture, building parts). Thus this study supports the contention made in a number of other places (e.g., Westoby, 1962) that in general forest industries as a group offer good opportunity for developing countries that want to start with labour intensive activities and then gradually and smoothly move toward more capital-intensive, modern and large scale technologies.

Different approaches are available to control technology transfer. Contractual agreements for foreign technology are being increasingly used in many countries. In other cases the entry of undesirable technology, for example technology that is associated with high levels of pollution, can be controlled by imposing outright prohibitions.

Often countries will strive to import technologies that involve heavy use of labour initially, with the idea that gradual adjustments over time will involve expansion of scale and importation of increasingly

capital-intensive technologies. A number of compulsory measures and fiscal and monetary policies such as taxes, subsidies and preferential credit can be used to guide this transition.

A key to understanding and coming to grips with the forest product technology issue is information, or knowledge about the alternatives. Experts on the subject have pointed out that lack of access to information on alternative, available technologies is often the major cause of inappropriate technology being used in LDC's (Moore, 1983; Amsalem, 1983). Information is needed to be able to choose intelligently among the array of potential technologies for meeting a particular need.

In the case of transfer of technology in the pulp and paper subsector, most countries - whether developed or less developed - often have to rely on a small number of highly skilled consultants. Thus, for example, PICOP recruited expatriates to run industrial operations maintaining overall management control in local hands. A study of a large scale export oriented pulp mill in Madagascar shows that employment of expatriates to fill most of the supervisory and most important operations would have been necessary at least for the first five or six years of the project (Simula, 1985). In practice, in other projects, it has been difficult to phase out foreign personnel in large scale pulp mills even in the longer term. This is one of the more complex industrial sectors and one where mistakes in choice can be very expensive. However, a government can take it upon itself to at least develop a basic understanding of the different potentials and the stages in the planning process where certain types of information are needed. Thus, public officials responsible for making decisions should at least be familiar with the stages, steps and information needs shown in Figure 6.

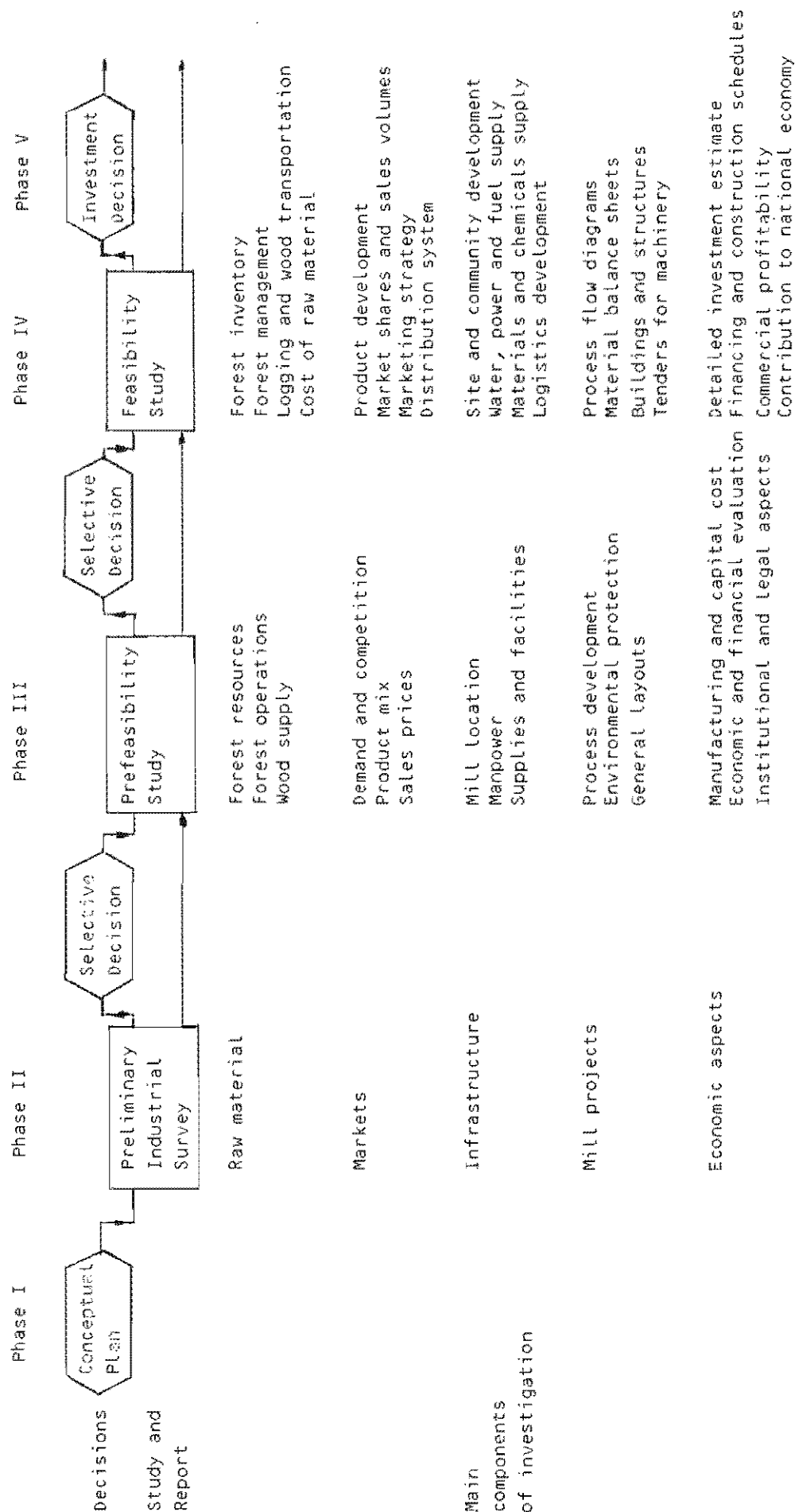
Technologies for products other than pulp and paper tend to be less complex and easier to deal with. A general view of some of the characteristics of the main product categories is shown in Figure 7. As indicated, technology and scale considerations vary with the process. Efforts should be made to develop more detailed information on those production categories which might be of interest. In some cases, local wood technology or wood products institutes exist which can undertake the necessary efforts to assemble the relevant information and then develop relevant training courses and extension activities to make local entrepreneurs aware of opportunities and sources of detailed information.

In many LDC's a central focus should be on technology search and acquisition instead of original research. Adapting what is already available and known can be the cheapest way to proceed, even if the acquired technology has to be purchased and then adapted. Quite often government involvement in this whole process is quite appropriate, even though most of the production will eventually take place in private, competitive MLE's. In point of fact, whether considered appropriate or not, there is a widespread tendency for increased government involvement in technology transfer and acquisition (cf. Wallender III, 1980 and UNIDO, 1982).

Wallender III (1984) writing about technology transfer in the forest industry sector provides a useful overview of the potential suppliers of technology and the types that are transferred. This framework provides a useful starting point for countries that wish to embark on an expanded or intensified technology transfer and acquisition programme related to MLE development in the forest-based sector (see Figure 8). A concrete example of such an effort is provided in Figure 9.

Figure 6

Investment analysis process in the pulp and paper industry



Source: Jaakko Pöyry & Co., Consulting Engineers, as cited in Ansalem (1983)

Figure 7

## Technological considerations for developing countries

Aspect	Sawwood Sawmill	Plywood	Fibreboard hardboard	Medium density fibre board	Particle board	Wafer board	Strand board	Cement particle board	Cement fibre board	Gypsum fibre board	Kiln dryer for secondary processing
Wood raw material yield	40-50 %	30-50%	85%	90%	90%	85%	85%	90%	90%	90%	-
Suitability for developing countries	Simple	Simple	Wet batch. Simple Wet cont. Inter dry- advanced	Advanced	Suitable most devel. countries	Suitable most devel. countries	Advanced	Suitable most	Simple all	Simple all	Yes
Maintain- ability of plants	Simple	Simple	Medium- sophisti- cated	Sophisti- cated	Medium	Medium	Sophisti- cated	Medium	Very simple	Very simple	Simple
Industrial infra- structure required	Simple	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Very simple	Very simple	Simple
Operation of process	One shift possible	One shift possible	Continuous except batch	Continuous	Continuous	Continuous	Continuous	Continuous	One shift possible	One shift possible	One shift or conti- nuous
Minimum econom. capacity	Varies	m3/day	m3/day	m3/day	m3/day	m3/day	High	m3/day	Low	Low	m3/day 5-10 or less
Local market export	20 120	Medium	15-20 70	75-100 200	30-40 200	30-40 200	Medium	20-30 50	V. Low	V. Low	High
Energy fuel (heating)	Low	Medium	High	Higher	Medium	Medium	Medium	Medium	-	-	-
Water	None	Medium	High	High	Medium	Medium	Small	Medium	Low	Low	-
Ecological Considera- tions	Small	Medium problem	Wet serious dry medium	Medium	Medium	Medium	Medium	Low	Nil	Nil	Small

Source: UNIDO, 1983a (360)

Figure 8

Relative knowledge transfer of alternative sources of technology

Technology Types	Supplier						
	General education	Direct foreign investment	Independent consulting/engineering	Independent licensing	Equip. sales	PVO	Gov. assistance
General knowledge	Yes	Possible	Seldom	0	0	Seldom	Yes
Industry specific	Possibly	Yes	Yes	0	0	Yes	Yes
System specific	Possibly	Yes	Yes	Yes	Yes	Yes	Yes
Firm specific	0	Yes	Possibly	Yes	Possibly	Possibly	Seldom
Ongoing Problem Solving	0	Yes	Seldom	Seldom	Seldom	Possibly	Seldom

0 = almost never provided.

Source: Wallender III, 1984

Figure 9

EXAMPLE OF A LOCAL TECHNOLOGY INSTITUTION

Fundación Chile, a nonprofit science and technology institution, is a good example of a new development program that is organized to effect the complete technology change cycle. The Fundación, jointly owned by the Government of Chile and International Telephone and Telegraph, has its own laboratories, pilot plants, training facilities, libraries, and professional staff. The Fundación is linked to a U.S. technology search organization, Burkholder-Wallender International, and several university and professional associations. The Fundación is organized specifically to help Chilean enterprises through all stages of their technology planning and installation.

In one area, the development of local hardwood plywood manufacture, the Fundación is providing a marketing research staff and certain funds to execute feasibility studies. The U.S. technology search organization was used to help identify U.S. purchasers for the hardwood and qualify firms that would help supply critical start-up and quality-assurance technologies for the proposed plant. Additionally, private volunteer organizations and U.S. consulting firms were identified and organized to provide experts to plan initial logging and port facility development.

The Fundación drew on a wide variety of experts and networks to help organize a continuous flow of assistance to qualify the opportunity, to identify purchasers of the final hardwood plywood, and even to supply technicians to begin logging. In parallel, these industry-specific knowledge resources were combined with the Fundación's expert staff to develop improved proposals and plans which have resulted in better financing for the long-term project. The project ultimately will stimulate a variety of spin-off forestry programs in the south of Chile. Other local experts were used to assist in installing the original programs and to provide follow-up.



Vertical and horizontal integration of production units can provide opportunities to cut costs and increase efficiency. Almost by definition, integration implies expansion of overall enterprise size and change in technology, broadly defined to include management technology.

The dramatic shifts in the pulp and paper industry in the developed countries provide evidence concerning the trend toward integration. Today a major portion of pulp or paper mills in industrialized countries are operated as integrated units. Among other things, physical integration of pulp and paper eliminates the expensive pulp drying step, since pulp can be pumped directly in slurry form to the paper mill. In the other wood products industries there are similar advantages which can accrue, both from horizontal integration and vertical integration. For example, integration of plywood or sawnwood with particle board provides a means for fuller utilization of wood from the forest. It also permits some broadening in the number of species which can be taken out of the woods, thereby in many cases reducing the unit cost of delivered logs. Integration, however, usually implies greater demands for scarce management and skills.

A technology related implication of the dramatic variation in relative factors costs in various countries is the development of profitable markets in used equipment for the forest products industry. Because of different cost levels in different countries it can be profitable for a LDC buyer to import and an industrialized country seller to export used machinery for production of plywood, sawnwood, etc. This may be a productive form of technology transfer which can produce positive development impacts.

## 6. ENVIRONMENTAL PROTECTION

Many countries may be naturally concerned with the potential impacts which expanded MLE activity can have on the environment. Large scale enterprises use considerable amounts of forest materials which must be grown over large areas and can influence the environment in a number of ways. A fine paper mill with an output of some 150 000 t/a would need to log an area of about 70-80 000 ha of mixed tropical hardwoods or, alternatively, some 30 000 ha of eucalyptus plantations over 20-year period (UNEP, 1982). The effects of MLE's activities in LDC's forest can thus be considerable, depending on the way in which the forest resources are managed.

Large scale projects, particularly those that are integrated, have the possibility of utilizing the forest raw material quite fully as compared with smaller operations. Also, if a MLE moves to an area with poor, degraded soils and starts a massive afforestation programme, effects can be positive. One case is that of the Cholguan Companies in Chile. The company started planting trees in a very degraded area with practically no alternative use. Today 30 000 ha are covered with forest plantations managed on a sustained yield basis, with the consequent positive side-effects on erosion control and water quality. Only a MLE can effectively implement programmes of this nature, and immobilize considerable financial resources for a relatively long period of time until plantations are mature.

The situation may be different if a MLE operates in areas with pre-existent natural resources. There is the possibility of long-term degradation of soils due to the removal of vegetation, and selective cutting alters the natural system of biological checks and balances thus increasing the risk of, for example, attack from insects. Logging

operations can also destroy the habitats of wildlife. Erosion due to logging has been a major problem in many countries including the Philippines, Malaysia and Indonesia. Such erosion affects waterways which often are major transport arteries and which feed into reservoirs which provide water for hydropower and irrigation. Government recognition of the social costs of logging induced erosion has been made explicit in some cases. For example, in Indonesia (East Kalimantan) a principal justification given for the imposition of an "additional" timber royalty in 1971 was to cover the costs of dredging the Mahakam river (Gillis, 1981).

Road construction can also produce very negative effects. De'Ath reports that Jant's roads in Papua New Guinea, particularly during the wet season, change stream courses and cause flooding, ponding and consequent stagnation during the dry season. Mosquitos and malaria follow. Bulldozing of river beds and banks for gravel have also spoiled drinking water and induced course changes, thus affecting negatively the general welfare of the local population (De'Ath, 1980).

When it comes to discharges into the environment the MLE's operating in the pulp and paper subsector are often mentioned as one of the main culprits. This industry uses large quantitatives of water and a large proportion is discharged as effluent. Mills discharge materials that can affect the quality of downstream water supplies. Leaching from solid waste disposal areas can also pollute groundwater resources. Main emissions to air originate in the boilers and contain sulphur dioxide, reduced sulphur compounds, particulate matter and nitrogen oxides (UNEP, 1982).

All these impacts can also be caused by smaller enterprises. However, operations in large scale produce concentrated results (given the same level of output) and may therefore exceed the capacity of the environment to absorb damage.

On the positive side, trends in pulping technology and pollution control indicate that a significant reduction in the environmental load has taken place in the recent past. For example, older mills needed about 180 m<sup>3</sup> of water to make a ton of pulp and 90 percent was discharged as effluent. Mills built in the seventies typically discharge about 70 m<sup>3</sup> per ton of pulp and new techniques can bring discharges to about 20, 30 m<sup>3</sup>. Pollution can also be reduced by treating condensates produced by pulp digestion and spent liquor evaporation. Biological oxygen loads have been reduced from 10-15 kg per ton of kraft to 2-4; from 25-30 to 5-6 in the case of softwood sulphite and from 50 to 10-12 in the case of hardwood sulphite pulps. Total reduced sulphur emissions have been reduced from 10 to 0.1-1.05 kg per ton of pulp (UNEP, 1985).

As an example, Table 2 indicates details of the differences observed in kraft mills in Canada. The table illustrates the fact that the differences are quite dramatic between effluent or pollution intensity of modern, state of the art pulp mills and the older mills built before the concern for pollution became serious.

However, all these advances have materialized at a cost. Investments to reduce serious pollution problems generated by the pulp industry can be very substantial, often amounting to more than 15 percent of total investment. Some indication of the magnitude and importance of the costs involved in meeting current water pollution control standards in various segments of the Canadian industry are provided in Table 3. When these costs are compared with the total investment costs for pulp and paper mills, it is evident that water pollution control takes a significant portion of investment.

Table 2  
Kraft mill effluent breakdown

	Older Mill			Maximum In-plant Control		
	Flow <sup>1/</sup> (m <sup>3</sup> /t)	SS <sup>2/</sup> (kg/t)	BOD <sup>3/</sup> (kg/t)	Flow (m <sup>3</sup> /t)	SS (kg/t)	BOD (kg/t)
Wood Preparation (wet)	15	90	16	-	-	-
Wood Preparation (dry)	-	-	-	5	2	1
Pulping (non-process)	10	3	3	5	0.2	0.1
Washing and Screening	15	5	15	3	0.3	0
Contaminated Condensates	10	0	15	-	-	-
Evaporator (non-process)	20	0	5	3	0	1
Recovery Furnace/Power Boiler	15	0	0	5	0	0
Bleaching CEDED	75	1	25	-	-	-
Bleaching OC EDED	-	-	-	10	0.2	10
Recausticizing (process)	2	10	5	0	0.1	0
Recausticizing (non-process)	5	1	0	2	-	0
Pulp Dryer	15	10	1	3	0.2	0.1
Accidental Losses	20	30	30	10	5	5
TOTALS	202	150	115	44	8	17.2

1/ m<sup>3</sup> per ton of pulp produced

2/ Suspended solids (SS)

Source: Environment Canada, 1984

3/ Biochemical oxygen demand (BOD)

Table 3  
Approximate water pollution control costs (1982 US\$)

	Capital costs (\$/daily ton product)	Direct operating cost* (\$/ton)
Kraft mill	24 000	7
Low yield sulphite	195 000	5 (credit)
Integrated newsprint/sulphite	40 000	3
Newsprint (without sulphite)	20 000	5
Other non-integrated paper	9 000	3

\*Direct costs include labour, energy, technical support, maintenance and chemicals but exclude depreciation, interest and taxes, etc.

Note: These costs were based on the mid-seventies proven technology, and it is probable that actual costs could be reduced in 1983 by the application of the in-plant technology that has been developed in recent years.

Source: Environment Canada, 1984

Because pollution control costs are so high, it has often been suggested that MLE's may have a certain propensity to transfer operations to those LDC's where controls are less strict, i.e. to "export high pollution industries". Although this contention is very plausible, all the serious empirical studies on this issue to date report inconclusive results (Gladwin, 1983; Stephenson, 1973).

The environmental problems outlined above can be very serious indeed. On the other hand, it has also been shown that the potential for improving the environmental impact of MLE's is also important. Policy options which can be used to realize this potential are discussed below.

In the case of public lands, provisions to ensure sound management practices by MLE's can be introduced in contracts and concessions agreements. Also, subsidies can be used to encourage the establishment of new industrial plantations thus diverting environmental pressure from more fragile natural ecosystems. Taxes can also be used to encourage reforestation. For example, refundable deposits for cubic metre exported have been required in Indonesia which are then returned to the exporter against evidence of reforestation. Similar measures have been applied in Sabah and the Philippines. Timber harvesting rules are also widely used in relation to harvest of natural forests in such countries as Malaysia, the Philippines and Indonesia. Protection against fire, insects and diseases can be provided by the public sector (subsidized) or required in concession agreements. To protect certain natural and scenic areas, harvesting activity can be excluded from them and national parks or other forms of reserves can be established. Closer integration of agricultural and forestry policies can help to prevent land use conflicts.

Licence fee systems can be used to discourage over-exploitation of easily accessible and attractive timber stands while encouraging the opening up of more distant and difficult areas. The major difficulty of these systems seems to lie in their administration. Virtually all forest fee systems and taxes on output or export lead to some degree of high grading, but flat rates per m<sup>3</sup> or per ton are the worst; ad valorem royalties and taxes are better but a finely differentiated system of specific, non-uniform royalties is necessary to minimize the loss. Rates which vary according to species are charged in the Philippines and Sarawak, while Indonesia, since 1979, has charged 6 percent royalty and 20 percent export duty ad valorem on all species. Royalty rates in Sabah vary from 44 percent on low f.o.b. prices to 57 percent at higher prices. Relogging of previously cut-over areas within five years appears to be a common practice, at least in Indonesia (Gillis, 1981).

Sanvictores (1980) suggests several other alternative approaches to ensuring better forest management in the Asia situation. The alternatives include:

- (i) Increased sale of land to private entities, i.e., to the MLE's currently holding the concession contracts or to other entities. (The assumption here is that the private owner will take better care of his own property);
- (ii) Use of long-term leases for public or private land;
- (iii) Longer duration of timber licences (under the assumption that present contract periods are too short to stimulate good forest management that will only pay off after the present licence holder has terminated his holding period);
- (iv) Use of government ownership and control of activities, such as the Sabah Foundation.

Many countries have laws which require mills to clean up their own pollution or to avoid it in the first place with installation of pollution control devices. Due to the high cost of pollution control measures public subsidies are often provided to avoid disinvestment or lack of interest in expansion investment particularly in the pulp and paper industry.

Effective pollution control requires constant public awareness, public supervision and public pressure. However, governments often experience difficulties in detecting environmental harm due to the lack of sufficient personnel, efficient monitoring systems and adequate institutions. These problems can be solved at least partially with help from international or bilateral technical assistance institutions. Early warning systems are particularly important in all those cases where damage propagates quickly and where there is a long period of time between detection and the materialization of the results of control actions. For example, insect and disease control in plantations is critical in tropical areas. In monocultures, damage can spread very rapidly and costs of control measures may also grow very fast.

In many cases and due to the extensive nature of forestry production, international action is required. Industrial effluents can be transported from country to country. Pests and diseases which may result from massive MLE intervention can also spread over national boundaries. In all these cases international cooperation is vital both for an early detection of problems and for concerted application of control policies.

## 6. CONCLUSIONS

The examination of the literature on the subject indicates that there is a general lack of empirical data related to the nature and magnitude of the development impacts of MLE's in the forest-based sector both in absolute terms and in relation to smaller enterprises as well as in comparison with non-forestry enterprises.

Information about the types of impacts discussed in this document as well as differentiation by scale and technology employed is not available in most countries. For example, indirect employment impacts are not routinely quantified. While there are many small area input-output studies which do provide indications of indirect employment, they do not provide the information on which to base a more dynamic view of employment shifts over time and they seldom distinguish between large and smaller scale enterprises in the forest-based sector.

Given the growing interest in the different dimensions of development impact considered here, countries should increase their efforts to systematically generate information on impacts of MLE's under a variety of conditions. It is particularly important to generate data that will help in analyzing the various trade-offs between different industry development strategies involving combinations of MLE and small scale enterprise activity, i.e., an appropriate enterprise mix. Relevant information can be generated at quite low cost in the process of routine management of projects.

Based on the limited information that is available, it appears that the impacts of MLE's on the employment side have been mixed. It is clear that MLE's use less labour per unit capital or output than do smaller, traditional enterprises in the sector. At the same time MLE's pay higher wages for hired labour than do the smaller traditional enter-

prises. Also MLE operations have resulted in effective penetration of markets for certain products, which could have not been possible to achieve with strategies based on small enterprises. This has resulted in an increase of employment opportunities. MLE development has also resulted in upgrading of skills. There has been a decrease in recent years in the use of expatriate labour in foreign operated MLE's. This has resulted in increased local labour use.

MLE's have been closely associated with the expansion of exports of forest-based products as well as with expanded use of lesser known species. The expansion of exports has meant a significant increase in local incomes, employment and availability of foreign exchange.

The experience related to import substitution policies has been mixed. While some countries have effectively developed a national industry behind the protective barriers of import substitution, often this has been achieved at a substantial cost. Given economies of scale and the limited size of domestic markets, in some cases monopolistic conditions and inefficiency have resulted.

Some of the highly polluting industries are in the forest-based sector but progress in pollution control has been very fast in the last few years. Similarly, large enterprises are associated with a concentration of pollution effects relative to the dispersed effects of many smaller enterprises generating the same output but the large size of enterprises make pollution control regulations easier to implement and control. Also large enterprises are more likely to be able to generate the necessary economic resources associated with costly pollution controls. Finally, examples of both appropriate management and mismanagement of forest resources are abundant, but it is apparent that due to their appetite for large amounts of wood, MLE's are more prepared as well as more able, financially and technically, to implement large afforestation programmes thus providing the means to satisfy increasing global demands for forest products while at the same time reducing the growing pressure on existing natural forests. In fact there are very few examples of massive afforestation programmes implemented without the participation or the influence of MLE's.

The study of policy measures which can be used to foster the development of large industrial enterprises while minimizing their negative developmental and environmental effects, reveals that options are numerous, complex and with differential results in terms of progress toward desired objectives.

Their interactions and costs of implementation have not been analyzed satisfactorily in the forestry based sector in general. Thus it is not uncommon to find policies being implemented simultaneously which have led to conflicting results. The nature and magnitude of these trade-offs need to be studied in order to increase the effectiveness of the various policy instruments and to plan adequately the future development the sector.

REFERENCES

- Amsalem, Michael A. Technology choice in developing countries: the  
1983 textile and pulp and paper industries. Cambridge, Mass.: The  
MIT Press. 239 pp.
- Balassa, Bela. A "stages approach" to comparative advantage. World Bank  
1979 Reprint Series: No. 136.
- Clausen, A.W. International trade and global economic growth. The  
1984 critical relationship. The World Bank, Washington, D.C.
- De'Ath. The throwaway people: Social impact of the Gogol Timber  
1980 Project, Madang Province. Institute of Applied Social and  
Economic Research. Boroko, Papua New Guinea.
- Environment Canada. State-of-the-art of the pulp and paper industry and  
1984 its environmental protection practices. Economic and Technical  
Review Report EPS 3-EP-84-2. Jan. 1984.
- Forsyth, David J.C., McBain, Norman & Solomon, R. Technical rigidity  
1980 and appropriate technology in less developed countries. In World  
Development, Vol. 8, pp. 371-98.
- Gillis, Malcolm. Fiscal and financial issues in tropical hardwood  
1980 concessions. New York: UNCTC (mimeo).
- Gillis, Malcolm. Foreign investment in the forest-based sector of the  
1981 Asia-Pacific region. Draft paper prepared for FAO of the United  
Nations.
- Gillis, Malcolm, Mescher, M. & Peprah, I. Foreign investment in the  
1983 forest-based sector in Africa. Unpublished report prepared for  
FAO of the United Nations. April.
- Gladwin, Thomas. Multinational enterprises and environmental  
1983 responsibility: A review of key concerns, control limitations and  
multilateral options. Oct. 10. Draft paper prepared for the  
OECD, Environment Committee.
- Gregersen, Hans. Export development programs for forestry. Paper  
1972 7CFM/C-VI/2G Seventh World Forestry Congress, Buenos Aires,  
Argentina 4-18 Oct. 1972.
- Hag, M.T. Rural industrialization policies and programmes in ASEAN  
1982 countries. UNIDO document, UNIDO/IS.347. Oct. 101 pp.
- Kobrin, S.J. Foreign direct investment: Industrialization and social  
1977 change. USA, Greenwich, Conn.: JAI Press, 205 pp.
- Lombard, Rancois J. Screening foreign direct investment in LDC's:  
1978 Empirical findings of the Colombian case (1967-1975) Journal of  
International Business Studies, Vol.9, No.3, pp.66-80.
- Mead, Margaret (Ed.). Cultural patterns and technical change. New York:  
1961 Mentor Books, Sixth Edition. 350 pp.
- Meyer, Rudy K. The transfer of technology to developing countries: The  
1974 pulp and paper industry. UNITAR Research Report 19. New York.

- Moore, Wilbert E. Impact of industry. Englewood Cliffs: Prentice Hall  
1965
- moore, Frederick T. Technological change and industrial development.  
1983 Issues and opportunities. World Bank Staff Working Paper No.613,  
Washington, D.C.
- Sanvictores, B. The role of transnational corporations in the development  
1980 of Asian tropical hardwood forest resources. Asia and Pacific  
Regional Workshop on Negotiations with Transnational Corporations  
in the Tropical Hardwood Sector.
- Simula, M. Modern large scale forest industries and their development  
1985 impacts. Preliminary case studies. Report prepared for FAO,  
Rome.
- Stephenson, Sherry. Corporate investment and production decisions. In  
1973 Ten Years of Multinational Business, pp. 86-98. Economist  
Intelligence Unit Special Series, No. 5. Cambridge, Mass.: Abt.  
Books.
- UNCTAD. Tariff and non-tariff measures in the world trade of wood and  
1983 wood products. July.
- UNEP. Environmental Management in the Pulp and Paper Industry.  
1982
- UNEP. World Industry Conference on Environmental Management. Report to  
1985 the Conference.
- UNIDO. The development of primary and secondary wood processing  
1983a industries. Issues Paper No.1. First Consultation on the Wood  
and Wood Products Industry, Helsinki, September 1983. Doc. 10/WG  
395/7. Vienna.
- UNIDO. Overview of selected problems of technology transfer to  
1982c developing countries. ID/WG.388/1. 22 Nov. UNIDO/LES Joint  
Meeting on Problems of Licensing into Developing Countries,  
Vienna, Austria, 22 June 1982.
- UNIDO. First Consultation on the Wood and Wood Products Industry.  
1983f Report ID/306 (Helsinki, Finland, 19-23 September 1983) Vienna:  
UNIDO. 38 pp.
- USAID. Horizons, Nov.-Dec. 1982. Washington, D.C.  
1982
- Wallender, Henry W., III. Developing country orientations toward foreign  
1980 technology in the eighties: Implications for new negotiation  
approaches. Columbia Journal of World Business. Vol. 15, No.2,  
pp.20-27.
- Westoby, Jack. Forest industries in the attack on economic under-  
1962 development. The State of Food and Agriculture, 1962, FAO, Rome.